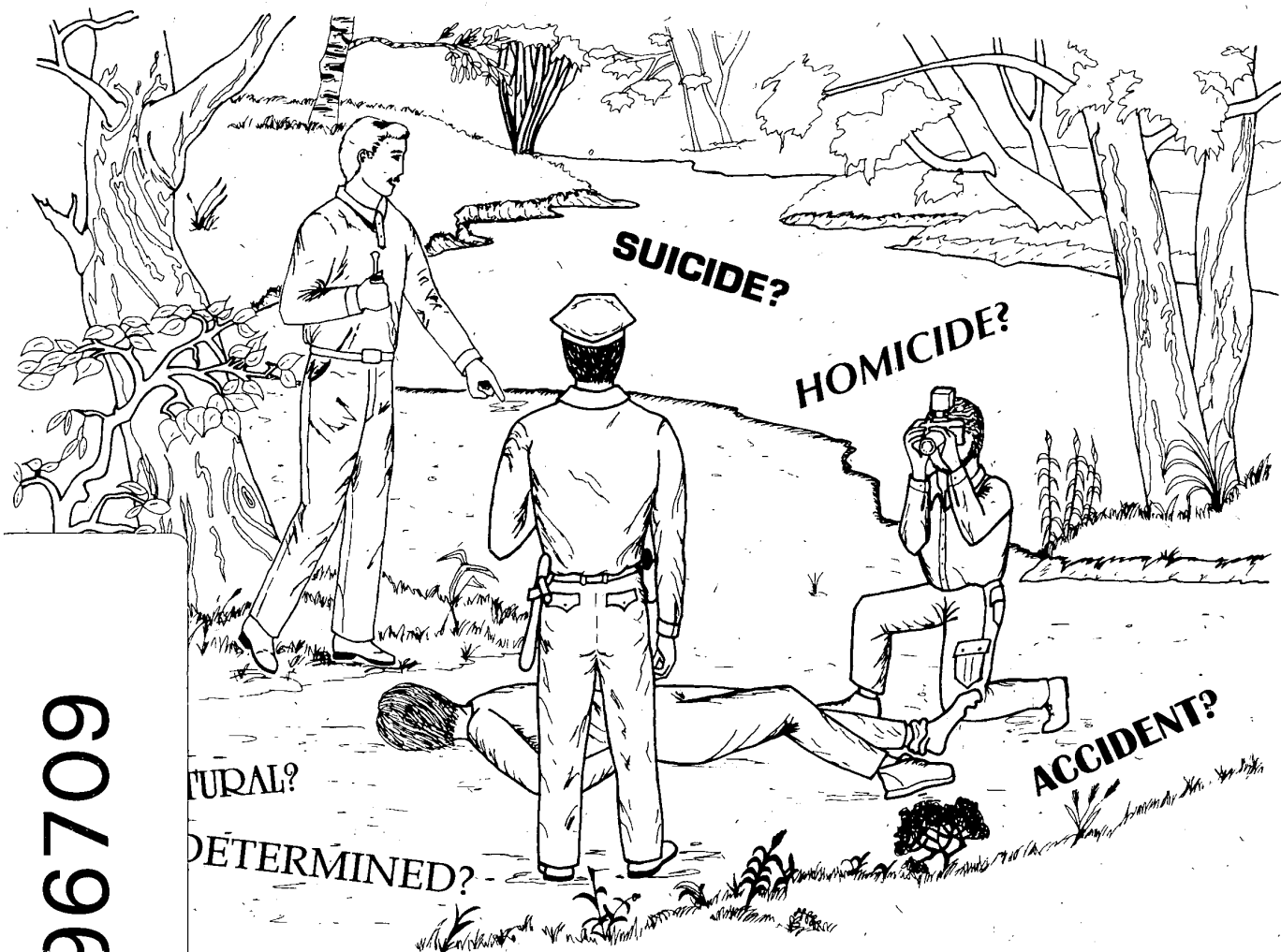




U.S. Department of Justice
Federal Bureau of Investigation

MANAGING DEATH INVESTIGATION



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***MANAGING DEATH
INVESTIGATIONS***

Revised, 1997

Arthur E. Westveer, MLA

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Acknowledgements

I wish to acknowledge the following three individuals who taught me the true meaning of the word "COP":

Baltimore Police Department, Lieut. James T. Middleton, Lieut. Eugene M. O'Hara, and Lieut. Herbert C. Hoover. Additionally, I would like to recognize these individuals whom I had the distinct pleasure of working with in the Baltimore Police Department, Criminal Investigation Division, Homicide Unit:

Det. Capt. James Cadden, Det. Lieut. Charles Kearney, Det. Sgt. Gerard "Rod" Brander, Det. Sgt. Rosario Buzzuro, Det. Sgt. Richard Ellwood, Det. Jack Brown, Det. August Buchheit, Det. Edward Chian, Det. John Coleman, Det. Steve Danko, Det. Dominick Glangrasso, Det. John Hess, Det. Jerome Johnson, Det. Robert Kuhn, Det. John Kurinij, Det. Ronald Mikies, Det. Lawrence O'Brien, Det. James Ozazewski, Det. Frank Perkowski, Det. Oscar Requer, Det. Timothy Timmons, Det. Raymond Trawinski, Det. Jennifer Wehr, Det. Leonard Willis and Det. Tom Russell.

Death investigation cannot be thoroughly and professionally conducted without the willing assistance of many individuals. Risking the omission of some, I wish to acknowledge the following professionals whose writings I have included in this compilation:

SA Harold A. Deadman, Laboratory Division, FBIHQ; Non-nan D. Sperber, D.D.S., Forensic Odontologist, San Diego County Coroner's Office, San Diego, California; Alphonse Poklis, Ph.D., Director of Toxicology, Medical College of Virginia; James L. Luke, M.D., LL.D.; and Gregory P. Wanger, M.D., Assistant Chief Medical Examiner, Office of the Chief Medical Examiner, Richmond, Virginia; John G. Ward, Jr., Forensic Scientist, Division of Consolidated Laboratory Services, Bureau of Forensic Science, Commonwealth of Virginia, Norfolk; Brian D. Blackbourne, M.D., Vernon J. Geberth, Lt. Commander (Ret.) N.Y.P.D.; Winston C. Norman, Major Case Specialist, VICAP, FBI Academy, Quantico, Virginia; Eric Witzig, Major Case Specialist, VICAP, FBI Academy, Quantico, Virginia; John E. Smialek, M.D., Chief Medical Examiner, State of Maryland; Robert R. Hazelwood (fon-ner SSA), John E. Douglas (former SSA),; SSA David Bigbee, Forensic Science Research and Training Center, FBI Academy, Quantico, Virginia; Gregory Cooper (fon-ner SSA), Chief of Police, Provo, Utah; SSA Robert Spalding, Crime Scene Processing Instructor, FBI Academy, Quantico, Virginia; Gene West, Fire Marshall (Ret), New York City; and Dr. James C.U. Downs, State Medical Examiner, Alabama.

I would also like to acknowledge and thank the following individuals from the Behavioral Science Unit and the Investigative Support Unit, who have assisted in and supported the production of this book: Anthony O. Rider, Unit Chief, Behavioral Science Unit; Dr. Anthony Pinizzotto, Forensic Psychologist, Behavioral Science Unit, FBI Academy, Quantico, Virginia; Mrs. Cynthia Lent, Research Assistant; Mrs. Marian C. "Beth" Griffin, Training Technician; and Mrs. Alvina G. Hayes, Training Technician.

A special thanks to Timothy Dalton, intern, from The University of Wisconsin-Madison, for his able assistance in revising and editing this fourth edition.

Cover design by Lisa Foundas, FBI Academy.

THE HOMICIDE INVESTIGATOR

NO GREATER HONOR will ever be bestowed on an officer or a more profound duty imposed on him than when he is entrusted with the investigation of the death of a human being.

It is his duty to find the facts, regardless of color or creed, without prejudice, and to let no power on earth deter him from presenting these facts to the court without regard to personality.

"There are those of us who live in rooms of experience that we can never enter."

John Steinbeck

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Introduction

The purpose of this publication is to consolidate the training material utilized in the Basic Death Investigation Course and Death Investigation Field Schools conducted by the Behavioral Science Unit, FBI Academy, Quantico, Virginia.

This course takes a holistic approach to investigating the death of a human being. It begins with a brief discussion of the history of the coroner's and medical examiner's systems to include a forensic autopsy.

In the section on approaching the death scene, we discuss the effects of a traumatic death scene on the first officer to arrive as well as the investigator assigned to the scene. Some investigative aids and techniques are reviewed, using case examples.

Also covered are the following topics:

Managing Death Investigations

Development of Coroner and Medical Examiner System

Approaching the Death Scene

Post Mortem Changes and Time of Death/Entomology

Injuries From Edged Weapons and Their Effects on the Body

Blunt Force Injuries and Their Effects on the Body

Blood Spatter Pattern Analysis

Homicide by Poison

Asphyxial Deaths

Fire and Heat-Related Deaths

Firearm Injuries

Signature/M.O.

Substance Abuse Deaths

Autoerotic Fatalities

Suicide/Equivocal Deaths

Forensic Pediatrics/Sudden Infant Death Syndrome

Munchausen Syndrome by Proxy

Criminal Investigative Analysis

Overview of Drowning

DNA

Miscellaneous articles germane and timely to the subject of death investigation are included at the end of this publication.

MANAGING DEATH
INVESTIGATIONS

Managing Death Investigations

by Arthur E. Westveer

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 - 7.
 - B. Selection of Personnel, Detectives, & Supervisors
 - 1. Legitimate Qualifications
 - a.
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DEATH INVESTIGATION BULLETIN

GLOSSARY OF TERMS AND DEFINITIONS
COMMONLY USED IN THE INVESTIGATION OF DEATH

This bulletin contains most of the terms and definitions commonly used in the various reports associated with death investigations.

Prepared by: Winston C. Norman, Major Case Specialist, FBI (Retired)

DEATH INVESTIGATION

GLOSSARY OF TERMS

ABBREVIATIONS USED:	Adj: - Adjective Syn: - Synonym
ABDOMEN:	Portion of the body between the thorax (chest cavity) and the pelvic area.
ABORTION:	1. The expulsion of the fetus usually in the first trimester of pregnancy. 2. The interruption of pregnancy before the state of fetal viability.
ABRADED MARGIN:	Syn: Abrasion ring. A zone of abrasion surrounding the entrance wound of a bullet, caused by the stretching of the skin and the rotational movement of the projectile.
ABRASION:	Wearing away of the skin in small shreds by friction.
ACID PHOSPHATASE:	A group of enzymes occurring in many cells of the body. The only secretion in which acid phosphatase is found is that of the prostate gland. The finding of acid phosphatase in vaginal washings or on clothing is thus regarded as indicative of the presence of semen.
ACUTE:	Sharp, severe or of brief duration.
ADHESIONS:	Found following operative intervention where the tissues effected adhere to themselves or a visceral cavity surface.

ADIPOCERE: Syn: Adipocire. A waxy, greyish-white substance consisting largely of free fatty acids, produced in the fatty tissues of the body by the hydrolysis of fats in a moist environment.

AGONAL: Adj: Related to the last moments of life or to the death struggle.

AIR EMBOLISM: See: Embolism

ALCOHOL: A hydroxy derivative of aliphatic hydrocarbons. When used without qualifications, the term denotes ethyl alcohol (C₂H₅O). Syn: ethanol, grain alcohol, the active ingredient of alcoholic beverages. Alcohols are central nervous system depressants.

- METHYL ALCOHOL: Syn: Methanol, wood alcohol (CH₃OH). A common industrial solvent and constituent of resins and varnishes. It is much more toxic than ethyl alcohol.

AMNESIA: Lack or loss of memory, especially in remembering past experiences.

AMPHETAMINES: Syn: "Speed." A group of drugs including amphetamine sulfate, methylamphetamine and dextroamphetamine. The amphetamines are central nervous system stimulants which in therapeutic doses cause elevation of mood, alertness, increase in mental ability and reduction of appetite. In toxic doses, they cause restlessness, irritability, hallucinations and panic states. Cerebral hemorrhage may be a terminal event.

ANALGESIC: A drug which relieves pain.

ANAPHYLAXIS: An acute and sometimes fatal reaction within seconds or minutes after exposure to an allergen to which an individual is hypersensitive.

ANATOMY: Study of the structure of the human body.

ANEMIA: Insufficient oxygen-carrying capacity of the blood.

ANEURYSM: A localized bulging of a blood vessel or chamber of the heart arising from a weakness of its wall.

- ARTERIO-VEINOUS: An aneurysm involving a direct communication between an artery and a vein. Arterio-venous aneurysms may be congenital in origin or be caused by an injury.

- BERRY (SACCULAR): Syn: Congenital aneurysm. An aneurysm involving one of the arteries at the base of the brain. Rupture of a berry aneurysm is a common cause of sudden death in young or middle-aged adults.

- MYCOTIC: An aneurysm arising in a weakness of a blood vessel wall caused by infection.

- TRAUMATIC: An aneurysm arising in a weakness of a blood vessel caused by injury.

ANGINA: Spasmodic pain.

ANGINA PECTORIS: Spasmodic pain in chest caused by sudden decrease of blood supply to the heart muscle.

ANOXIA: Lack of oxygen.

ANTEMORTEM: Adj. Premortem: present or occurring before death.

ANTERIOR: Adj: Ventral: before, in front of, facing toward the front.

ANTIDOTE: The remedy for counteracting a poison.

ANUS: The distal end and outlet of the alimentary canal.

AORTA: The main artery arising from the heart and giving rise to the entire systemic arterial system.

ARACHNOID: The middle membrane covering the brain and spinal cord.

AREOLA: The pigmented ring around the nipple of the breast.

ARTIFACT: A change brought about artificially and not by natural or traumatic processes.

ARTERIOSCLEROSIS: A group of pathological conditions affecting arteries and resulting in hardening, thickening, loss of elasticity of the wall, and often in narrowing of the lumen.

ARTERY: A blood vessel carrying blood on its way from the heart to the tissues of the body.

- CORONARY ARTERIES: The two main arteries and their tributaries arising from the aorta and supplying blood to the heart muscle.

ASPHYXIA: Death caused by lack of oxygen or by the inability of the tissues to utilize oxygen.

- CHEMICAL: Asphyxia produced by a chemical agent which prevents the combination of hemoglobin and oxygen (e.g., carbon monoxide), or the release of oxygen from hemoglobin (e.g., cyanide).

- TRAUMATIC: Asphyxia caused by compression of the chest and prevention of respiratory movements.

ASPIRATION: Breathing or drawing in of a substance into the respiratory tract, blocking same.

AUTOEROTICISM: Sexual arousal and/or gratification without a partner.

AUTOLYSIS: The dissolution of cells and tissues by enzymes normally present in them. Autolysis is the earliest morphological postmortem change and is the predominant change in sterile cadavers such as newborn infants. It is also the main mechanism in the dissolution of infarcts.

AUTOPSY: Syn: Necropsy, postmortem. A dissection of the body after death to determine the cause of death and to study the changes in the tissues caused by disease or violence. The term is often used to include any subsequent examination, including microscopic or chemical.

- PSYCHOLOGICAL. A review of investigative findings and the performance and evaluation of a series of structured interviews conducted by a psychiatrist or trained psychologist with close friends, acquaintances, and relatives of a deceased person in order to determine his psychological make-up during life. This information may be of assistance in determining factors related to the death.

- SOCIOLOGICAL: A review of related sociologic and demographic considerations of a deceased person in an attempt to correlate these with the circumstances of death and thereby identify social conditions common to several or many deaths in the expectancy of identifying common etiologic or mitigating conditions.

AVULSION: A tearing away of part of a tissue.

BARBITURATES: Syn: "Barbs," "candy," "goof balls," "peanuts." A group of drugs used as sedatives, hypnotics and anesthetics. They include thiopental (ultrashort-acting), pentobarbital and secobarbital (short-acting), amobarbital (intermediate) and phenobarbital (long-acting).

BAROTRAUMA: Injuries, such as rupture of the eardrum, caused by sudden changes in atmospheric pressure.

BATTERED CHILD SYNDROME: See: Syndrome.

BENZEDRINE: Brand of amphetamine sulfate (Smith, Kline and French Laboratories). Benzedrine tablets syn: "bennies," "hearts," "peaches," "roses."

BERRY ANEURYSM: See: Aneurysm.

BIRTH INJURY: Syn: Birth trauma. An injury to the infant sustained during birth. Common birth injuries include fractures of the skull, rupture of the dural venous sinuses, brain damage, stretching of nerves and dislocation of joints.

BLISTER: Syn: Bulla, vesicle. An elevation of the superficial layer of the skin or mucous membrane containing fluid. When small, often called a vesicle or bleb; when large, a bulla. Blisters may be antemortem or postmortem in origin.

BLOOD GROUPS: Individuals who have the same type of blood with regard to the two major red cell antigens A and B. Persons having antigen A only are said to be blood group A; those possessing antigen B only,

BLOOD GROUPS,
CONTINUED:

blood group B; those having both antigens, blood group AB; and those having neither antigen, blood group O. Also includes other groups such as M,N,S, etc.

BRUISE:

See: Contusion.

BRUSH BURN:

See: Abrasion.

BURKING:

A homicidal form of traumatic asphyxia employed by Burke and Hare in which one of the assailants sat on the chest of an intoxicated victim.

BURN:

An injury caused by dry heat.

CADAVER:

A dead body, a corpse.

CADAVERIC SPASM:

Stiffening and rigidity of a single group of muscles occurring during or immediately after death. The existence of this entity is debated.

CAFE CORONARY:

Asphyxia due to the impaction of a bolus of food in the larynx or trachea.

CAISSON DISEASE:

Syn: Decompression sickness, "the bends." A form of gas embolism seen in divers, tunnel workers, etc. who are being brought quickly from an environment of high atmospheric pressure to one of lower pressure. It is due to the release of bubbles of nitrogen from the blood.

CALLIPHORA
VOMITORIA:

Syn: Blow fly, blue bottle fly. A common fly which deposits its eggs on recently dead bodies and the larvae of which play an important part in the disintegration of the tissues.

CALLUS: The tissue which gradually connects the fragments of a broken bone. Callus at first consists of fibrous tissue which is later converted into bone. The microscopic and X-ray appearance of a callus is roughly indicative of its age and thus may often be of importance in cases of suspected battered child syndrome.

CARBON DIOXIDE: A heavy, colorless gas. Carbon dioxide forms in tissues and is eliminated by the lungs.

CARBON MONOXIDE: A toxic gas produced by the incomplete combustion of organic materials. It combines with hemoglobin thus preventing the carriage of oxygen and producing a state of asphyxia. Carbon monoxide is an important constituent of motor exhaust and coal gas.

CARCINOMA: Cancer. This will usually be defined by the portion of the organ or body affected.

CARDIAC TAMPONADE: Compression of the heart by the rapid accumulation of fluid in the pericardial sac. Cardiac tamponade is usually caused by bleeding into the pericardial cavity due to rupture of the heart or one of the coronary arteries.

CARDIOMYOPATHY: A primary disease of the heart muscle.

CARDIOVASCULAR: Pertaining to the heart and blood vessels.

**CARNAL KNOWLEDGE:
(STATUTORY RAPE)** Sexual intercourse with an individual below the legal age of consent.

CAROTID: Arteries of the neck.

CARTILAGE: The gristle or white elastic substance attached to articular bone surface and forming certain parts of the skeleton.

CELLULAR DEATH: See: Death.

CEREBROSPINAL FLUID: "CSF." The clear fluid which is secreted by the choroid plexuses in the brain and which circulated through the ventricular system of the brain and the subarachnoid space.

CEREBRO-VASCULAR ACCIDENT: "CVA." A stroke, severe injury to the brain resulting from spontaneous hemorrhage or thrombosis.

CERVICAL: Pertaining to the neck.

CERVIX: Syn: Cervix uteri. The neck of the uterus connecting the uterine cavity with the vagina and consisting of the external os and internal os.

CHOKING: Asphyxia caused by the mechanical occlusion of the upper respiratory passages, e.g., by a bolus of food.

CHRONIC: Sickness of long duration.

CIRRHOSIS: A chronic disease of the liver with scarring and reduced function most frequently associated with alcoholism but also may follow hepatitis and other more rare diseases.

CLAVICLE: Collarbone.

CLITORIS: An erectile structure, one of the female genital organs located beneath the anterior commissure of the labia minora.

CLOT: A soft, semi-solid coagulum formed in stagnant or postmortem blood, its structure being large determined by gravity. It thus differs from a thrombus.

- CHICKEN FAT THROMBUS: A bright yellow layer, consisting predominantly of white blood cells, and forming the uppermost part of a clot. The position of the chicken fat clot has been used in attempts to determine the position of the body after death.

- CURRANT JELLY CLOT: A dark red layer, consisting of predominantly red blood cells and forming the lower part of a clot.

- POSTMORTEM CLOT: A clot formed in the blood vessels, chambers of the heart or sites of hemorrhage after death.

- CLOTTING: See: Coagulation.

- COAGULATION: Syn: Clotting. The transformation from a liquid state to a solid or semi-solid mass. Usually applied to the formation of fibrin in blood resulting in a clot or thrombus.

- COCAINE: Syn: "Bernice," "candy," "coke," "corine," "dust," "flake," "gold dust," "snow," "stardust." An alkaloid from the leaves of the Erythroxylon trees native to Peru and Bolivia. Systemically, cocaine is a cerebral stimulant; topically, a local anesthetic. Used illicitly, it is usually sniffed in the form of a white powder.

- CODEINE: One of the alkaloids of opium. its analgesic effect is weaker than that of morphine, but is a better suppressant of the cough reflex.

- COLON: That part of the large intestine which extends from the cecum to the rectum.

- COMA: A state of deep unconsciousness from which a person cannot be aroused. Causes of coma include poisonings, brain injuries, stroke, diabetes mellitus and uremia.

COMATOSE: Unconsciousness. No response to any stimuli. NOTE: the person is not dead.

COMMUNUTED FRACTURE: A break of a bone into small fragments.

CONCUSSION: A diffuse injury to an organ caused by a violent impact. Usually applied to the brain (commotio cerebri).

CONGENITAL: Existing at or dating from birth.

CONJUNCTIVA: Delicate membrane lining of the eyelid.

CONTACT FLATTENING: The flattening of muscles which are in contact with a hard surface during rigor mortis.

CONTRE COUP: An injury of an organ occurring on the side opposite to that suffering a blow or impact, resulting from impact of the organ on the interior of the body wall. The term is usually applied to the brain but other organs such as the lungs may suffer contre coup injuries.

CONTUSION: An injury without laceration to the superficial tissues of an organ or the body surface; caused by a blunt impact resulting in a hemorrhage into the tissue beneath the skin. Contusions are usually caused by violence but may be spontaneous in certain blood disorders. During life, the color of contusions changes gradually from red to green to yellow, giving a rough indication of their age. Contusions sustained shortly prior to death may at first show no discoloration of the skin surface but may become more noticeable after the blood in the capillaries has settled to another part of the body.

CONVULSION: A violent, involuntary contraction or series of contractions of the voluntary muscles.

CORONAL: Adj. In the transverse direction.

CORONAL PLANE: An imaginary plane bisecting the body from side to side at right angles to the sagittal plane. This term is useful in describing gunshot wounds.

CORONARY: A term applied to vessels, nerves, ligaments of the heart.

CORONARY THROMBOSIS: Occlusion of one of the coronary arteries by a thrombus. One of the causes of a "heart attack."

CORONER: An official appointed or elected to investigate certain types of fatalities and to preside over inquests. He/she may or may not be a physician.

CRANIAL SUTURES: The fibrous lines of union between the bones of the cranium. The gradual disappearance of the cranial sutures is one of the anatomical features upon which an estimate of the age of skeletal remains may be based.

CRANIOTOMY: To operate on the head. Brain surgery.

CRANIUM: That part of the skull which encloses the brain.

CRIB DEATH: See: Sudden Infant Death Syndrome.

CRICOID CARTILAGE: The lowermost cartilage of the larynx.

CUT: Syn: Incised wound, slash, slice. A wound caused by a sharp object, usually metal or glass. The wound is longer than deep and tends to gape. Its edges are usually not contused, distinguishing it from a laceration.

CUTANEOUS: Pertaining to the skin.

CUTIS ANSERINA: Syn: Goose flesh, goose pimples. A roughening of the skin caused by the contraction of the erector muscles of the hairs. In the living person, it is caused by fear or exposure to cold. In the cadaver, it is a manifestation of rigor mortis. The presence of cutis anserina in a body recovered from water was at one time regarded as indicating that death had occurred in water. This view is no longer held.

CYANOSIS: A bluish or greyish discoloration of the skin and mucous membranes due to the circulation of insufficiently oxygenated blood.

DEATH: The permanent cessation of all vital functions.

- CELLULAR DEATH: The permanent loss by the cell of its functional integrity. The earliest manifestation of molecular death appears to be an irreversible change in the selective permeability of the cell membrane.

- SOMATIC DEATH: Syn: Clinical death. The permanent cessation of respiration and circulation. Absence of response to external stimuli, of spontaneous muscular movements and lack of brain function as determined by the electroencephalogram have

- SOMATIC DEATH:
(CONTINUED) recently been added to the criteria on which the definition of somatic death marks the the extinction of the biological and legal personality.

DECIDUOUS TEETH: Syn: Milk teeth. The first dentition of the child consisting of 20 teeth.

DECOMPOSITION: The separation of compound bodies into their constituent principles - postmortem degeneration of the body.

DEFENSE WOUND: See: Wound.

DELIRIUM: A state of mental disorientation, usually temporary.

DELUSION: A false belief, contrary to reality, which cannot be corrected by reasoning.

DEMENTIA: An irreversible mental deterioration, the end result of many intoxications or neurological disorders.

DETERIORATE: To become worse - impairment.

DEXEDRINE: Brand of dextroamphetamine sulfate (Smith, Kline and French Laboratories). Dexedrine tablets, syn: "dexies," "hearts," "oranges."

DIACETYL MORPHINE: See: Heroin.

DIAPHRAGM: The musculomembranous partition that separates the abdomen from the thorax.

DILATATION AND CURETTAGE: Syn: D and C. A surgical operation consisting of the dilatation of the cervical canal and the scraping of the lining of the uterine cavity.

DIPTERA: An order of insects consisting of the true flies, most possessing a single pair of wings. The order includes the species Calliphora vomitoria which infests recently dead bodies and the larvae of which feed upon the tissues.

DISARTICULATION: Amputation or separation at a joint.

DISEASE: Any departure from a state of health; illness or sickness.

DISINTERMENT: Syn: Exhumation. The recovery of a body from the earth. Usually applied to the removal of a body from a grave for the purpose of medical examination or transportation to another burial site.

DISTAL: Adj: Further from the trunk or from the origin.

DORSAL: See: Posterior.

DROWNING: Death due to the immersion of the nose and mouth in water or other fluid. Until recently, drowning was regarded as purely asphyxial in nature; however, it is said that only 10-12 per cent of drownings involve true asphyxia. The vast majority of cases are associated with the inhalation of large quantities of water which causes some degree of anoxia as well as acute disturbance in the electrolyte balance of the blood.

- DRY DROWNING: Asphyxia believed to be caused by laryngeal spasm due to the aspiration of small quantities of fluid, or by vagal response to immersion, resulting in cardiac standstill.

- WET DROWNING: Drowning following which large amounts of fluid are found in the lungs.

- DURA MATER: The outer and strongest of the three membranes surrounding the brain.
- ECCHYMOSIS: An extravasation of blood into the skin, mucous or serous membrane. An ecchymosis is larger than a petechial hemorrhage.
- EDEMA: The presence of excess fluid in the tissue. Edema may be localized as in an area of inflammation or may involve the entire body.
- ELECTROCUTION: Death caused by the passage of an electrical current through the body. The usual mechanism of death is ventricular fibrillation or paralysis of the respiratory center.
- EMBALMING: A method of preserving the cadaver by preventing putrefaction. Embalming usually involves the perfusion of the vascular system with a fixative fluid into the serous cavities by means of a trochar. Various dyes such as eosin may be added to the perfusion fluid.
- EMBOLISM: The plugging of a blood vessel by an embolus. When used without qualification, the embolus consists of a thrombus.
- AIR EMBOLISM: Occlusion of blood vessels by bubbles of air which may be introduced into the blood stream by positive pressure as in cases of criminal abortion, by negative pressure of stab wounds of the neck. Air embolism must be distinguished from the presence of gas due to putrefaction.

- BONE MARROW EMBOLISM: Occlusion of blood vessels by fragments of bone marrow. It may follow extensive fractures or orthopedic operations.

- FAT EMBOLISM: Occlusion of capillary blood vessels by fat droplets. It is most commonly seen in the vessels of the brain, lungs and kidneys and follows fractures or contusions of adipose tissue.

- GAS EMBOLISM: Embolism by an insoluble gas as may be seen in caisson disease.

- PULMONARY EMBOLISM: Occlusion of the pulmonary artery or its main branches usually by a thromboembolus. A common cause of sudden death.

- TALC EMBOLISM: Embolism by particles of talc in the circulation. It may lead to the formation of small granulomata in the lungs. See: Junkie's lung.

- EMBOLUS: A mass of undissolved matter which travels through the blood stream and may plug a vessel which is too narrow to permit passage.

- EMBRYO: Syn: Conceptus. The developing child in the uterus during the first trimester of pregnancy.

- EPIDERMIS: The outermost layer of the skin.

- EPIGLOTTIS: A leaf-shaped structure situated at the root of the tongue protecting the opening of the larynx during swallowing.

- EPIGLOTTITIS: An inflammation of the epiglottis usually caused by Hemophilus influenza. A cause of rapid death in young children.

EPILEPSY: A group of disorders marked by episodic impairment or loss of consciousness and, frequently, convulsions.

EPIPHYSEAL INJURY: Dislocation of the epiphysis of a bone often caused by forceful pulling of an extremity. A common type of injury in the battered child syndrome.

EPIPHYSIS: A part of a bone which is separated from the main part during the period of active growth by a layer of cartilage and which fuses with the main part during adolescence and early adult life.

EXHUMATION: See: Disinterment.

EXSANGUINATION: Death due to loss of blood from the circulatory system.

FALLOPIAN TUBES: Syn: Oviducts, uterine tubes. A pair of muscular tubes connecting the region of the ovaries to the cavity of the uterus.

FAT EMBOLISM: See: Embolism.

FATTY METAMORPHOSIS OF THE LIVER: Fatty liver, a change in the liver following excessive alcohol ingestion and poor diet.

FECES: Bodily waste discharged through the anus.

FEMUR: The thigh bone.

FETISHISM: Association of lust with items of certain portions of the female body or with certain articles of female attire.

FETUS: Syn: Conceptus. The developing child in the uterus during the second and third trimesters of pregnancy.

FIBRILLATION: Fluttering of the heart. Not controlled by motor nerve.

FIBULA: The outer and smaller bone of the leg, below the knee.

FLAIL CHEST: A chest having lost stability as a result of multiple rib fractures. The loose rib fragments interfere with the inspiratory expansion of the lungs.

FONTANELLE: A soft spot between the cranial bones of a fetus or infant. Normally, the newborn has two fontanelles: the anterior which is located between the frontal and parietal bones and which closes at the age of about 18 months and the posterior which is located between the parietal and occipital bones and closes at about six weeks.

FORENSIC: Adj: Applied to the law.

- FORENSIC MEDICINE: Syn: Legal medicine. Those parts of medical knowledge which are applied to legal problems.

FRACTURE: A break in the bone.

- BUMPER FRACTURE: A fracture of one or both legs below the knee caused by the bumper of a motor vehicle. It is usually a compound fracture.

- COMMINUTED FRACTURE: A fracture having several fragments due to splintering of the bone.

- COMPOUND FRACTURE: A fracture communicating with the outside through a wound.

FRATRICIDE: The act of killing one's brother or sister.

GANGRENE: The death of an extremity or portion of an organ in the living organism.

GARROTTING: Asphyxia caused by the twisting of a ligature around the neck.

GASTRIC: Relating to the stomach.

GESTATION: The period of intrauterine development.

GRAZE: An abrasion of the skin caused by contact with a rough surface. The direction of the graze may be indicated by a sharply demarcated beginning and tags of epidermis at the end.

GROSS: As perceived by the naked eye.

HALLUCINATION: A false perception, auditory, olfactory or visual which has no basis in fact.

HANGING: A type of ligature strangulation in which the constricting force is due to gravity.

HASHISH: Syn: "Hash." The resinous juice of the flowering tops and upper leaves of the female hemp plant, cannabis sativa, sold in the form of cakes or blocks. Usually smoked in a pipe. Due to its high content of cannabinols, it is more potent than marijuana.

HEAT EXHAUSTION: A state of collapse following exposure to high temperatures caused by depletion of the body's electrolytes and fluids. Clinically, it resembles shock.

HEAT STROKE: A state of collapse following exposure to high temperatures. It is caused by injury to the body's heat regulating mechanisms.

HEMATOMA: A collection of blood in the tissues resulting from hemorrhage.

HEMOPERITONEUM: The presence of blood in the abdominal cavity.

HEMOPHILIA: Blood is slow clotting or does not clot, allowing a person to bleed to death.

HEMORRHAGE: The escape of blood from a blood vessel.

HEMOTHORAX: The presence of blood in the chest cavity.

HEROIN: Syn: "H," "Harry," "horse," "joy powder," "scat," "schmeck," "smack," "shit." Diacetyl morphine. A semi-synthetic made by the acetylation of morphine. Not legally available in the United States, Canada or Great Britain. Sold illicitly as a white powder usually heavily adulterated with lactose or quinine. Usually injected intravenously but may be smoked or snuffed.

HISTOTOXIC: Poisonous to tissue or tissues.

HOMOSEXUAL: Syn: "Fag," "fairy," "fruit," "queen," "queer." An individual sexually attracted to members of the same sex. When used without qualifications, indicates a male homosexual.

HORIZONTAL PLANE: An imaginary plane traversing the erect body parallel with the level ground. Useful in describing gunshot wounds.

HUMERUS: Large bone in upper arm above elbow.

HYMEN: Syn: Maidenhead. A membrane which partially occludes the external opening of the vagina.

HYOID BONE: A U-shaped bone in the neck above the larynx. From its central body projects the greater and lesser cornua. The latter are frequently found broken in cases of manual strangulation.

HYPERTENSION: High blood pressure.

HYPNOTIC:	A drug which produces sleep.
HYPOSTASIS:	The settling of blood after death into the dependent parts of the body. In the skin, this is manifested by lividity. In the internal organs, congestion is due to hypostasis.
HYPOTHERMIA:	A state of abnormally low body temperature, usually below 95° F.
HYPOXIA:	Lack of sufficient oxygen.
IDIOSYNCRASY:	An unusual or individual reaction, usually to a drug.
INCEST:	Sexual intercourse between closely related individuals.
INCISION:	A wound inflicted by an instrument with a sharp cutting edge.
INFANTICIDE:	The killing of an infant.
INFARCT:	The death of a portion of an organ in the living organism due to sudden occlusion of its blood supply.
INHALATION:	The drawing of air or other vapor into the lungs.
INSTAR:	A stage in the development of an insect larva.
INTESTINE:	The membranous tube that extends from the stomach to the anus.
INTRA:	Prefix meaning within.
ISCHEMIA:	A state of inadequate blood supply to an organ or tissue.
JAUNDICE:	Yellow pigmentation of skin most commonly resulting from liver failure.

JUNKIE'S LUNG: Lungs showing microscopic granulomata caused by the intravenous injection of insoluble materials such as talc or starch granules. Seen in drug addicts. Sudden death due to cor pulmonale has been recorded.

LACERATION: Syn: Split, tear. A wound caused by crushing or tearing of the tissues, usually showing a break in the surface.

LAPAROTOMY: An operation in which the abdominal cavity is opened.

LARVA: Syn: Maggot. A stage of metamorphosis of certain insects between the egg and the pupa. The larva may molt several times, each stage being known as an instar.

LARYNX: Syn: Voice box. A hollow muscular and cartilaginous structure lined with mucous membrane situated between the hyoid bone and the trachea. Its components include the epiglottis, thyroid, cartilage and cricoid cartilages. It contains the vocal cords.

LATERAL: Adj: Away from the midline, towards the side.

LESBIAN: A female homosexual.

LESION: Any abnormal change in the structure of a tissue.

LIGAMENT: Any fibrous, tough band which connects bones or supports viscera.

LIVER: The largest glandular organ situated in the upper part of the abdomen on the right side, usually of a dark red.

LIVIDITY: Syn: Livor mortis. A dark red or bluish-red discoloration of the dependent portions of the external surface of the body due to postmortem stasis of blood.

- CONGESTION: Lividity caused by the distention of skin capillaries by blood.

- DIFFUSION: Lividity partly due to hemoglobin staining of the dependent portions of the skin. Diffusion lividity tends to be "fixed" in contrast to congestion lividity.

LSD: Syn: "Acid." Lysergic acid diethylamide. A hallucinogenic alkaloid occurring in morning glory seeds. Now usually produced synthetically.

LUMBAR: Pertaining to or near the lower region of the back.

MANDIBLE: Lower jaw bone.

MANSLAUGHTER: A legal category of homicide, a lesser offense than murder.

MARBLING: The appearance of vascular patterns on the skin after death.

MARGINAL ABRASION: See: Abraded margin.

MARIJUANA: The flowering tops and upper leaves of the female hemp plant (*Cannabis sativa*), usually sold as a coarse powder and smoked in the form of a hand-rolled cigarette. Its pharmacological activity is believed to be due to tetrahydrocannabinol.

MASOCHISM: Pleasure derived from physical or psychologic pain inflicted either by oneself or by others.

MAXILLA: Upper jaw bone.

MECONIUM: The feces of the newborn. The presence of meconium in the amniotic fluid is indicative of fetal distress. The absence of meconium in a normal intestine of a newborn is strong evidence of a live birth.

MEDIAL: Adj: Toward the midline.

MEDICAL EXAMINER: A physician who, by statute, investigates certain types of fatalities by conducting such examinations as are considered necessary.

MEDICAL JURISPRUDENCE: Those parts of the law which apply to the practice of medicine.

MEMBRANE: A thin layer of tissue which covers a surface or divides a space or organ.

MENINGITIS: An inflammation of the membranes surrounding the brain and spinal cord.

MESCALINE: A hallucinogenic drug derived from the peyote cactus.

MESENTERY: Tissue connecting the intestine to the posterior abdominal wall.

METAPHYSES: Growing portion of bone.

METHADONE: A synthetic analgesic drug similar in its effects to morphine and used as a substitute drug in the treatment of narcotic addiction.

MIDLINE: The center of the head, chest and abdomen.

MISCARRIAGE: The expulsion of the fetus, usually in the second trimester of pregnancy. See: Abortion.

MORIBUND: In a dying condition, dying.

MORPHINE: A vegetable alkaloid, the principal constituent of opium. Morphine is a powerful analgesic and nervous system depressant with addicting properties.

MUMMIFICATION: The drying of a dead body or parts thereof to a brown, leathery, parchment-like condition on exposure to a warm and dry environment.

MYOCARDIAL INFARCTION: An area of death in heart tissue, usually resulting from coronary thrombosis.

MYOCARDITIS: An inflammation of the heart muscle caused by bacteria, viruses, parasites or hypersensitivity.

MYOCARDIUM: The heart muscle.

NARCOTIC: A drug producing stupor, sleep and relief of pain.

NATAL: Pertaining to birth.

NAUSEA: Tendency to vomit; sickness at the stomach.

NECROPHILIA: Sexual attraction to or interest in dead bodies.

NECROSIS: The death of cells in the living organism.

NEMBUTAL: A brand of pentobarbital (Abbot Laboratories). Nembutal capsules, syn: "nimbys," "yellow jackets."

NON COMPOS MENTIS: Not of sound mind, insane.

OCCIPUT: The back of the head or the skull.

ODONTOLOGY: Syn: Dentistry. The knowledge of the development, structure and function of the teeth as well as of the pathological processes involving them. The forensic application of odontology are largely concerned with the identification of individuals.

OPIUM: Syn: "Hop," "mud," "tar." The juice of the unripe seed capsules of the poppy plant (*Papaver somniferum*). The milky juice is dried and the crude opium is sold as a dark brown gummy substance. Its pharmacological activity is due to a number of alkaloids including morphine and codeine. Crude opium is usually smoked in pipes.

ORBIT: Eye socket.

OSSIFICATION: The transformation of cartilage or fibrous tissue into bone.

- CENTERS OF
OSSIFICATION: Points of ossification, an early stage in the development of the skeleton. The presence of certain centers of ossification is an indication of the age of an individual.

OSTEITIS: Inflammation of a bone.

OSTEOLOGY: The knowledge of the development, structure and function of bones.

OVARY: The female sex gland which secretes sex hormones and in which the ovum develops.

OVERLAYING: The accidental smothering of a young child in bed by a sleeping adult. Overlaying was formerly regarded as a common event. It is now regarded as rare.

OVUM: The egg or female reproductive cell which after fertilization develops into the embryo.

PANCREAS:	A large elongated gland behind the stomach.
PARALYSIS:	The loss of the power of voluntary motion.
PARANOIA:	Mental disorder characterized by the development of ambitions or suspicions into delusions of persecution.
PATELLA:	Knee cap.
PATHOLOGY:	Syn: Pathologic anatomy. That branch of medicine concerned with the alterations in the structure and function of tissues caused by disease or violence. The practice of pathology includes the performance of autopsies.
PEDERASTY:	Homosexual anal intercourse with boys.
PEDOPHILIA:	Sexual activity of adults with children. It may involve any form of heterosexual or homosexual activity.
PERITONEUM:	A serous membrane which lines the internal surface of the abdominal walls and envelops the abdominal organs.
PERITONITIS:	An inflammation of the peritoneum.
PERMEATION:	The spreading through a tissue or organ of a disease process.
PETECHIAE:	Syn: Petechial hemorrhage. Tiny hemorrhages in the skin, mucous membrane or serous surfaces.
PHALANX:	Any one of the small bones of the fingers and toes.
PHOSPHATASE:	See: Acid phosphatase.

PLACENTA: Syn: Afterbirth. A round, flat organ at the site of implantation containing maternal blood vessels and through which the fetus receives oxygen and nourishment. The finding of placental tissue in the uterus is absolute proof of pregnancy.

PLEURITIS: "Pleurisy," inflammation in the chest cavity.

PNEUMONIA: Inflammation in the lung.

POSTERIOR: Adj: Dorsal, to the rear, behind, or facing backwards.

POSTMORTEM: Adj: Occurring after death.

- INTERVAL: The time between death and the examination of the body.

- CHANGES: A number of physical and chemical changes which commence immediately after death and eventually lead to complete disintegration of the body.

PROXIMAL: Adj: Nearer to the trunk or the origin.

PSYCHOSIS: A group of severe mental disorders in which there is loss of contact with reality and which are usually characterized by hallucinations.

PSYCHOSOMATIC: Pertaining to the mind-body relationship.

PTOMAINS: A group of toxic substances produced by the breakdown of proteins during putrefaction. Formerly believed to be a cause of food poisoning.

PULMONARY: Pertaining to the lungs.

- EMBOLISM: The closure of the pulmonary artery or one of its branches by an embolus.

- INFARCTION: An area of necrosis in lung tissue produced by sudden arrest of circulation in a vessel.

PUPA: The resting stage in the metamorphosis of certain insects between the larva and the adult form.

PUTREFACTION: The disintegration of the tissues brought about by bacterial action.

- GASES: Gases evolved in the process of putrefaction, largely hydrogen sulfide, ammonia, methane and carbon dioxide.

RADIUS: The outer and shorter bone of the arm, below the elbow.

RAPE: Sexual intercourse with a person without consent or with consent when the person is not qualified to give consent (when too young, mentally defective, etc.)

RECTUM: The terminal portion of the large intestine. It opens to the outside through the anus.

RENAL: Relating to the kidneys.

RESUSCITATION: To revive, as in drownings and electrical shocks.

RETARDATION: Delay or hindrance.

RHESUS FACTOR: A group of antigens carried on the red blood cells first found in the rhesus monkey. Individuals possessing the rhesus factor are said to be "Rh positive," those who do not are said to be Rh negative."

RIGOR MORTIS: Syn: Cadaveric stiffening. A stiffening and contraction of the musculature (both voluntary and involuntary) of the body after death.

SADISM: A practice in which pleasure or sexual satisfaction is derived from the infliction of physical or psychologic pain or abuse on others.

SAGITTAL: Adj: In the anteroposterior direction.

- PLANE: An imaginary plane traversing the body in an anteroposterior direction, useful in describing gunshot wounds.

SALICYLATES: A group of drugs used as analgesics, antipyretics and for topical application. Salicylates are commonly involved in suicidal poisons in adults and accidental poisonings in children.

SCALD: A surface injury caused by moist heat. In the skin, preservation of hairs distinguishes a scald from a burn.

SCAPULA: Shoulder blade.

SCHIZOPHRENIA: A mental disorder.

SCLERA: The white of the eye - a tough membrane.

SCRATCH: An abrasion caused by a pointed object passing over the skin. The heaping up of the epidermis at one end may indicate the direction of the scratch.

SEAT BELT INJURY: Abdominal injuries sustained by acute flexion over a seat belt during sudden deceleration. Seat belt injuries include flexion compression fracture of the neck, tears of bowel or mesentery or injury to th pregnant uterus.

SECONAL: Brand of secobarbital (Eli Lilly & Co.). Seconal capsules syn: "pinks," "red birds," "red devils," "seggys."

SECRETOR: An individual secreting blood group specific substances in the body fluids and secretions such as milk, saliva and seminal fluid. About 80% of the population are secretors.

SEDATIVE: A drug which allays excitement. Sedatives include the barbiturates, bromides and chloral hydrate. In large doses, sedative may act as hypnotics.

SEGMENTATION: Syn: Box car sign. Numerous transverse interruptions of the blood column in the vessels of the choroid of the eye. It has been regarded as one of the earliest signs of death.

SEMEN: Syn: Seminal fluid. A viscous, whitish fluid ejected from the penis during orgasm and consisting largely of spermatozoa and secretions of the prostate gland and seminal vesicles.

SEPTICEMIA: Syn: Blood poisoning, sepsis. The presence of pathogenic bacteria in the blood.

SHOCK: A condition characterized by pallor, low blood pressure, rapid but shallow pulse and clammy perspiration.

- PRIMARY: Syn: Faint, syncope. A transient loss of consciousness due to fear or violent emotion.

- SECONDARY: Syn: Oligemic shock, surgical shock, traumatic shock. A state of shock, often progressing to death, caused by a sudden reduction of circulating blood volume.

SINGEING: Syn: Branding. An area of burned skin or hair surrounding the entrance wound of a bullet fired at close range and caused by hot gases escaping from the muzzle.

SMOTHERING: Asphyxia produced by the occlusion of the mouth and nostrils, e.g., by a pillow.

SMUDGING: An area of blackening produced by powder gases and surrounding the entrance wound of a bullet fired at close range.

SODOMY: Syn: Buggery. A form of sexual intercourse in which the penis of the active participant is inserted into the anus or the mouth of the passive participant.

SPASM: Sudden, violent, involuntary contraction of a muscle or group of muscles.

SPERMATOZOA: The mature male reproductive cells produced in the seminiferous tubules of the testis. The main cellular constituent of semen.

SPLIT: Syn: Splitting wound. a wound of the skin caused by the compression of the tissue between a hard, blunt object or hard surface and bone. A split may resemble a cut but usually shows ragged edges and contusion of the adjacent tissue.

SPRAIN: The twisting or straining of a joint with injury to the joint capsule or ligaments but without displacement of the bone.

SPUTUM: Matter ejected from the mouth; saliva and mucous.

STAB: Syn: Penetrating wound, perforation, puncture. A wound caused by the penetration of a pointed instrument. In contrast to a cut, the depth of a stab is greater than its width.

STAGNANT: Failure of circulation (for example: shock, cardiac failure).

STEERING WHEEL
INJURY:

An injury caused by the impact of the steering wheel on the chest and upper abdomen of the driver during sudden deceleration. It frequently includes rupture of the liver and a flail chest.

STILLBIRTH:

The birth of a dead infant during the last trimester of pregnancy or at term. A infant is regarded as stillborn if it has not shown any sign of life while completely external to the mother. See: Abortion and Miscarriage.

STIPPLING:

Syn: Powder stippling, tattooing and powder burns. Dispersed particles of burned and unburned gunpowder embedded beneath the skin surface around a bullet wound.

STRANGULATION:

Death caused by compression or constriction of the neck.

- LIGATURE:

Strangulation by a ligature, such as a rope, stocking, towel, etc.

- MANUAL:

Syn: Throttling. Strangulation by one or both hands. Manual strangulation frequently causes injury to the thyroid cartilage.

STROKE:

A sudden or severe cardiovascular attack, with rupture of a blood vessel in the brain.

SUBARACHNOID
HEMORRHAGE:

Bleeding, often spontaneous, sometimes from injury, between the brain and its covering membrane, the arachnoid.

SUBDURAL:

Under the dura mater, or between the dura and arachnoid membrane covering the brain as in subdural hematoma.

- HEMATOMA:

Bleeding, almost always from injury, between the inside of the skull and the dura which covers the brain. This accumulation of blood produces pressure on the brain.

SUBLUXATION: A partial dislocation of a joint.

SUDDEN INFANT DEATH SYNDROME: See: Syndrome.

SUFFOCATION: The stoppage of respiration.

SYNDROME: A set of signs and symptoms which occur together.

- BATTERED CHILD: The presence in a child of multiple injuries caused by repetitive trauma, generally inflicted by the parents. These injuries, which usually vary in age, may include bruises, fractures, separation of epiphyses, eye injuries, subdural hemorrhage and rupture of organs.

- CRUSH: Kidney failure caused by damage to tubules and precipitation of hemoglobin, following severe crushing injuries, usually of the extremities. a similar syndrome may follow incompatible blood transfusions.

- MALLORY-WEISS: Vomiting of blood due to a mucosal tear of the gastroesophageal wall. Regarded as a result of vomiting.

- MENDELSON'S: An acute hemorrhagic pneumonia caused by the aspiration of gastric acid. Often a complication of obstetrical anesthesia or of vomiting in the debilitated or immobilized patient.

- REYES: A usually fatal syndrome in infants and young children consisting of hyperexcitability, seizures, hepatomegaly and hypoglycemia. At autopsy, cerebral edema and a fatty liver are found.

- SUDDEN INFANT
DEATH:

Syn: Crib death, SIDS. Sudden death in apparently well infants, usually between the third and sixth months of life, with negative or minimal autopsy findings.

TATTOO:

Syn: Powder stippling. An area of burned grains near the entrance wound of a bullet fired at close range.

TEMPERATURE PLATEAU:

The period immediately after death during which the internal body temperature does not fall. The temperature plateau may last 1-5 hours.

TEMPORARY CAVITY:

A momentary cavity created in the tissues by the rapid passage of a missile, causing much disruption. The size of the temporary cavity depends upon the energy of the missile and its rate of transfer to the tissues. The space remaining after the collapse of the temporary cavity is the permanent cavity.

T.H.C:

Tetrahydrocannabinol, a constituent of hashish and marijuana.

THROMBOSIS:

Blood clotting inside the blood vessels, often in leg veins.

- CORONARY:

Thrombosis narrowing or occluding the lumen of the coronary artery.

THROMBUS:

A solid coagulum formed in circulating blood in the blood vessels or chambers of the heart, its structure being largely determined by the turbulence of the blood. Its architecture thus differs from that of a clot.

- MURAL:

A thrombus attached to the wall of a blood vessel or heart chamber.

THYROID CARTILAGE: The main cartilage of the larynx. It has two posterior projections on either side which are frequently broken in cases of strangulation.

TIBIA: The inner and larger bone of the leg below the knee.

TORSO: The trunk of the body without the head or extremities.

TOXIC: Adj: Pertaining to, caused by or acting as a poison.

TOXICOLOGY: The science of the nature of poisons, their effects and detection.

TOXIN: A poisonous substance produced by bacteria, animals or plants.

TRACHEA: Syn: Windpipe. A cartilagenous tube connecting the larynx with the bronchi.

TRACHEOSTOMY: Syn: Tracheotomy. A surgical operation making an opening in the neck to facilitate breathing.

TRANQUILIZERS: A drug which sedates and reduces anxiety. The tranquilizers include the pheonthiazines, diazepines and butyrophenones.

TRANSSEXUAL: A disturbance of gender identity in which the person feels a lifelong discomfort with his or her own sex and a compelling desire to be of the opposite sex.

TRANSVESTITE: An individual obtaining sexual gratification by wearing the clothing of the opposite sex.

TRAUMA: A wound or injury.

- TRAUMATIC ASPHYXIA: See: Asphyxia.

TREMOR: An involuntary trembling or quivering.

TUINAL: Brand of sexobarbital and amobarbital (Eli Lilly and Co.). Tuinal capsules Syn: "double trouble," "rainbows," "tooies."

ULCER: An open sore of skin or mucous membrane.

ULNA: The inner and larger bone of the forearm.

UMBILICAL CORD: A cord connecting the navel of the fetus with the placenta and containing two arteries and one vein.

UNCONSCIOUS: Same as comatose. No response to any stimuli. THE PERSON IS NOT DEAD.

UREMIA: Presence of urinary materials in the blood. The person is unable to eliminate urine due to kidney failure.

UTERINE TUBES: See: Fallopian tubes.

UTERUS: Syn: Womb. A muscular hollow organ in the female in which the embryo develops.

VAGAL INHIBITION: Syn: Vagal reflex. Stoppage of the heartbeat through stimulation of the vagus nerve. Vagal inhibition may be caused by pressure on the neck, immersion in cold water, minor surgical procedures, etc.

VAGINA: The tubular musculofibrous passage in the female connecting the vulva with the cervix.

VAGUS: The tenth cranial nerve originating in the brain stem, passing through the neck and chest and supplying branches to the larynx, heart, lungs, stomach and abdominal cavities.

VASCULAR: Pertaining to or full of blood vessels.

VEIN: A blood vessel carrying blood from the tissues to the heart.

VENA CAVA: Superior main vein draining the abdominal and pelvic viscera and the lower extremities.

VENTRAL: Relating to the front of the body.

VENTRICLES: 1. The two lower, more muscular chambers of the heart.
2. Four intercommunicating cavities in the brain into which the cerebrospinal fluid is secreted.

VENTRICULAR FIBRILLATION: Irregular and ineffective contractions of the ventricles of the heart leading to sudden death.

VESICLE: See: Blister.

VIABILITY: As applied to a fetus, the stage of development at which it would be capable of extrauterine existence. Variously given as 20-24 weeks of gestation.

VISCERA: The large interior organs of the body.

VITAL: Adj: Characteristic of or essential of life.

- REACTION: A reaction in a tissue, such as inflammation, occurring during life and thus used to distinguish antemortem from postmortem wounds.

- SIGNS: Physical signs such as respiration and pulse, indicative of the presence of life.

VULVA: The external female sexual organs consisting of the vestibule, clitoris, labia majora and labia minora.

WASHERWOMAN'S HANDS: A wrinkling of the skin of the hands and feet caused by prolonged exposure to moisture. May occur before or after death.

WHIPLASH INJURY: An injury to the tissues of the neck caused by a sudden overextension of the cervical spine. It is common in rear end collisions. The injury usually involves the muscles and spinal ligaments, but in severe cases may damage the intervertebral discs, esophagus, trachea and sympathetic chain.

WIPING: Syn: Ring of dirt. Dirt and lubricant from the gun barrel and surface dirt from the bullet deposited on edges of a gunshot wound when there is no intermediate target. May be minimal or absent in non-lubricated ammunition (automatic or semi-automatic weapon).

WOUND: An injury to the body caused by exterior violence.

- DEFENSE: A wound, usually on the fingers, hands or forearms of the victim of an attack, sustained while trying to grasp a weapon or ward off the assailant. The nature of the wound depends on the weapons used for assault.

- PENETRATING: A wound which extends into an organ or tissue, having both an entrance and an exit opening.

PERFORATING: A wound which completely transverses an organ or tissue, having both an entrance and an exit opening.

X-RAYS, SOFT:

Syn: Grenz rays. X-rays of lower voltage than those used for diagnostic purposes. Important use in identifying entrance gunshot wounds which may have small particles of metal present on clothing or skin.

ZYGOMA:

Cheek bone.

Supervision And Management Of A Homicide Investigation¹

By Vernon J. Gerberth, Lt. Commander (Ret.) NYPD

The purpose of this article is to provide homicide supervisors with practical and specific considerations for formulating management objectives in the investigation of homicides. Administrative policies and procedures employed by police agencies are usually determined on a jurisdiction-to-jurisdiction basis. Therefore, the author cannot present an all-inclusive management technique applicable to all law enforcement agencies. However, certain basic principles of homicide investigation, along with interagency responsibility, can be developed into guidelines that will contribute to the proper and intelligent handling of murder cases.

Management Policy

Two basic principles of any homicide investigation are documentation and preservation. To ensure that these principles are accomplished, there must be an established management policy that gives direction to the investigative unit.

Various methods and techniques can be employed to properly document and preserve events at the scene. Managing a homicide investigation is simply an extension of these techniques through supervision. Management assures that the preliminary investigation and initial actions taken at the scene, as well as the total investigative effort, have been properly documented, and that any evidence recovered has been properly handled and preserved.

An effective homicide investigation is the responsibility of the entire police organization, not just the individual investigator assigned to the case. Consequently, there is a need for efficient coordination of activities and procedures critical to the processing of the case.

Examples of some of these activities follow:

- collection of evidence
- procedural tactics
- duties of patrol officers at the scene
- preparation of forms and reports
- overtime allowance
- case-officer responsibility
- confidential informant funds
- allocation of equipment
- supervisor's duties and
- notifications

These activities must be properly managed in order to bring the entire organization into play to effect the successful conclusion of the case. However, management must provide for flexibility and

Adapted from Vernon J. Gerberth, "Supervision and Management of a Homicide Investigation," Practical Homicide Investigation Tactics, Procedures, and Forensic Techniques. Third Edition, 1996. Used with permission of the author.

common sense. Therefore, any system implemented to direct and manage murder cases should be realistic and allow for policy variations at the point of execution.

Teamwork

All members of a police department contribute to the process of crime solving, whether it be the operator in the communications division who initially takes the call and elicits additional information, or the patrol officer who responds to the scene and detains a key witness or suspect. Everyone must work together toward the common goal of solving the homicide.

Teamwork is necessary if the goal is to be achieved. Therefore, the duties of detectives and the activities of patrol officers must be integrated to complement one another, and the management policy should stress this principle.

Policy and Procedure

Each agency must establish guidelines and procedures that will allow the organization to function efficiently within their jurisdiction purview. Homicide investigations, however, present additional management considerations because two distinctively unique operational divisions are involved.

For example, the investigation of a homicide is usually initiated by the patrol division, which operates under patrol guidelines. The patrol division, in turn notifies the investigative division, which operates under investigative guidelines. Investigators, upon arrival at a scene, assume responsibility for the case and take over the investigation from patrol officers, possibly directing uniformed officers and additional police units at the scene as required by the investigation.

Policy must provide for the efficient coordination of these various units by either the investigator assigned to the case or the detective supervisor, if present, in order to maintain control over the homicide investigation.

In addition, any policy established must meet the legal requirements of, and be compatible with, the responsibilities of other agencies. For example, the offices of the District Attorney or Solicitor have a specific responsibility for the ultimate prosecution of the case. The Medical Examiner or Coroner's office has the responsibility for determining the cause of death.

Since each of these organizations is required by law to conduct independent investigations into the facts and circumstances of death, police agency policy has to provide for mutual cooperation and exchange of information.

How an agency organizes its departments or divisions to perform investigative function is important. This includes the selection and training of personnel for investigative assignment, management of investigative personnel, and the designated units that are responsible for conducting criminal investigation.

How are members selected for assignment to investigations?

Is the selection based on legitimate qualifications, i.e., department exam, aptitude testing, seniority in rank, supervisor's recommendation, or board qualification?

What type and quality of training is afforded the members?

Is the training provided members sufficient for the assignment or does the department allow new investigators to "feel their way"? Are outside sources utilized for more advanced in-service training? Are members encouraged to attend training sessions both within and outside the agency?

Is specialization, generalization or rotation assignment utilized?

Specialization for homicide assignment is the ideal situation if the agency can justify specialists for the work load. Even in agencies where the work load is not sufficient for a full-time homicide specialist, a select few are generally chosen to investigate homicide cases. Generalization is acceptable for smaller departments that do not have a substantial case load.

Rotation must have been created by someone with no understanding or appreciation of the investigative mission. It is demoralizing for officers to be transferred out of a preferred assignment without cause; rotation does not allow for career growth, and it frustrates professional ambition. It takes as long as two years for most officers to become familiar with all aspects of investigations and become proficient at the work. It doesn't make sense to periodically transfer experienced investigators back to patrol simply for the purposes of rotation.

How are supervisors selected for investigative assignment?

Qualified members from within investigative units should be selected for assignment as supervisors or commanding officers of the function. The policy of sending a newly-promoted investigator back to a uniform assignment for some sort of "cleansing" is not good utilization of resources. Such a policy has adversely affected the overall success of many investigations sections. Inexperienced supervisors oftentimes fail to properly delegate routine matters and involve themselves in operations rather than the supervision of operations.

Case Management

Case management relates to the processes involved in monitoring the progress of an investigation, beginning with the initial report, or officer-initiated police action, and continuing through all phases of the investigation until the case is closed.

Have administrative procedures been implemented to provide documentation of the case and preservation of evidence?

The official police report and documents in the case file are extremely important instruments. The documentation of events, as well as the official police response to the investigation, form the basis for prosecution.

The path from arrest to conviction is fraught with technical and legal booby traps. Hence, there is a need for intelligent case management that takes into account the reality of "Discovery v. Documentation."

Proper case management requires documentation of the pertinent facts of the case, but not police administrative matters, i.e., supervisory reviews, case recommendations, meal times, travel to and from, roll call assignments and daily activity reports. Such information does not belong in the case file.

Inappropriate departmental policy and/or procedures regarding investigative strategies are usually based on bureaucratic, political, and/or personal consideration not related to the primary objective of solving the case.

The interference of high-ranking officials is also often a problem. Police Commissioners, Chiefs of Police, Sheriffs, and other top-ranking officers are supposed to be administrators, not detectives or squad commanders. The immediate mission of the supervisor of the detectives is to provide coordination of resources and to direct personnel through the Squad Commander.

This chain of command is necessary to maintain order and responsibility. High-ranking officials should not communicate orders directly to officers, and they definitely should not be involved in operational processes such as interrogating suspects and tactical procedures. On-scene activities are best left to the investigators assigned to the case. Ranking officers with expertise should contribute through channels unless specifically requested to participate.

Interagency Rivalry

A working relationship must be established among police, prosecutors, and medical examiner/coroners based on cooperation, trust and respect. Police and prosecution should complement each other and should feel at ease in giving and receiving advice from one another during an investigation.

There is no room for interagency rivalry in a homicide investigation. Agencies with dual responsibility for the investigation of sudden and unexplained deaths must reach an accord as to ultimate case responsibility among the jurisdictions involved.

The best way to accomplish a cooperation venture is through continued personal contact and understanding of each other's roles and duties. Each of the three official agencies of inquiry has specific responsibilities and duties that may at times overlap, and a misunderstanding can take place. This is especially true in sensational murder cases where there are inordinate amounts of public or agency pressure, requests for regular progress reports, and demands by the news media for a story.

The duties of each agency involved in the investigation of a homicide are determined by both tradition and law. However, policies should be instituted within each organization that transcend individual positions and address the common goal or objective. Courtesy and tact are always helpful in interagency dealings.

Basically, the duties of each are:

1. The ultimate responsibility for the investigation of crime rests with the local law enforcement agency. The chief law enforcement official within any community is the police chief, the sheriff, or the police commissioner and his or her designated representatives.
2. The District Attorney, State's Attorney, or Solicitor in turn is responsible for the ultimate prosecution of the crime and as such, should be kept aware of all developments of the police investigation. He or she is responsible for all legal investigative operations such as search warrants, arrests warrants, grand jury presentations, etc.
3. The medical examiner/coroner is responsible for the determination of cause, manner, and mode of death and should be apprised of all developments of the police investigation.

Flexibility and common sense by the representatives of each of these agencies ultimately benefits all concerned and eases misunderstandings. Remember, the key to a successful homicide investigation is teamwork and mutual respect for each other's goals and objectives.

Effective Procedures

The management and supervision of a homicide investigation can be separated into five specific segments. The case preparation for court and prosecution and any subsequent case analysis are separate prosecutive and administrative functions, which, for the purposes of this article, do not apply to the following.

Practical homicide investigation supervision techniques are:

- Supervising the preliminary investigation at the scene
- Directing specific investigative duties
- Supervising the homicide crime scene search
- Providing for the effective documentation of events
- Conducting an investigative critique (an information conference of participants in the investigation, which can take place any time during the case.)

On-Scene Supervision

It is imperative that the supervisor, when notified that detectives are requested to respond to a possible homicide, record the following information:

- Date and time received
- How initial report was received
- Name of person making report (this includes police officer)
- Complete details

At this point the homicide supervisor either responds directly with investigators, or responds individually. I recommend that the supervisor take his own transportation to the scene.

If personnel are available, it helps to assign a member to maintain communications within the command. This person's responsibility is to make follow-up notifications, record requests for identifications and special services and take requests from the command post at the crime scene. This assignment is critical in major case investigations when trying to evaluate the full extent of the investigation.

There are special duties to be performed upon arrival at the scene:

- Record the exact time of arrival
- Record the exact address
- Record police units present
- Confer with detectives at the scene to determine if an investigator has been assigned to the case. If not, assign one immediately
- Confer with patrol supervisor and establish cooperation;
- Confer with the first arriving officer for a quick briefing;
- Make a visual inspection of the crime scene and the crime in order to get a feel for the case and establish perimeters;
- Solicit opinions and/or theories from police personnel at the scene;
- Determine investigative needs and make assignments. Providing necessary manpower and equipment establishes your authority;
- Implement an assignment sheet. Knowing who is performing what assignment assists coordination.

The supervisor's notebook should detail exactly who has what assignment. This enables the supervisor to properly assign members and record exactly what has transpired at the crime scene. As members report back, the supervisor should jot down a brief description of their activities. This notebook is valuable for subsequent written reports.

Initiate an investigative canvass, which is simply a door-to-door inquiry or roadblock operation in order to obtain information and/or locate witnesses. The supervisor should assign a sufficient number of officers to effectively cover the area to be canvassed. If large-scale, assign a supervisor to coordinate the canvass and instruct to use questionnaires for follow-up surveys.

If the victim has been removed to a hospital, assign either a patrol unit or detective to respond to the hospital to assure proper evidence collection procedures regarding clothing, ID papers, etc., are undertaken. There may also be an opportunity to obtain a dying declaration.

Ascertain what alarms have been transmitted. Review alarms for appropriate information and consider updating them based on information developed at the scene.

Provide for the dissemination of information to all units and personnel involved in the investigation. Keep the command post and investigators informed of all relative and current information as it becomes available.

Utilize patrol officers to maintain lines and instruct detectives to use courtesy and tact in dealing with people at the scene. Assign members in street clothes to "work the crowd" to obtain leads from conversations. Depending on circumstances, bilingual officers might mingle with bystanders. Also direct that photos be taken of the crowd.

Direct that ambulance or EMS personnel be interviewed if they arrived before police. Their activities at the scene, as well as people they may have seen or things they overheard, could be important.

Specific Duties

Regarding the suspect in custody:

- Establish the probable cause for arrest
- Determine the scope of the preliminary investigation
- Advise detectives to instruct patrol officers to document their observations regarding any overhears, statements, and any information provided by informants and/or witnesses.

Regarding interviewing and interrogation of a suspect in custody:

- Direct investigators to document their Miranda warnings
- If the suspect is cooperative, have detectives take a preliminary statement at the scene, which may be used to assist in the recovery of any evidence, etc.

The formal interrogation should be conducted at the station house, and no one should interfere with an investigator in the process of taking a statement from a suspect. The cardinal rule of interrogation is: never intrude on an interview of a suspect. This includes supervisors.

In the examination of a suspect for evidence, advise investigators to document--by both photography and sketch--any scratches, bruises, injuries, etc., observed on the suspect. Advise transporting officers to be aware of evidentiary considerations (do not allow victim to wash, etc.).

Dying Declarations

A seriously injured victim should be considered a candidate for a dying declaration. Direct investigators to respond to the hospital, obtain witnesses if possible, and attempt to obtain a statement from the injured victim.

There are no set guidelines, such as an exact sequence of questions. However, you want to establish that the victim is competent, lucid, and does believe that he or she is about to die.

Suspect's Mental State

Evaluation of any suspect's demeanor and/or mental capacity is important. Detectives should document the suspect's actions and mental capacity from the time of arrest to arraignment. This procedure is necessary to prepare against a possible diminished capacity defense.

Crime Scene Search

The crime scene search, the most important phase of the investigation conducted at the scene, is a separate and distinct function. Ideally, there should be a crime scene investigator or evidence technician assigned to conduct the search. Departments should train a sufficient number of investigators for this important function.

Agencies oftentimes do not put enough emphasis on this phase of the investigation, opting instead for something less-time consuming, e.g. a confession. Make sure your investigators do a proper search.

Supervision of this function is aimed at preserving and documenting the event. The purpose of a crime scene search is to obtain evidence. If there is any possibility that any evidence you are about to seize requires a search warrant, it's the supervisor's job to assure that the proper warrant is obtained.

Supervisors should be aware of the warrant exceptions:

- emergency
- plain view
- consent
- search of suspect after arrest

Any search method can be utilized and is usually determined by the size, location, and complexity of the scene. It doesn't matter which method is selected as long as the search is systematic and complete.

The scope of a search is determined by a theory or hypothesis arrived at by the detective supervisor and investigators based on their initial observations. This theory, which is provisional, is based on simple assumptions of how and why the homicide occurred. Remember: anything can be evidence.

The primary responsibility is the isolation and protection of the crime scene. The objective is to establish the corpus delicti and the identity of the criminal.

Upon arrival, ascertain boundaries. Do not move blindly into an area. Confer with those already on the scene to decide the approach and paths of entry and exit. Prior to any crime scene search, direct that photographs and crime scene sketches be made.

The initial survey is an opportunity to develop a mental image. Remember to be escorted by the first arriving officer. Ascertain whether or not any fragile evidence is present to assure collection.

When examining an outdoor crime scene, the following procedures are important:

1. Rope off the largest area
2. Establish a path of entry and exit

3. Conduct examination as soon as possible (Before losing daylight or experiencing weather changes.)
4. Direct that surrounding area be searched
5. If weather becomes bad, order evidence be collected immediately

Under ordinary circumstances, an outdoor scene would not be searched during nighttime hours. However, it is necessary to safeguard the area, take photographs before the body is moved, and protect the body against additional damage in transport.

Release of the crime scene is also a critical decision. Authorities should hold on to the scene as long as possible as there may be a need for additional photos, or information may reveal the need for an additional search.

Before cleaning the crime scene consider: the defense attorney might visit the crime scene to judge the extent of the police investigation. He will be alert to areas that were or were not processed. Direct that all materials used to process the scene be placed in a receptacle that can be taken from the scene when the police leave. Make sure that all police equipment has been removed from the premises before the scene is released.

Supervisory Hypothesis

The supervisory hypothesis is as follows: Ask yourself, "What happened?" Keep an open mind; don't be influenced by the police call or initial statements. Make a determination based on the total information available.

The question is: was death caused by homicide, suicide, accident, or natural causes? The answer must be based on the following:

1. Do the facts, the crime scene, the statements, and the physical evidence support the explanation? Things are not always as they appear to be. Don't be afraid to change your mind. Any hypothesis is only provisional at best.
2. Examination of the body at the scene. All photographs and sketches should be completed before examining the body. Obtain a complete description of the body as well as the clothing. Portions of the body that were not accessible to the on-scene photos should be examined and photographed.

Release of the body is a critical decision. Once it is removed from the scene, no additional procedures can be undertaken. It should be wrapped in a clean white sheet before being placed in a body bag.

Investigative Conference

An investigative conference is an important part of any well-run homicide investigation. The conference need not be a formal gathering; it can take place anytime during the investigation or after each of the other four phases.

The conference, directed by the chief investigator at each critical point of the investigation, is to assess the investigation by gaining an overall synopsis. Each member relates his or her progress and ideas; everyone is kept abreast of all developments and there is a general discussion.

The daily investigative conference is somewhat different and usually takes place at the station house. It attempts to assess the entire investigation on a daily basis.

Management and supervision of a homicide investigation is unique in its comparison to other police management operations. The management of day-to-day patrol operations and administrative functions can many times be proceduralized due to their routine and repetitive nature. The intelligent management and supervision of homicide investigations, however, requires a different approach that takes into account the unpredictables of a murder investigation.

However, rules and procedures, as well as established policies, give direction and coordination to the function. In addition, there may be guidelines implemented for specific investigative actions. The on-scene supervisor directs and coordinates a team effort based on established policies. However, as a manager, he has the authority to allow for variations of the guidelines when needed. This flexibility is based on necessity and common sense.

The supervision and management function requires the supervisor to actively participate in the investigation. This does not mean "playing detective" and jumping into the operational aspects, such as interrogation of suspects, crime scene collection, interviews of witnesses, etc.

Active participation means sharing an interest in the investigation, intelligently directing activities and utilizing the investigative critiques to properly establish priorities. In addition, it enables the supervisor to assess the case and provide the necessary resources to effectively investigate the case.

The supervisor of homicide should ideally have a homicide or an investigative background because experience is a prime asset. This does not mean that a supervisor who lacks a homicide or investigative background cannot effectively supervise investigations. However, it does suggest that there is a need for learning the investigative processes involved.

***DEVELOPMENT OF THE
CORONER AND THE MEDICAL
EXAMINER SYSTEM***

Development of the Coroner and the Medical Examiner Systems¹

Forensic Sciences in Antiquity

The earliest application of forensic medicine had to do with the interdiction against suicide, which has been regarded as a crime against the public interest since before the birth of Christ. It appears that this was largely due to the fact that occasional communities, even in those days, sustained epidemics of suicides. It is probably also rooted in the primitive belief that the individual who took his own life was possessed by evil spirits and might pass them on to other members of his community. Anthropologists have reported a similar phenomenon in more modern days in certain relatively uncivilized African tribes, where the hut belonging to the victim of a suicide is burned to the ground and his family expelled from the village. It is recorded that suicide was strongly condemned in ancient Greece because the individual was regarded as a servant of the gods and self-destruction constituted an act of rebellion against the gods. It was accepted in certain instances, however where the community had condemned an individual, as in the case of Socrates, who in turn committed suicide by drinking hemlock. A medicolegal opinion as to manner of death had to be reached in such cases in order that a decision could be rendered as to whether the penalty--usually consisting of denial of the funeral rights to those who had offended against religion--should be inflicted. In the same way, in ancient Rome, soldiers who committed suicide were treated as deserters, and criminals who committed suicide in order to escape punishment were likewise condemned.

In the tenth century suicide became a crime under the common law in England, and in 1184 the Council of Nimes made the condemnation of suicide part of the canon law of the Roman Catholic Church. The decisions as to manner of death seem to have been made mostly by an investigation of the circumstances without specific examination of the body, although historians have reported that Antistius, a physician in Rome, examined the body of Julius Caesar and reached the opinion that, of the twenty-three wounds Caesar sustained, the only mortal wound was one in the chest.

In China a handbook entitled *Hsi Yuan Lu* was published in about 1250. It contained guidelines for the postmortem examination of bodies, including descriptions of various wounds caused by sharp versus blunt instruments. It also offered comments on the determination of whether an individual found in the water had died of drowning or had been killed beforehand and of whether a burned individual was dead before the onset of the fire.

¹This section is excerpted from R.S. Fisher (1980), *History of Forensic Pathology and Related Laboratory Sciences*. In W.U. Spitz and R.S. Fisher (Eds.), *Medicolegal Investigation of Death* (2nd edition), Springfield, IL: Charles C Thomas.

The Early Development of the Autopsy in Forensic Investigations in Europe

The written records of the development of forensic pathology in Europe begin in 1407, when a volume subsequently known as the Bamberg Code appeared. Twenty-three years later, a more extensive penal code, known as the *Constitutio Criminalis Carolina*, was issued by Emperor Charles V for all the lands included in his empire. The two documents portrayed the importance of forensic pathology in requiring that medical testimony be an integral part of the proof and trials involving decisions about whether the manner of death was infanticide, homicide, abortion, or poisoning. They apparently did not specify that complete autopsies were to be performed, but wounds were opened to determine their depth and direction. Thus it appears that some degree of skilled medical knowledge was required of the expert witness. Meanwhile, Andreas Vesalius, the first of the pioneers in anatomy, was dissecting cadavers and for the first time established the true facts of the anatomy of the body.

In the latter half of the sixteenth century Ambrose Paré performed official medicolegal autopsies. He reported the findings in lungs of smothered children and studied the traces left by sexual assault. Fidelis and Zacchia in Italy, in the early seventeenth century, were likewise engaged in anatomical dissections and reported analyses of injuries to internal organs. Fidelis described the findings in drowned bodies that would distinguish between homicidal and accidental drowning. Zacchia's work included descriptions of bullet and stab wounds, findings in asphyxial deaths, the distinction of suicide from homicide, the differentiation of sudden death from natural causes and, in cases of infanticide, the determination of whether an infant had been born alive.

The first formal lectures in forensic pathology were held by Michaelis and Bohn at the University of Leipzig, where students were apparently instructed in the subject of violent death and simulated natural deaths. As a result of advancement of knowledge by these pioneers, the judicial authorities and the police in Europe soon began to call upon physicians to aid in the solution of fatal crimes, and most of the larger jurisdictions developed centers, commonly known as institutes of forensic medicine, where experts carried out their investigations. There was little of scene investigations by these physicians, since this chore rested principally with the police, but in instances where bodies were found in trunks or in the water it was not uncommon for the medical investigator to examine the associated evidence. Indeed, it was in this context that the recognition of the medicolegal importance of bloodstains first developed.

The Coroner System in England

The historical developments of medicolegal investigation in America can be clearly traced back to the English coroner system, which had developed in that country some 600 years before.

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The justices in eyre, who were apparently comparable to the travelling circuit court judges of modern day, could order the coroner to perform duties of administrative or inquisitorial

nature within the region for which he had been appointed. These duties were carried out either alone or with the sheriff, but certain of them were earmarked specifically for the coroner's office, and he could perform them without being ordered to do so. Among these were holding of inquests over dead bodies and *appeals* (inspection of an individual's wounds, recording the accusation against another individual and, if the wounds appear likely to be fatal, arresting the accused individual).

* * * * *

Blackstone has written an appropriate brief paragraph describing the coroner's duties at the time Edward I became King in 1272:

The office and power of a Coroner are also like those of a Sheriff, either judicial or ministerial, but principally judicial . . . And consists, first, in inquiring, when any person is slain or dies suddenly, or in prison, concerning the manner of his death. And this must be upon sight of the body; for if the body be not found, the coroner cannot sit. He must also sit at the very place where death happened, and the inquiry must be made by a jury from 4, 5, or 6 of the neighboring towns over which he is to preside. If any be found guilty by this inquest of murder or other homicide, the coroner is to commit them to prison for further trial and must certify the whole of his inquisition, together with the evidence thereon, to the Court of King's Bench, or the next assizes.

* * * * *

In 1877 a law was enacted requiring the inquest to be conducted whenever the coroner had reasonable cause to suspect violent or unnatural death or when the cause of death was unknown. This had the effect of granting the coroner the widest authority to investigate cases and was indeed in sharp contrast to the continental system, where investigations were commenced only by the prosecutors or police officials. Thus, the coroner system developed as a broad-spectrum investigative agency concerned with a large proportion of all deaths, including many nonviolent deaths. In 1888 the election of the coroners by freeholders was abolished and an appointee system developed under which the head of the local governmental unit appointed the coroner. There remained, however, no minimum qualifications for office. These were established in 1926, when a law was enacted requiring five years experience as a medical practitioner, barrister or solicitor if the individual was to qualify as coroner. Interestingly enough, in Northern Ireland similar legislation excluded doctors from holding the position of coroner unless they were also lawyers.

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The Establishment of Forensic Pathology in America

The early American colonists, originating in England, brought the coroner system with them in essentially the state of development it had reached by the early 1600s. Thus, there is a record of a coroner's inquest in the colony of New Plymouth, New England, in 1635; briefly, the inquiry found that John Deacon died as a result of bodily weakness caused by fasting and extreme cold.

The governor of Maryland, Leonard Calvert, appointed Thomas Baldrige of St. Mary's to be sheriff and coroner on January 29, 1637, and authorized him to, "Doe all and everything . . . the office of sheriff and coroner of any county in England doe. . . ."

Baldrige was soon hard at work, because on January 31, 1637, he impaneled a jury of twelve men to hold an inquest over the body of one John Bryant. Their verdict was, "John Bryant by the fall of a tree had his blood bulke broken; and hath two scratches under his chinne on the left side; and so that by means of the fall of the said tree upon him the said John Bryant came to his death." This coroner's office was one and the same as the sheriff's office, and while it did not carry any fixed stipend, it provided a substantial income because the sheriff was responsible for the collection of property taxes, poll taxes and other levies, and he usually received 10 percent of his collections. The early definition of the coroner's duties is also recorded in the Archives of Maryland, preserved by the Maryland Historical Society, whereby on April 30, 1640, the governor appointed John Robinson, high constable, as coroner for St. Clements Hundred in St. Mary's County. The definition of duties included--

Upon notice or suspicion of any person that hath or shall come to his or her death entirely within the limits of that hundred to warn as many inhabitants of the said hundred as you conveniently may to view the dead body and to charge the said persons with an oath truly to inquire and true verdict to grant how the person viewed came upon his or her death according to the evidence. . . .

Autopsy examinations of bodies are recorded in Massachusetts as early as 1647, when the General Court of Massachusetts Bay concerned with the teaching of medical students authorized that "an autopsy should be made on the body of a criminal once in four years." The medicolegal application of the autopsy is recorded in Maryland on March 21, 1665, when a Mr. Francis Carpenter was brought before the Talbot County Court on suspicion of murdering one Samuella Yeoungman, a servant of his. The coroner's report absolved Mr. Carpenter, saying--

Wee of the Jury haueing viewed the Corps of Samuella Yeoungman and finding A Depression in the Cranenum in on [one] place, and another wound where all the muscle flesh was Corrupted, and withall finding Corrupt blood betweene the Dura and Piamater, and the braine and several other bruises in the head and body therefore our verdict in that for want of Looking after the abouesaid wounds, were the Cause of his death.

The record does not reveal whether Mr. Carpenter may have inflicted the original wounds on the deceased's head.

* * * * *

Perhaps the earliest formal mention of the physician in connection with the work of the coroner was in 1860 in Maryland, where the Code of Public General Laws authorized the coroner or his jury to require the attendance of a physician in cases of violent death. The choice of the physician was left to the coroner. Eight years later the legislature authorized the governor to appoint a physician as sole coroner of the city of Baltimore. In Boston in 1877 the Commonwealth adopted a statewide system requiring that the coroner be supplanted by a physician known as a medical examiner. Unfortunately, the jurisdiction of the medical examiner was confined to "dead bodies of such persons only as are supposed to have come to their death by violence."

The entry of the science of pathology as a subspecialty of medicine into the investigation of deaths began in the latter part of the nineteenth century. In 1890 in Baltimore a city ordinance authorized the Board of Health to appoint two physicians with the titles of medical examiner and assign them the duty of performing all autopsies requested by the coroner or the state's attorney of the city of Baltimore. In 1915 New York City adopted a law eliminating the coroner's office and creating a medical examiner system, authorizing investigation of deaths resulting from criminal violence, casualties or suicide, or suddenly while in apparent health, or when not attended by a physician or imprisoned or in any suspicious or unusual manner. The medical examiner was granted the authority to make a decision as to the necessity of an autopsy, and his appointment from a civil service list by the mayor provided the first civil service appointment in the annals of American medicolegal investigation. The first chief medical examiner, Dr. Charles Norris, was also given the authority to order an autopsy when in his judgement it was necessary, thus establishing the first essentials of a competent medical examiner's system, i.e. a broad spectrum of cases to be investigated and the authority to autopsy when the public interest demanded it. . . .

DEATH INVESTIGATION

MEDICAL TERMINOLOGY

I. Explanation of Medical Terminology

A. Anatomy

Anterior - toward the front.

Aorta - the large artery connected to the heart which distributes blood to the other arteries.

Artery - thicker walled blood vessels, under pressure, which carry blood from heart to the body.

Cardiac - relating to the heart.

Cerebral - relating to the brain.

Cerebrospinal Fluid - "C.S.F" - the fluid about the brain and spinal cord.

Cholecystic - relating to the gall bladder.

Coronary arteries - the blood vessels supplying the heart.

Dorsal - related to the back of the body or the back of the hand or foot.

Gastric - relating to the stomach.

Hepatic - relating to the liver.

Lateral - toward the side

Medial - toward the middle.

Midline - the center of head, chest and abdomen.

Peritoneum - the abdominal cavity.

Pleural - the chest cavity about the lungs

Posterior - toward the back.

Pulmonary - relating to the lungs.

Renal - relating to the kidney.

Vein - thin walled blood vessels which return blood to the heart.

Ventral - related to the front of the body.

B. Diseases

Aneurysm - a weakening of the wall of a blood vessel with dilation of the vessel and often later rupture of the vessel causing severe bleeding.

Arteriosclerosis - "hardening of the arteries" - an aging process marked by narrowing of blood vessels by build-up of cholesterol and scar tissue.

Carcinoma -

Sarcoma - All are malignant tumors and included

Lymphoma - in the broad definition of cancer.

Leukemia -

Cerebra-vascular Attack- "C.V.A." - a stroke, severe injury to the brain resulting from spontaneous hemorrhage or thrombosis.

Cirrhosis - a chronic disease of the liver with scarring and reduced function most frequently associated with alcoholism but also may follow hepatitis and other more rare diseases.

Embolus - a thrombus which breaks away from where it formed and travels to another area of the body.

Emphysema - a chronic disease of the lungs reducing one's ability to breath.

Fatty Metamorphosis of the Liver - fatty liver, a change in the liver following excessive alcohol ingestion and poor diet.

Hemorrhage - bleeding either outside the body or into one of the body cavities.

Hypertension - high blood pressure.

Infarction - dead tissue in an organ due to insufficient circulation of blood.

Jaundice - yellow pigmentation of skin, most commonly resulting from liver failure.

Myocardial Infarction - "heart attack" - death of an area of heart muscle.

Necrosis - death of tissue.

Peritonitis - inflammation in the abdominal cavity.

Phlebitis - Inflammation of the veins.

Pleuritis - "Pleurisy" - inflammation in the chest cavity.

Pneumonia - inflammation in the lung.

Thrombophlebitis - A blood clot in an inflamed area.

Thrombosis - blood clotting inside the blood vessels often in leg veins.

Uremia - kidney failure.

C. Injury

Bruise - the bluish swelling of blood beneath skin.

Comminuted fracture - a break of a bone with separation of the broken ends.

Contusion - essentially the same as bruise.

Laceration - a tearing of the skin.

Subarachnoid hemorrhage - bleeding, often spontaneous, sometimes from injury, between the brain and its covering membrane, the arachnoid.

Subdural hemorrhage - bleeding, almost always from injury, between the inside of the skull and the dura which covers the brain. This accumulation of blood produces pressure on the brain.

D. Medical procedures

Autopsy - an examination of the body of a deceased person, both an external and an internal examination, for the purpose of identifying disease and injury present and determining the cause of death.

Bronchoscopy - looking in the bronchi (airway in the lungs) with the aid of a metal tubular instrument, a bronchoscope.

Craniotomy - an operation in which the skull is opened.

Cystoscopy - as above but related to the urinary bladder.

E.K.G. - E.C.G. - electrocardiogram, a tracing on a

strip of paper showing the electrical activity of the heart and allowing diagnosis of heart disease.

E.E.G. - electroencephalogram, a tracing of the electrical activity of the brain allowing diagnosis of disease of the brain.

Gastroscopy - as above but related to the stomach.

Laparotomy - an operation in which the abdominal cavity is opened.

Laryngoscopy - looking into the larynx (voice box) with the aid of a metal instrument, a laryngoscope.

Lumbar puncture - placing a thin needle in the lower back and withdrawing the fluid about the spinal cord (cerebrospinal fluid "C.S.F.")

Sigmoidoscopy - as above but related to the sigmoid colon.

Thoracotomy - an operation in which the chest cavity is opened.

ANATOMY FOR INVESTIGATORS

By Brian Blackbourne, M.D.

**Selected Illustrations and revisions By David Lambrecht
F.B.I. Academy**

SURFACE ANATOMY ANTERIOR

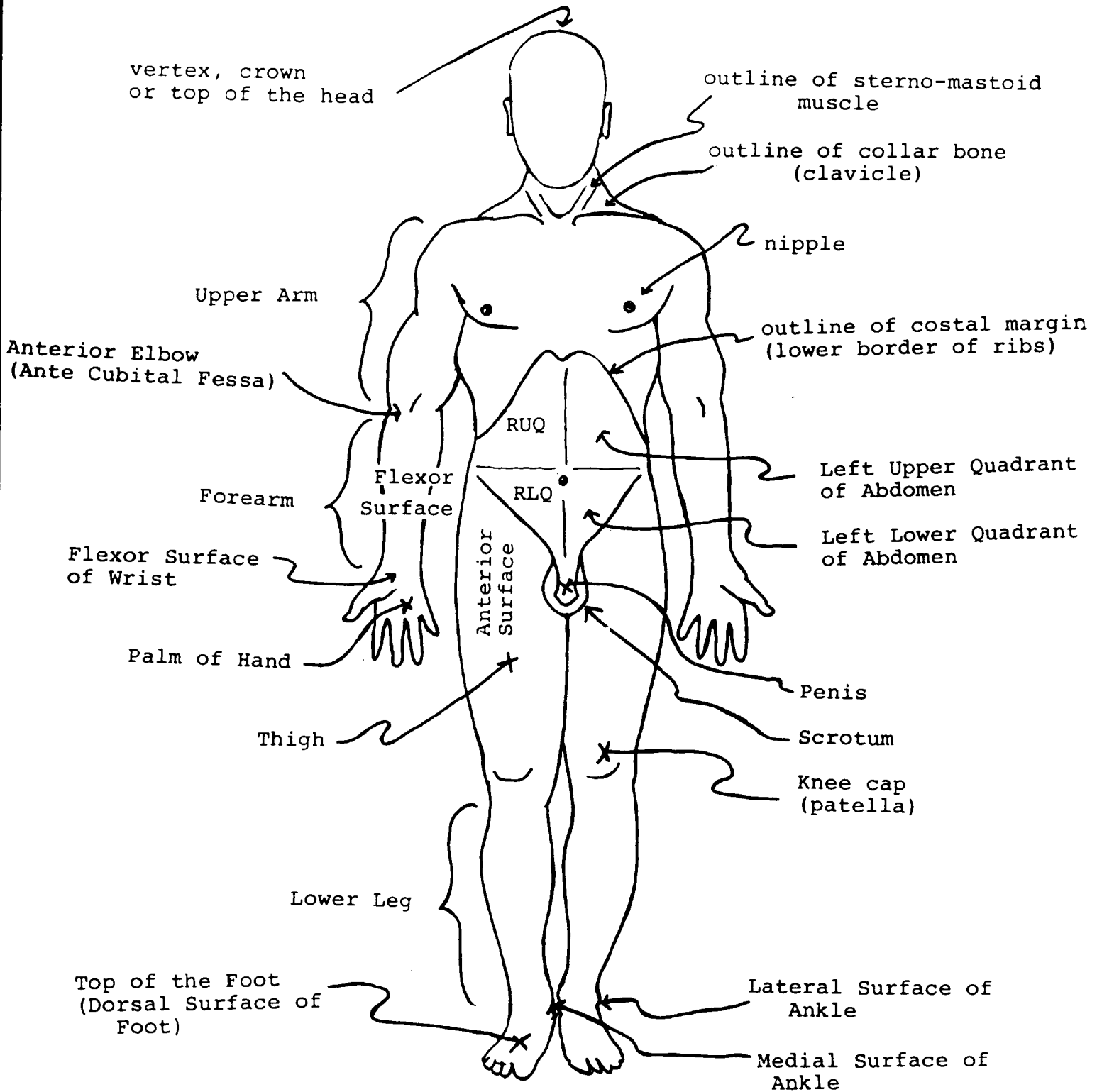
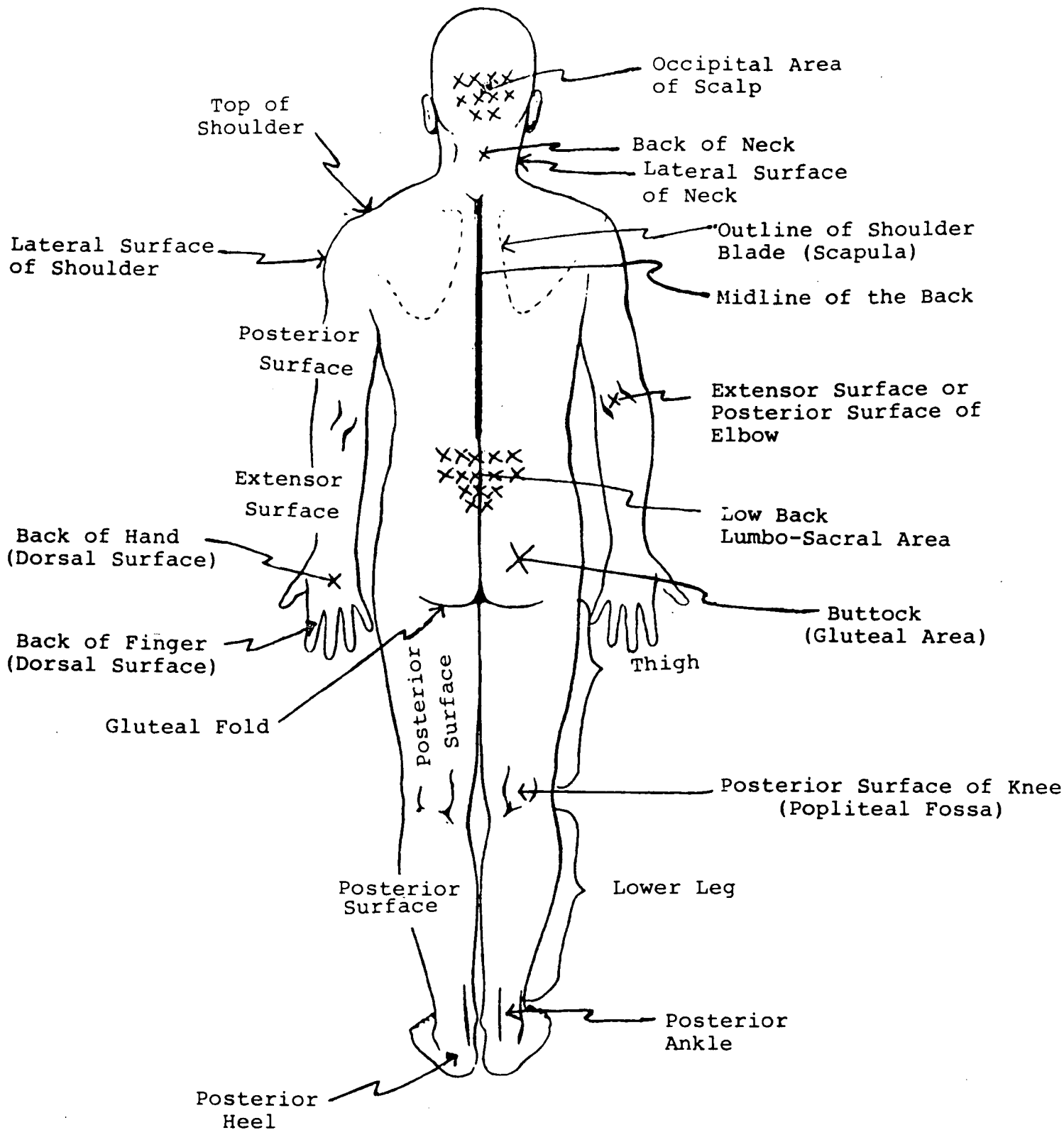
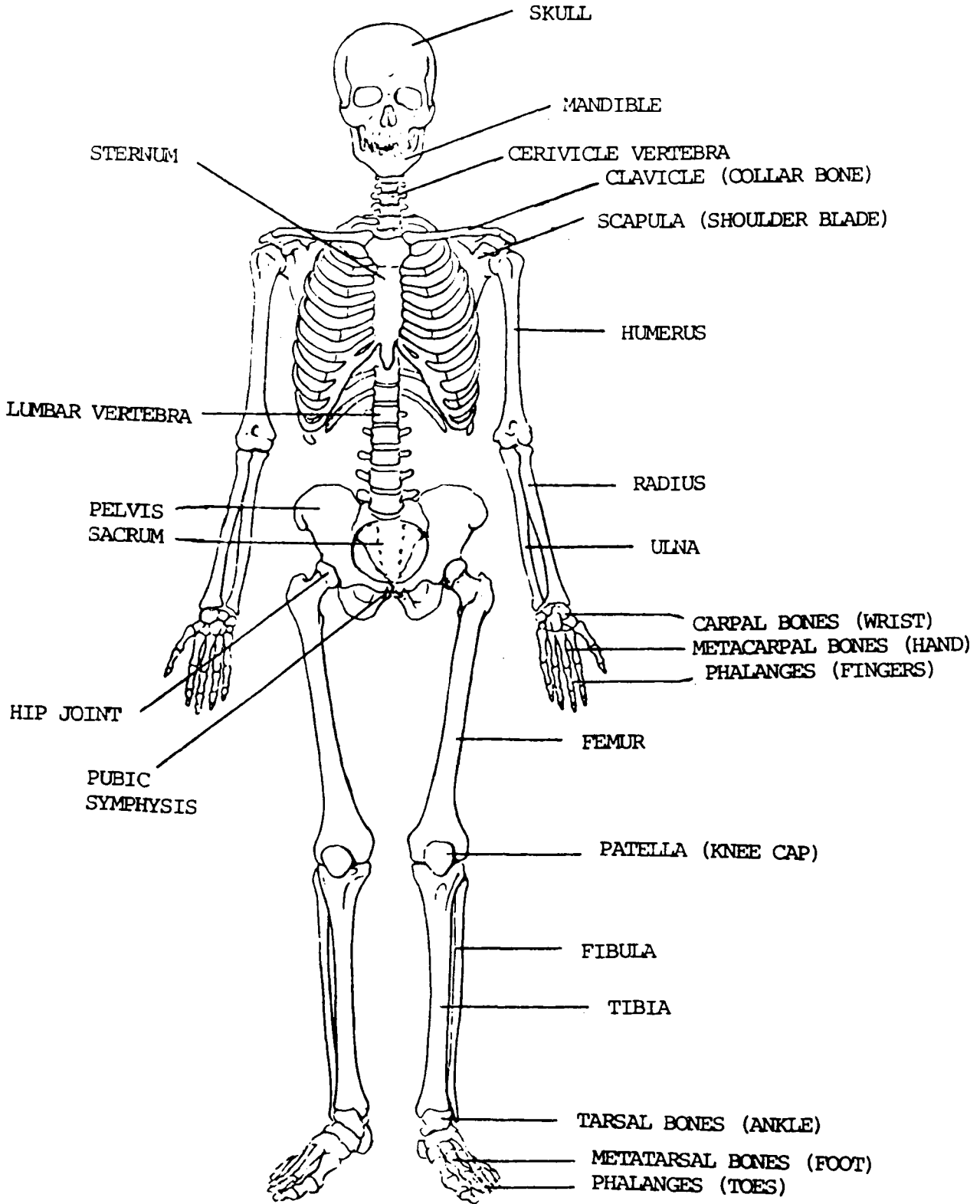


Illustration by
David Lambrecht

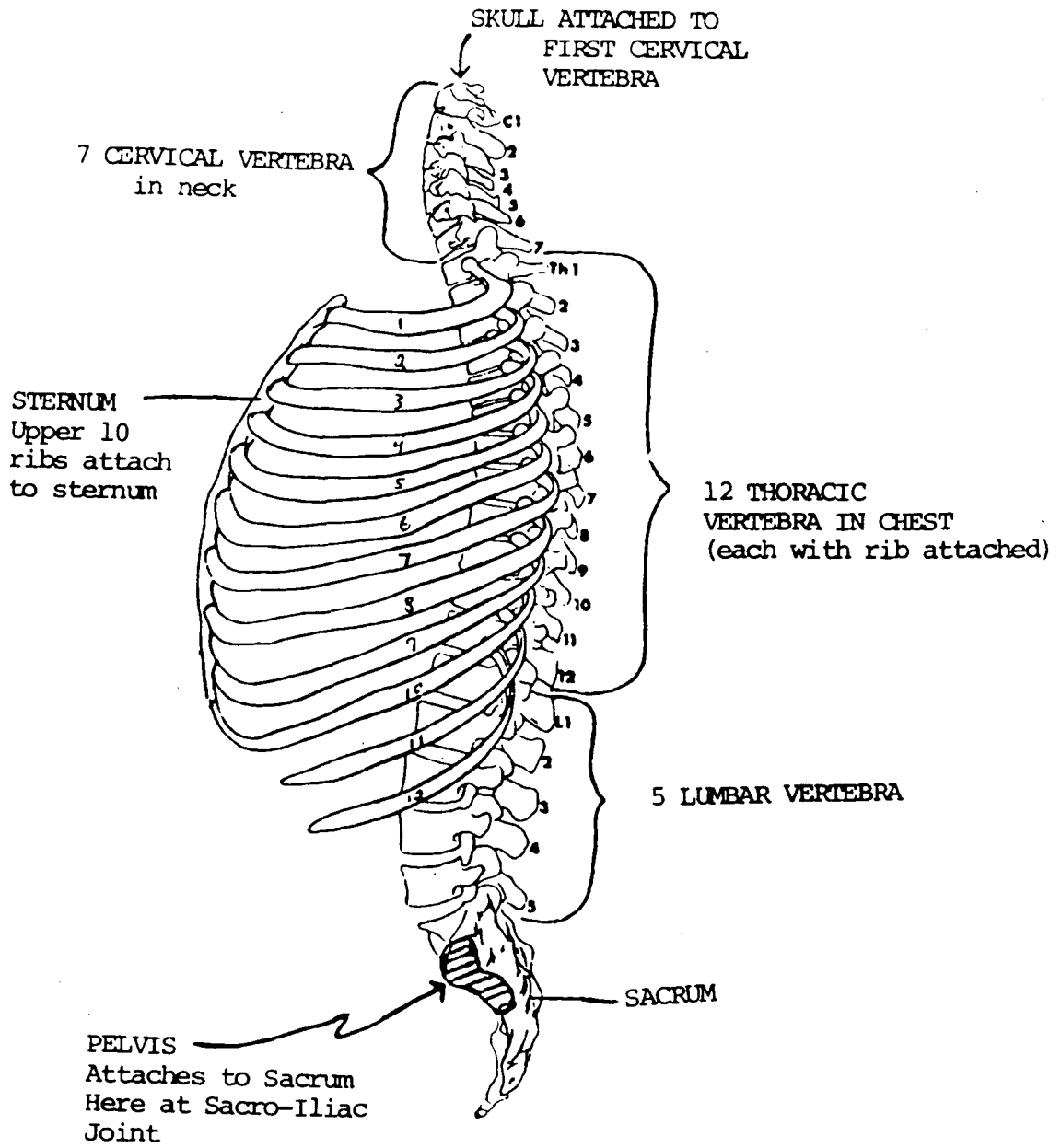
SURFACE ANATOMY POSTERIOR



SKELETON



BACKBONE AND RIBS



THORACIC + ABDOMINAL ORGANS

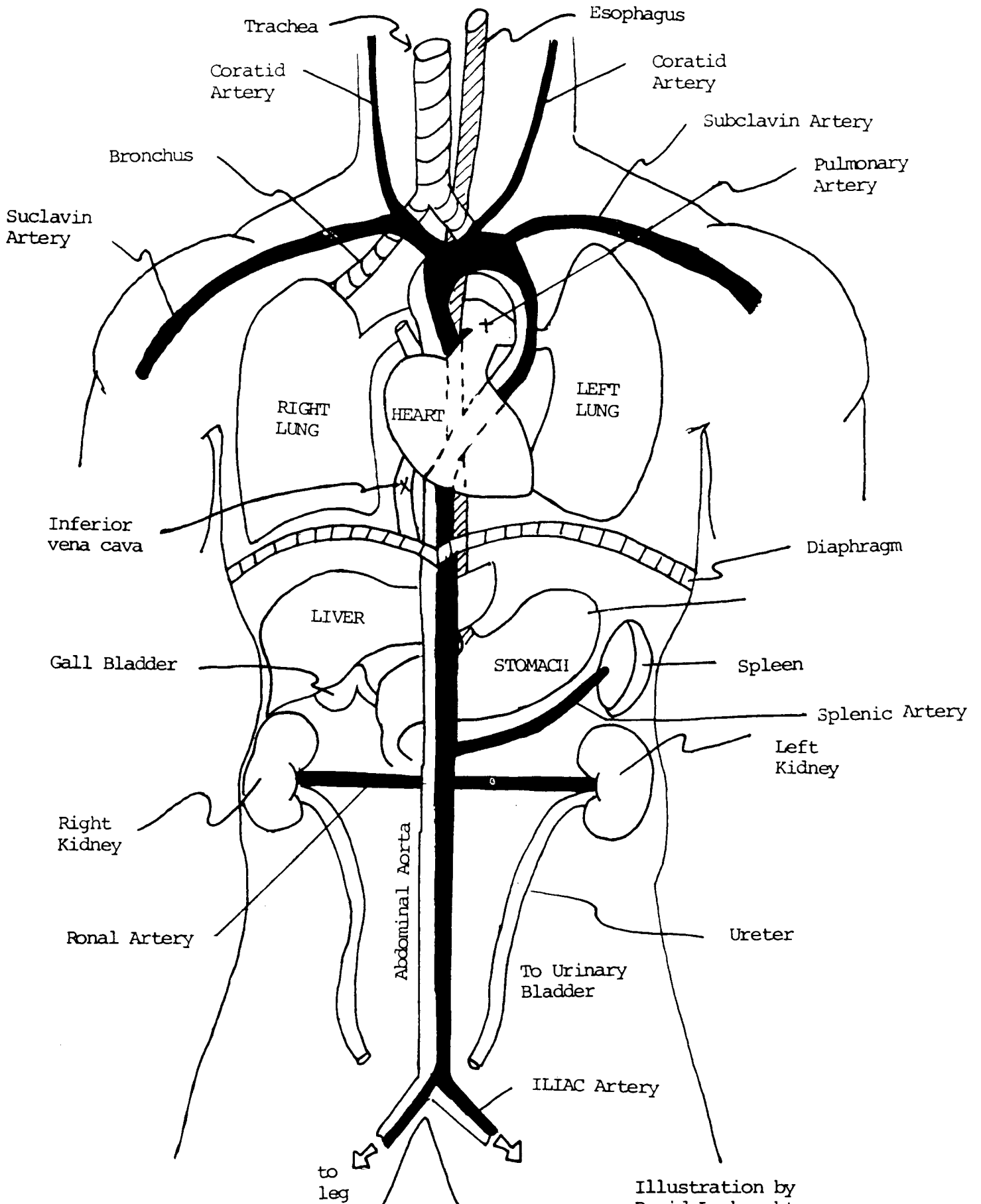


Illustration by David Lambrecht

THE RIGHT HEART

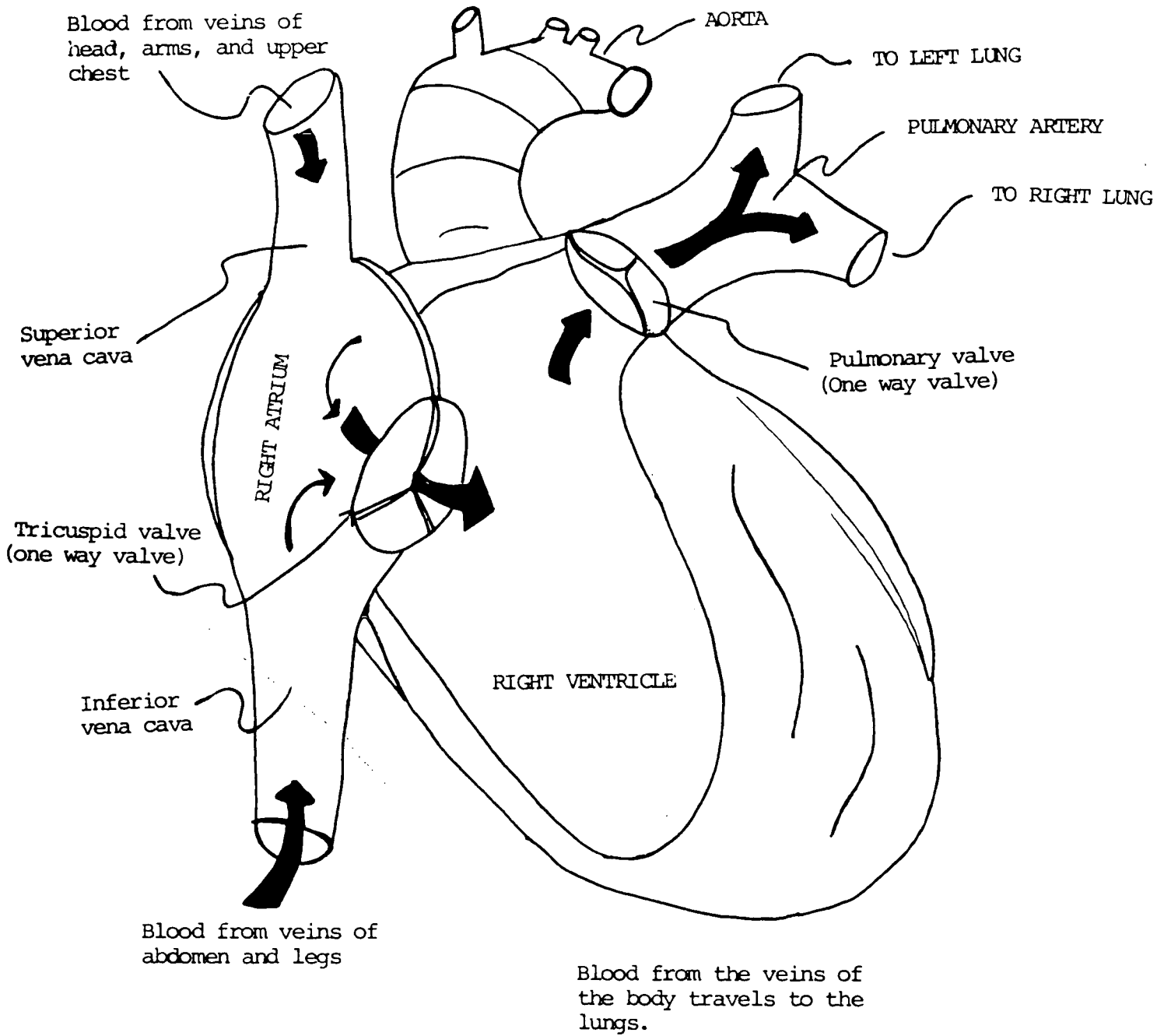
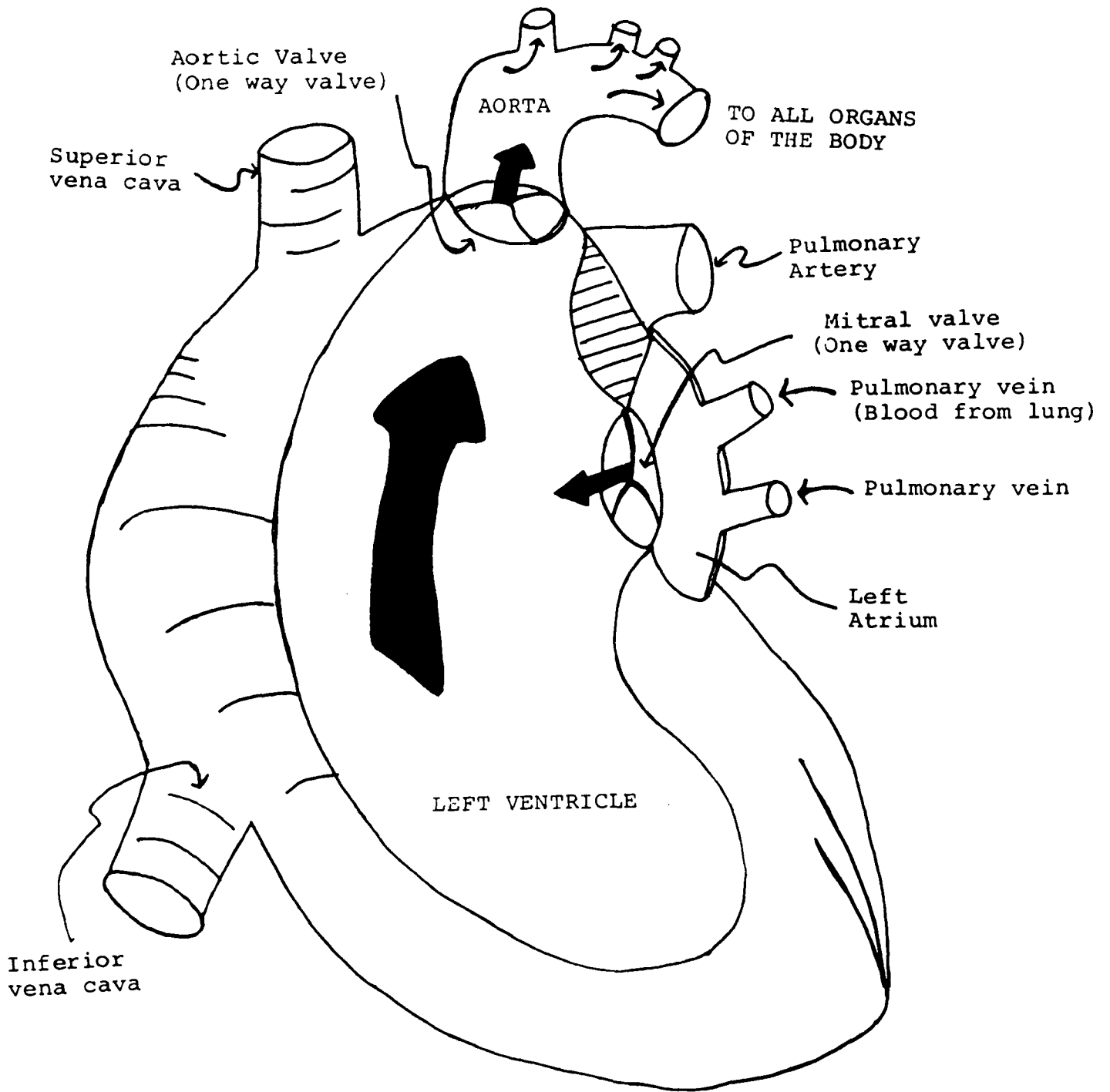


Illustration by
David Lambrecht

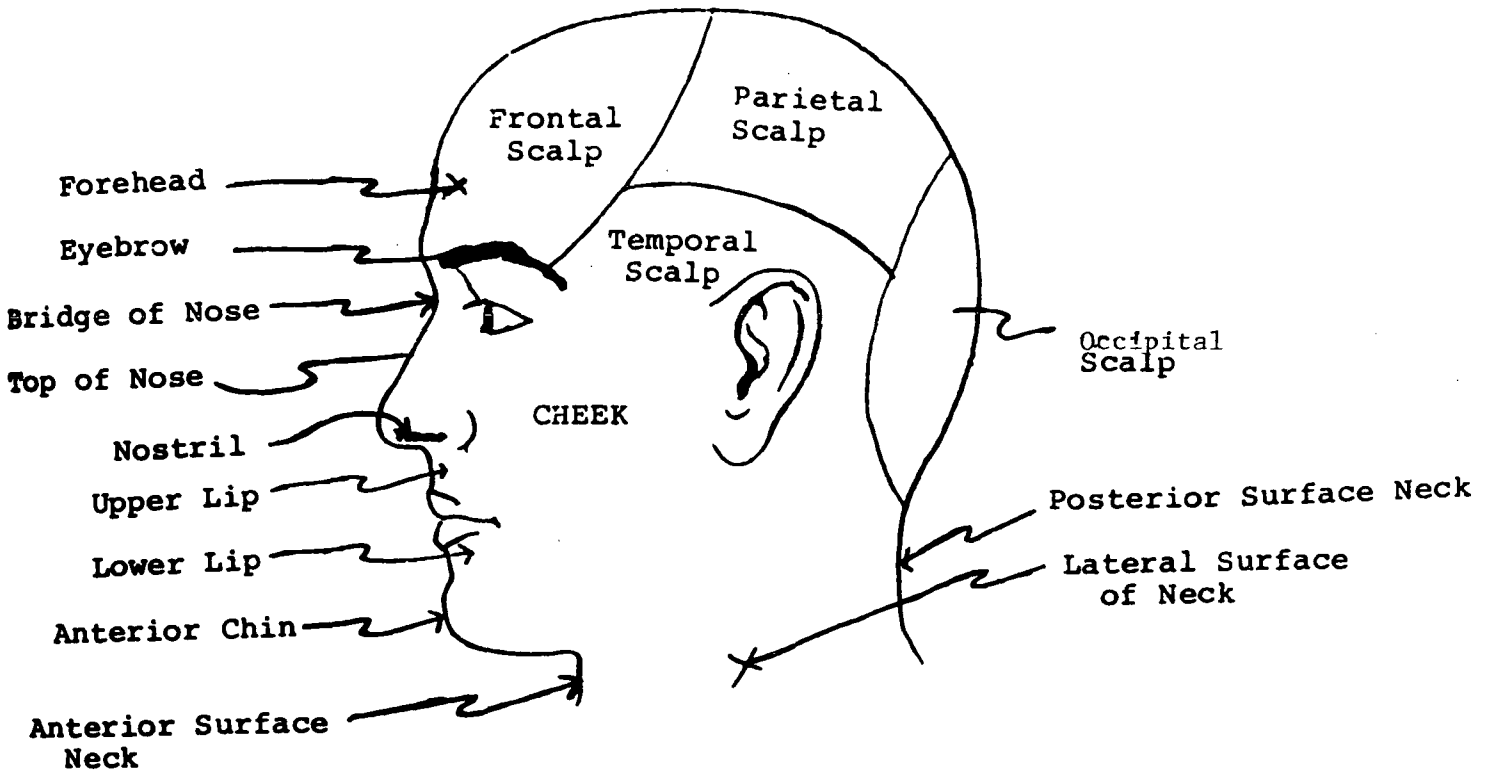
THE LEFT HEART



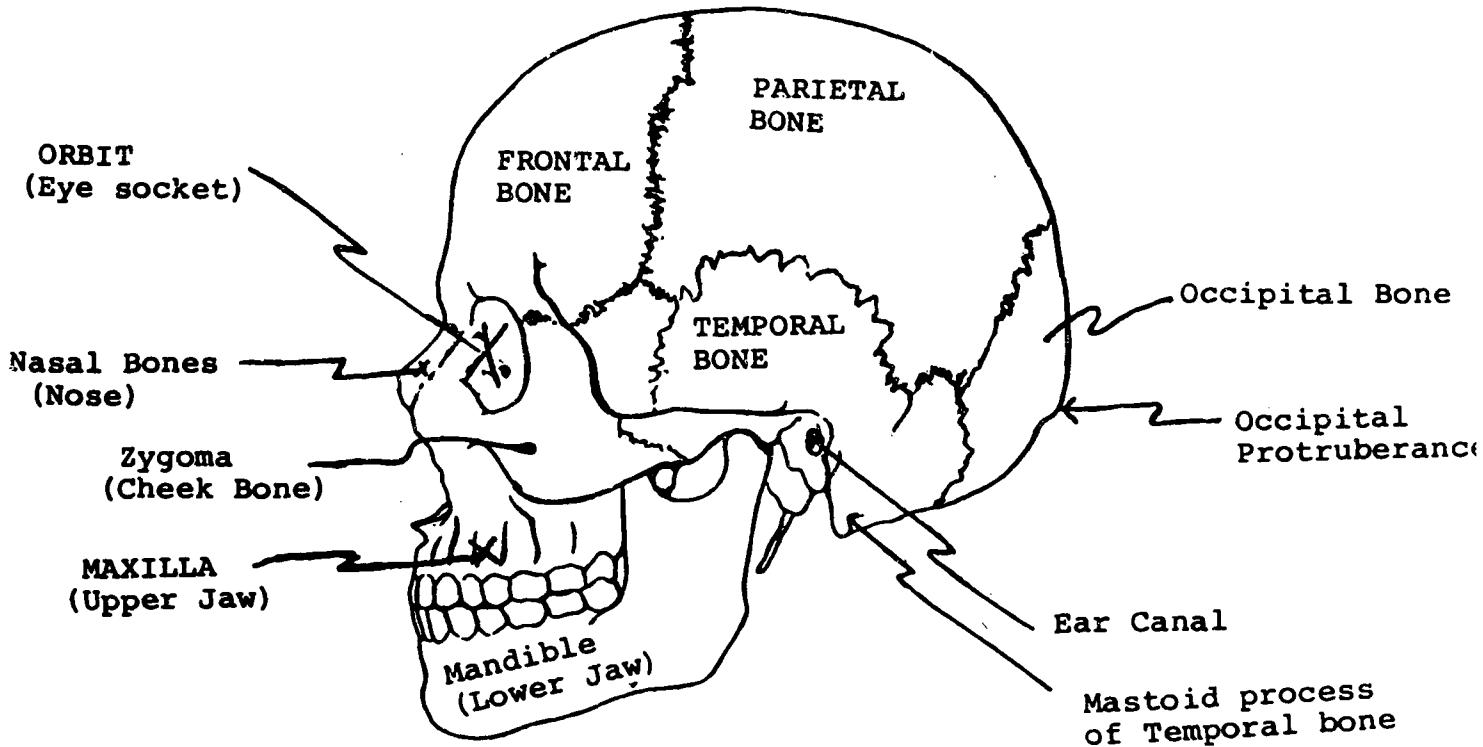
Blood from the lungs is distributed to all body organs.

Illustration by David Lambrecht

SURFACE ANATOMY FACE + SCALP



BONES OF FACE AND SKULL



FORENSIC

AUTOPSY

The Forensic Autopsy: External Examination

Vincent J.M. Dimaio, M.D.

The forensic autopsy differs from the hospital autopsy in objectives, significance, and manner of approach. In a medical-legal autopsy, one must establish the identity of the deceased, the cause of death, and the manner of death. The presence of any drugs or secondary trauma, which would influence the interpretation of the cause or manner of death or of the circumstances leading to the death, must be documented. In a forensic autopsy, in contrast to a hospital autopsy, the external examination of the body is often the most important part of the procedure. In criminal cases evidence should be sought, collected, and preserved for use in subsequent prosecution of the person responsible for the injury.

A medical-legal autopsy should never be performed until the pathologist knows the circumstances surrounding the death. Just as a hospital pathologist reviews the chart prior to the autopsy, so must the individual doing the medical-legal autopsy "review" the circumstances leading to and surrounding the death. Such a review will often guide the pathologist's approach to the case, as well as indicate what evidence should be sought.

All bodies received for autopsy should be logged in as to time and date of arrival, who transported the body, and who received it. Valuables should be removed and a list made of them. Earrings, rings, and wristwatches, may be left on the body if their presence is noted. The body should then be kept in a secure area where casual visitors or the curious cannot gain access.

The first object in a forensic autopsy is documentation of the identity of the deceased. In some of the older medical examiner systems, identification of the deceased is made by the next of kin. When this procedure is used, a note should be made on the autopsy protocol as to the time and date of identification, the person who made the identification, and the person to whom the identification was made.

Such personal identification is the least reliable method. Under the stress of sudden, unexpected, and sometimes violent death, the next of kin have on numerous occasions identified the wrong body. It is our feeling that identification photographs and fingerprints are the methods of choice. Prior to the autopsy an identification photo should be taken, with a sign indicating the autopsy number in the picture. In court this photograph can be identified by the next of kin as a picture of the deceased. The medical examiner can then identify it as a picture of the individual he autopsied. If the defense feels that the photograph is too gory and may influence the jury, it can be admitted in evidence on the condition that it is not shown to the jury. Fingerprints should also be taken on every body examined. In all homicides, suspected homicides, or gunshot wound cases, these fingerprints should be taken only after the prosecutor has a chance to examine the hands for trace evidence, wounds, or powder soot.

The importance of examining clothing in cases of gunshot wounds can never be overemphasized. The presence or absence of bullet holes and of soot around such holes may indicate the position of the deceased at the time he was shot, as well as the range at which he was shot. This in turn may be of great significance in determining whether a death was suicide or homicide, and if homicide, whether it was compatible with self-defense. Following all traumatic or suspected traumatic deaths during which the victim was clothed, the clothing should be examined before it is removed from the body and a list of the clothing should be made. In cases of gunshot wounds, pertinent, positive, or negative findings concerning the clothing must be recorded. The presence or absence of bullet holes and surrounding soot should be noted.

If an individual survives a gunshot wound long enough to be transported to a hospital, the clothing is often cut or torn away. This is an acceptable practice insofar as diagnosis and therapy are concerned; the clothing, however, should not be discarded, destroyed, or released to the next of kin. The hospital should retain it and turn it over to the crime lab, the proper police agency, or the physician designated to conduct the forensic autopsy. This physician should draw no final conclusions regarding the wounds prior to examining the clothing.

After the clothing is removed from the body, it should be handled as little as possible. It should be placed in a clean container and labelled with the victim's name, the date, the autopsy number, and the name of the physician, before its transfer to the appropriate authority.

Whenever a piece of evidence is removed from a body, whether it be trace evidence, bullet, or clothing, it should be placed in a bag or container with at least the name of the deceased, the autopsy number, the date, and the name of the prosecutor. In the case of a bullet, it is often best to indicate the location from which the bullet was recovered and the markings put on the bullet. This evidence should be stored in a secure area. When the police or crime lab personnel come to pick up the evidence, a signed receipt should be obtained. This receipt is necessary to prove maintenance of the chain of evidence. The time and date of transfer as well as the names of the recipient of the evidence and the individual who transferred the evidence should be recorded on the receipt; the receipt should then be signed by both individuals.

The Autopsy Report

Vincent J.M. Dimaio, M.D.

The autopsy report should begin with a general description of the body. This should include the age; race; height; weight; degree and distribution of rigor mortis and livor mortis; hair and eye color; and appearance of the nose, ears, mouth, teeth, and external genitalia. Any external evidence of disease, as well as the presence of scars or tattoos, should be indicated. A list of the clothing worn by the deceased should also be included.

Following the general external examination section, all evidence of injury should be described. This description of injury should be kept in a separate section. It should not be distributed under the descriptions of individual organs or organ systems. Grouping all the injuries in one section makes for a more coherent autopsy report. In addition, when one later has to testify regarding the case, it is not necessary to search through the whole autopsy report to find the injuries.

Gunshot wounds and knife wounds should be described in terms of location, shape, dimensions, and appearance. Pertinent positive and negative findings should be recorded. The distance of all wounds from the top of the head and from the midline should be specified. In addition, it is advisable, even mandatory, to orient such injuries with respect to some landmark in the vicinity of the wound, e.g., the umbilicus or the nipple. In the case of a gunshot wound, one should indicate whether it is an entrance or an exit wound. The presence or absence of abrasion rings, powder, soot, searing, and powder tattooing should be noted and the dimensions of these items described. This is especially important when dealing with powder tattooing. Defects of the clothing corresponding to the gunshot wounds should also be described.

After external examination of the injury, description of the wound track should be given in anatomical order. The amount of blood present in pleural or peritoneal cavities should be indicated. A bullet should not be recovered by instruments; rather, fingers should be used in order to preserve the rifling marks on the bullet. The bullet should then be marked on its base (never on its side) with initials or numerals. If it cannot be marked on the base, it may be marked on the tip, as long as the markings do not obscure any rifling. Following a description of each wound, a sentence should be added indicating the overall path of the bullet through the body, e.g., front-to-back, left-to-right or downward.

In all descriptions having to do with the size of the wound, inches and fractions of inches should be used as the system of measurement. The metric system should not be used at the present time because the forensic autopsy report is often examined by and intended for individuals not familiar with this system. In addition, when testifying in court, one is expected to describe the wound in inches rather than according to the metric system. Weights of organs and nontraumatic lesions may be described using the metric system, however.

In all gunshot wound cases, photographs and x-rays should be taken when possible. Diagrams illustrating the major injuries or findings are often extremely useful.

All the forensic autopsies should be complete in order to be of maximum value. This means that the head, chest, and abdominal cavities should be opened and the organs removed. In cases of homicide, there is no exception to the rule that the autopsy must be complete.

In the autopsy report, a description of the internal organs should follow the section on external examination of the body and description of the wounds. Previous descriptions of injuries to these organs need not be repeated. After description of the internal viscera, the next section of the autopsy report should be devoted to microscopic and toxicologic findings. Microscopic sections are often unnecessary in cases of trauma where death occurred almost immediately. Appropriate toxicologic studies should be performed depending on the type of case. In all cases of homicide, blood alcohol and blood type should be performed, as a minimum. If the victim was hospitalized for a considerable period of time prior to autopsy, blood alcohol determination is unnecessary. When drug use is suspected, a complete toxicologic examination should be performed. If there is doubt, tissue and fluids should be saved and frozen. One can always go back to these specimens if necessary. In the case of trauma, if a person has been hospitalized for a number of days or received multiple units of blood, toxicologic analysis of the blood at autopsy is generally of no use. Most trauma cases will have had blood drawn for typing and cross-matching at the time of admission. This blood is often retained in the blood bank for one to two weeks. In such cases, the blood bank personnel should be contacted to see if they have any of the original blood, so that it can be used for typing and drug analysis.

The autopsy report should be concluded with sections labeled "Findings" and "Opinion." The "Findings" should include all significant gross microscopic and toxicologic observations, in order of importance. The major cause of death should be listed as the first finding. The last section, labeled "Opinion," should be worded as plainly as possible. Medical terms should be avoided if ordinary English will suffice. This is the part of the protocol that will interest most people when they consult the autopsy to determine how and of what the individual died. The conclusion should be short, straightforward, and to the point. Speculations concerning minor points should not be included. Extensive speculation in the conclusion often comes back to haunt the prosecutor.

In difficult cases the pathologist should not hesitate to seek advice and consultation from other pathologists or forensic scientists. Even the most experienced forensic pathologist will request a second opinion on a difficult case.

Summary

In summary, there are six points to be remembered in performing an adequate forensic autopsy.

1. A complete history of the circumstances surrounding the death should be obtained prior to the autopsy.

2. The identification of the deceased should be documented.
3. A complete, detailed external examination of the body and of the clothing should be performed. In all cases of homicide or suspected homicide, the clothing should be saved.
4. A complete autopsy should be performed and injuries should be documented with diagrams, photos, and x-rays when indicated.
5. Pertinent negatives should be included in the report of the autopsy.
6. Toxicologic studies should be performed when indicated.

NOTES

APPROACHING THE DEATH
SCENE

Approaching the Death Scene

I. PRELIMINARY

- A. Proceed to scene and assess situation
- B. Render aid to injured
- C. Effect arrest
- D. Locate witnesses
- E. Interview complainant and witnesses
- F. Maintain crime scene and protect evidence
- G. Inform other police officers
- H. Note all conditions, events, and remarks
- I. Arrange for searching scene and collecting evidence
- J. Report the incident
- K. Yield responsibility

II. At the Scene

- A. Attitude and emotion must be controlled in order to ensure a thorough and professional investigation.
“Cool-Calm-Detached”
 - 1. Attitude: Evidence will be located if time and effort are expended in a professional and methodical processing of the scene.
 - 2. Emotions: Conscious and subconscious reactions to violence and brutality can affect the investigation to a point that good judgement is transformed into complete confusion.

III. Theory of Exchange

- A. The perpetrator will take away traces of the victim and the scene
- B. The victim will retain traces of the perpetrator and may leave traces of himself or herself on the perpetrator
- C. The perpetrator will leave behind traces of himself or herself at the scene

IV. Crime Scene Sketch

A. Purpose of crime scene sketch

1. Refresh memory of investigator
2. Brief investigators not on the scene
3. Refresh the memory of the witnesses
4. Refresh memory of cooperative suspect in his/her reconstruction of events
5. Develop a clear understanding of what happened
6. Develop a theory as to what happened through evidence collected
7. Explain to the prosecutor, judge, jury, witnesses a clear representation of the scene, location of evidence, and sequence of events

B. Elements of crime scene sketch

1. Symbol, indicating points of compass
2. Case and type, victim's name, location, date, and time
3. Legend
4. Measurements from FIXED points
5. Anything pertinent (i.e., slope of ground, snow, rain, mud, room, apartment)
6. Name of person making sketch

C. Crime scene sketch supplement

1. Aerial photographs
2. Road maps
3. Blueprints
4. Floor plan
5. Street map

V. Canvass

A. **When:** in almost all cases

1. Approximate time of death or assault
2. Use common sense - more than once

B. **Why:** eyewitness to crime or suspect

1. Information about the circumstances
2. Approximate time of occurrence
3. Information about the deceased

- a. Friends
- b. Habits
- c. Motive ?

C. **Scope:** any place from where the scene could be observed or heard

1. Route taken by victim
2. Escape route of suspect
3. Tag numbers

D. **Personnel**

1. Must have an interest
2. Should know some detail of the crime
3. Make a written record of persons contacted

E. **Canvass form**

1. Name and assignment of officer
2. Date and time of interview or attempt
3. Name, age, address, home and work telephone numbers
4. **Who else lives here?**
5. Do you know of incident
6. How, what do you know?
7. Heard from whom?
8. Relationship--last seen or talked to?
9. Were you on the crime scene?
10. Statement taken

VI. Investigator's Notebook

- A. Date and time notified
- B. Location
- C. How notified--by whom?
- D. Time of arrival on scene
- E. Describe scene from outside
- F. Address
- G. Who is on the scene?
- H. Weather conditions
- I. Lighting
- J. First officer
 1. Name
 2. Assignment

3. Time of arrival on scene
4. Who was on the scene
5. What did they do, touch
6. What did the officer do
7. Conditions of scene when officer arrived
8. Witness statements
9. **OFFICER OPINION**

VII. The Primary Crime Scene

Investigations usually begin where the body is originally found.

VIII. Secondary Crime Scenes

- A. Where the assault took place
- B. Where the victim was confined
- C. Route to and from primary scene
- D. Method used to transport victim
- E. Anyplace where evidence is located (suspect residence, stores, etc.)

IX. Processing the Death Scene

- A. Be thorough and professional
- B. Photograph and measure before touching anything
- C. Remember the theory of exchange and transfer
- D. Anything and everything should be considered

X. Release of the Scene

- A. Hold as long as possible
- B. Never release before:
 1. Initial canvass is completed and reviewed
 2. All known witnesses interviewed and statements taken
 3. Suspect processed and statement checked
 4. Final check by you and others

XI. Physical Evidence: Any tangible article, large or small, that tends to prove or disprove a point in question

- A. "The Unimpeachable Witness"--cannot be eluded by:

1. Faulty memory
 2. Prejudice
 3. Poor eyesight
- B. Physical evidence:
1. Must be obtained legally
 2. Collect and preserve properly
 3. Maintain proper chain of custody
 4. Conduct proper tests with proper personnel
- C. Location of physical evidence:
1. Nearest to where critical act occurred
 2. Point of forced entry
 3. Route of escape and approach
 4. Suspect (clothing, body, hair, body fluids, etc.)
 5. Location of weapon
 6. Vehicle used
 7. Suspect's residence
 8. Location of physical assault
 9. Location from where body was removed
- D. Physical evidence used to:
1. Reconstruct the crime
 2. Identify the participants
 3. Confirm or discredit an alibi

XII. Summary

The investigation of death, particularly the homicide, is one of the most important investigations to which a police officer may be called upon to respond.

There are three basic principles involved in the initiation of an effective death investigation.

- A. **Rapid response** to the death scene by patrol officers, the purpose being to protect evidentiary materials before they are destroyed, altered, or lost.
- B. **Evidence.** Anything and everything should be considered evidence. Physical or testimonial evidence must be noted, preserved, and brought to the attention of the investigators.

- C. **Notification of additional resources.** After the scene is secured, immediate and appropriate notification must be made to the homicide investigators.

Collecting and Handling Evidence Infected with Human Disease-Causing Organisms

“Today ... investigators and crime scene technicians are more likely than ever before to encounter crimes of violence involving blood and other body fluids of persons with infectious diseases.”

By

PAUL D. BIGBEE, M.S.

Special Agent

Serology Unit

Laboratory Division

Federal Bureau of Investigation

Washington, DC

You have been assigned as the case investigator in a homicide that has just occurred in your jurisdiction. The crime scene is an apartment which has been properly secured by the first officers arriving. Upon entering the apartment, you observe the nude body of a young man, who has been stabbed numerous times, lying in a pool of liquid and coagulated blood. His hands are bound at the wrists with rope, the body has been emasculated, and no weapon is found. You also discover a hypodermic syringe, a spoon "cooker," and a suspicious white powder near the body, and in the bathroom, three drugs, Isoniazid, Rifampin and Ethambutol, prescribed for someone at that address.

An experienced investigator could quickly ascertain that this was the scene of a homosexual murder and involves at least one intravenous drug user. The prescription drugs pose a dilemma until you later learn that they are

prescribed for persons with active cases of tuberculosis.¹

This victim is typical of one who fits into the group of high-risk people often infected with AIDS, hepatitis B, and tuberculosis. Knowing this, you resist the urge to immediately leave the apartment and begin to process the crime scene. But, how should you proceed? What precautions should you take to protect yourself and others from possibly contracting a lethal or infectious disease? And, what do you do with the evidence once it is collected?

Today, with AIDS and hepatitis B infections virtually epidemic, investigators and crime scene technicians are more likely than ever before to encounter crimes of violence involving blood and other body fluids of persons with infectious diseases. It is also likely that the patrol officer will encounter these infectious body fluids during his routine activities. For example, the

mouthpieces used on breath alcohol instruments can be contaminated with the saliva of a person with a communicable disease. Officers conducting traffic accident investigations may come in contact with potentially infectious blood, and the search of a suspected drug user can and has resulted in serious puncture wounds from secreted hypodermic needles.

This article does not purport to solve all the potential problems posed to law enforcement officers when handling blood and other body fluids. Its purpose is to acquaint the officer with some of the most commonly encountered diseases from infectious body fluids and to recommend precautions that can be taken.

Human beings can be infected with pathogenic (disease-causing) microorganisms and may or may not show symptoms of a disease state. Examples of these pathogens include bacteria,



Special Agent Bigbee

such as those responsible for tuberculosis, syphilis, and gonorrhea; viruses, such as those responsible for AIDS, hepatitis, and herpes; and fungi, such as that responsible for candidiasis. Other microscopic organisms, such as one-celled animals, can also be found in the blood of humans.

Since it is beyond the scope of this article to present a detailed listing of each potentially infectious micro-organism law enforcement officers may encounter, this article will concentrate on the disease-causing organisms responsible for AIDS, hepatitis B, and tuberculosis. However, the precautions taken when dealing with any pathogen that may be found in body fluids are essentially the same.

AIDS

Acquired Immune Deficiency Syndrome (AIDS) has a variety of manifestations that range from asymptomatic (no symptoms) infection to severe immunodeficiency and life-threatening secondary infections or cancer.² The virus responsible for AIDS, HTLV-III (Human T-lymphotropic Virus Type III) is a "retrovirus" which invades the victim's immune system, destroys it, and causes the patient to become highly susceptible to secondary infections, including a severe form of pneumonia caused by the one-cell animal *Pneumocystis carinii*. Kaposi's sarcoma, a form of cancer, may also develop. The Centers for Disease Control (CDC) in Atlanta, GA, advise that tuberculosis cases in the United States have recently increased because of the occurrence of tuberculosis among persons with AIDS.³ The manifestations of this disease are usually confined to the lung area, but in AIDS patients, the bacteria often invades other areas of the body, including the lymph system.

The AIDS virus has been isolated from blood, bone marrow, saliva, lymph nodes, brain tissue, semen, cell-free plasma, vaginal secretions, cervical secretions, tears, and human milk.⁴ There is currently no vaccine against this virus which, if fully developed as a disease, is fatal.

The highest frequency of AIDS cases occurs in male homosexuals, intravenous drug users, and hemophiliacs—the "high-risk" categories. The transmission of AIDS has been shown to occur from male to male, male to female, female to male, by intravenous drug users sharing infected needles, from blood and blood product transfusions, transplacentally (through the placenta), by artificial insemination, and during organ transplant.⁵ In one unusual case, a male hemophiliac received the infection from a blood product, transmitted the virus to his wife, who then infected her infant after birth by Caesarian section, presumably from contaminated human milk.⁶

It appears unlikely that the virus is transmitted through casual contact or airborne particles. Cases of accidental inoculation by laboratory personnel with AIDS and hepatitis by needles and other sharp instruments have occurred.⁷ Correctional facility officers should be aware that the virus has been isolated from inmates in the United States who claim both homosexual contact and intravenous drug use.⁸ Because the incubation period may be years in duration, it seems logical that more prison inmates will exhibit symptoms of AIDS in the future.

In a study by the U.S. Department of Defense, conducted from October 1, 1985, through March 3, 1986, it was determined that positive tests for AIDS antibodies in military recruits was 1.5 per 1,000, a pattern that could be consistent throughout the United States in general.⁹ Leading experts and epi-

"The first line of defense against infection at the crime scene is protecting the hands and keeping them clean and away from the eyes, mouth, and nose."

demologists anticipate that in the next 20 years, this number will increase exponentially.

Researchers have determined that the AIDS virus can survive at least 15 days in dried and liquid blood samples at room temperature,¹⁰ although the survivability of the AIDS virus in other body fluids has not been determined. It is not known how long the hepatitis B virus and the tuberculosis spore can survive at room temperature.

Hepatitis B

Hepatitis B (serum hepatitis) is a viral infection that can result in jaundice, cirrhosis, and sometimes, cancer of the liver. The virus may be found in human blood, urine, semen, cerebrospinal fluid, vaginal secretions, and saliva.¹¹ Injection into the bloodstream, droplet exposure of mucous membranes, and contact with broken skin are the primary hazards. There is a vaccine currently available against hepatitis B.

Tuberculosis

This bacterial disease can be transmitted through saliva, urine, blood, and in some cases, other body fluids by persons infected with it. It can enter the body through droplets that are inhaled and primarily causes lung infections. The tuberculosis bacteria forms spores, similar to seeds in plants, that are highly resistant to drying and other physical means that would easily kill other bacteria.¹²

Defenses Against Exposure

What can be done to minimize the exposure of investigators and crime scene technicians to pathogenic microorganisms? The first line of defense

against infection at the crime scene is protecting the hands and keeping them clean and away from the eyes, mouth, and nose. The best protection is to wear disposable gloves. Any person with a cut, abrasion, or any other break in the skin on the hands should never handle blood or other body fluids without protection. Convenient boxes of latex medical examination gloves, in different sizes, may be purchased and kept in the crime scene kit or in the trunk of a patrol car. Always keep a plastic bag, clearly marked, which will be used for no other purpose than to collect contaminated items until they can be disposed of properly. Replace the gloves when they become heavily stained or if you leave the crime scene. When you are completely finished with the crime scene, or if you leave temporarily, wash your hands thoroughly with soap and water. If cotton gloves are worn when working with items having potential latent fingerprint value, wear cotton gloves over latex ones. Remember that under no circumstances, should anyone at the crime scene be allowed to smoke, eat, drink, or apply makeup.

Shoes can become contaminated with blood, which can then be transported from the crime scene to automobiles, the police station, or home. Protective coverings made of disposable plastic or paper should be considered.

Particles of dried blood fly in every direction when a dried blood stain is scraped. Because of this, surgical masks and protective eyewear should be considered when the possibility exists that dried blood particles or drops of liquid blood may strike the face or eyes. A mask and glasses will not protect you from viruses due to their minute size, but will certainly help prevent dried or liquid blood particles, which contain vi-

ruses, from entering the mouth, nose, or eyes.

While processing the crime scene, constantly be alert for sharp objects, since hypodermic needles and syringes are often secreted in unusual places. When handling knives, razors, broken glass, nails, or any other sharp object bearing blood, use the utmost care to prevent a cut or puncture of the skin. Even seemingly innocuous items, such as metal staples in paper, present a potential hazard. For this reason, use paper or plastic tape, whenever possible, when packaging evidence.

In the event you receive an accidental puncture or cut from a needle or instrument on which blood or another body fluid is present, immediately seek medical assistance. If an antiseptic, such as rubbing alcohol is available, cleanse the wound with the antiseptic, then wash with soap and water prior to seeking medical assistance. A physician will decide the best course of remedies, depending on the situation and the type of wound.

If practical, use only disposable items at a crime scene where infectious blood is present. However, even these items, such as pens, pencils, gloves, masks, and shoe covers, should be decontaminated before disposal. Preferably, the items should be incinerated; however, if this is not possible, arrange with your pathologist or a local hospital to sterilize the items by autoclaving and then dispose of them properly.

All nondisposable items, such as cameras, tools, notebooks, etc., also must be decontaminated. These items should be cleansed thoroughly with a solution consisting of 1 cup of sodium hypochlorite (common household liquid bleach) dissolved in a gallon of water (never mix bleach with ammonia or al-

“ ... protective practices ... along with exercising care and using common sense, will decrease the risk to the law enforcement officer and others.”

coned. Either a bleach solution or primary, rubbing alcohol will kill the AIDS virus within 1 minute.¹³ Remember to wear gloves to protect the hands when decontaminating.

Spit blood that has not been analyzed as evidence should also be cleaned with the same bleach solution. The solution should be poured on these stains and allowed to air dry. Before releasing the crime scene, advise the owner of the potential infection risk.

Even after the evidence has been properly dried and packaged, it is still potentially infectious. Therefore, appropriate warnings should be placed on all items. This can be accomplished by purchasing adhesive-backed labels bearing the international biohazard symbol and a space for labeling the appropriate disease, or simply writing on each package a warning, such as “Caution! Contains Potential Hepatitis (or AIDS) Case.” This will alert all persons subsequently handling the evidence, such as laboratory personnel, prosecutors, defense lawyers, and police officers, to the hazards therein. To avoid removing evidence contaminated with infectious body fluids in the courtroom, place the items in transparent packaging once they have been properly dried, with appropriate initials, marking, etc., visible for identification.

Evidence containing any body fluid contaminated with human pathogen that is shipped to a forensic laboratory by U.S. mail is subject to the Code of Federal Regulations, Part 72. This regulation specifies that appropriate warning labels must be placed on the package, and any liquid substance must be triple wrapped and sealed.¹⁴ For further information on these procedures, contact the Centers for Disease Control, Office of Biosafety, 1600 Clifton Road, N.E., Atlanta, GA 30333 (404) 329-3883.

When conducting a crime scene investigation involving the shedding of blood from persons known to have infectious or contagious diseases—or even when it is suspected, the investigator should be very judicious with respect to the materials collected and forwarded to the laboratory for analysis. For example, in the scenario described earlier, it is obvious that the blood flowing from the victim's wounds originated from him. In another example, if John Smith is shot in the chest with a .44-caliber revolver by John Doe at a distance of 20 feet, there are several witnesses to the crime, and the assailant immediately flees the area with the weapon, it is obvious that the pool of blood underneath the body of John Smith originated from him. There is no probative value in analyzing the blood from the scene. Investigators and crime scene technicians should also consult with their local, State, or Federal forensic laboratory before submitting items for examination from persons with diseases, especially AIDS.

There are currently two opinions in forensic laboratories concerning the examination of cases with body fluids derived from persons with AIDS infections. The first is that the virus is not highly transmissible in dried stains and liquid blood samples, poses little hazard to laboratory personnel, and will be analyzed as usual. The other is that even though laboratory workers are at low risk of acquiring an AIDS infection from forensic specimens, that risk is not acceptable, especially when the laboratory worker could acquire an infection and unknowingly transmit it to his or her spouse.

The FBI Laboratory, in conjunction with the National Institutes of Health and the National Bureau of Standards, is currently conducting research into the feasibility of sterilizing forensic evidence with gamma radiation without

destroying the proteins required for serological examination. This procedure, if successful, would allow the evidence to be sterilized, thereby presenting no health hazard to laboratory workers or anyone subsequently handling the evidence and allowing for a complete serological examination. Until this procedure proves successful and is adopted, the FBI Laboratory will accept AIDS cases for analysis only if prior authorization has been obtained from the Section Chief, Scientific Analysis Section. The current prerequisites for acceptance of an AIDS case in the FBI Laboratory are as follows:

- 1) The contributor must understand that the submitted evidence will be autoclaved, which will render the evidence unsuitable for serological analyses. Other units of the FBI Laboratory will then conduct their examinations.
- 2) Acknowledgement letters from both the prosecuting and defense attorneys must accompany all evidence advising they are aware that serological evidence will be destroyed and that this procedure will not be subject to legal or judicial action in the future.
- 3) The evidence must be properly packaged and labeled.

It is the goal of the FBI Laboratory to continue to perform examinations as a full-service laboratory for its contributors. However, the safety and welfare of its employees and the rest of the law enforcement community are the laboratory's highest priorities and must be taken into consideration when accepting and analyzing evidence.

In the event your laboratory will not process cases involving blood or other body fluids from AIDS victims or suspects, it is recommended that the inves-

ligator contact that laboratory for the name and addresses of other public or private laboratories equipped to deal with infectious diseases and willing to examine the evidence.

Conclusion

Law enforcement personnel investigating violent crimes must handle blood- and body fluid-stained evidence on a constant basis. Often, these body fluids will be contaminated with infectious and disease-causing micro-organisms. There is no sure way to prevent accidental inoculation or contraction of a disease. However, protective practices, such as those discussed in this article, along with exercising care and using common sense, will decrease the risk to the law enforcement officer and others. These safety procedures should

always be used, and the officer should always assume that blood and other body fluids are potentially infectious, regardless of the source.

Footnotes

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²Centers for Disease Control, "Classification system for Human T-lymphotropic virus type III Lymphadenopathy-associated virus infection," *MMWR*, vol. 35, 1986, pp. 334-349.

³Supra note 1.

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⁷Abbott Laboratories, Diagnostics Division, "HTLV-III infection in health care workers," *HTLV-III Chronicle*, October 1985, pp. 1-6.

⁸Centers for Disease Control, "Acquired immune deficiency syndrome (AIDS) in Prison Inmates—New York, New Jersey," *MMWR*, vol. 31, 1983, pp. 700-701.

⁹Centers for Disease Control, "Human T-lymphotropic virus type III-Lymphadenopathy associated virus antibody prevalence in U.S. military recruit applicants," *MMWR*, vol. 35, 1986, pp. 4211-424.

¹⁰L. Resnick, et al., "Stability and inactivation of HTLV-III LAV under clinical and laboratory environments," *JAMA*, vol. 225, 1986, pp. 1887-1890.

¹¹G. Wistreich and M. Lechtman, *Microbiology* (New York: McMillan Publishing Company, 1984).

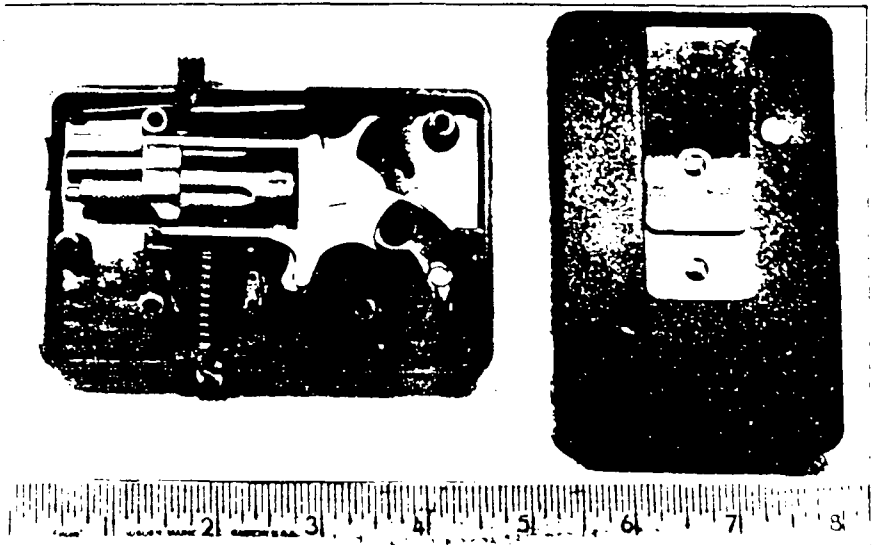
¹²Ibid.

¹³Supra note 10.

¹⁴D. Taylor (1986), Centers for Disease Control, Atlanta, GA (personal correspondence); 1986; J. Richardson and W. Barkley (eds.), *Biosafety in microbiological and biomedical laboratories*, U.S. Department of Health and Human Services, Centers for Disease Control and National Institutes of Health, 1984, pp. 13-23.

Perilous Personal Pager

Both the Orange County, CA, Marshal's Department and the Massachusetts State Police submitted to the *Bulletin* information on this weapon which poses a new threat to law enforcement. The weapon hoister, with authentic label, telephone number, and belt clip, resembles the individual pagers which have become so commonplace in today's society. Inside, a five-shot, .22LR short barrel revolver can be concealed. External controls and an opening in the bottom allow the weapon to be cocked and fired while remaining within the plastic casing. The same weapon also fits into a brass belt buckle.



PERSONALITY ASSESSMENT

Managing Death Investigations

Personality Assessment

by Arthur E. Westveer
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Introduction

Personality Assessment

The Personality Assessment is an investigative aid designed to elicit accurate answers to significant and important questions pertaining to death. In addition, this assessment can be beneficial when investigating equivocal death cases.

When using this assessment it is important to ask the questions the same way to everyone interviewed and to indicate, on the record, the responses of the person interviewed verbatim.

****This is modified version of the Personality Assessment form used by the NCAVC in their investigations.**

PERSONALITY ASSESSMENT

GENERAL BACKGROUND:

Name/Aliases
Gender
Date of Birth
Place of Birth
Citizenship
Race
Height/Weight

FAMILY:

Socioeconomic status of family

Number of brothers (provide names and ages)

Number of sisters (provide names and ages)

Status of parents (living/deceased; ages; health; married/divorced/remarried;
residence location; employment; criminal history)

Religion of family and to what degree is it practiced?

Which parent or other family member has had the most influence in the
subject's life?

Describe the subject's relationship with parents and siblings and the frequency
of contact (include any significant change in the relationship in recent years).

GENERAL DATA:

What is the most important thing/person/value etc., in this subject's life?

Type of residence and general description of neighborhood.

What days/dates are especially significant to the subject, i.e. birthdays, anniversary of significant events, employment, etc.

What is the subject's current financial status?

Has the subject made any recent changes in his/her finances (e.g., changes in bank accounts, names on accounts.).

MARITAL STATUS

Single/Married/Divorced/Separated with pertinent dates (include prior marriages/significant relationships/reasons for separation/divorce)

Describe current marriage and/or significant relationships (specifically the subject's attitude about this with others about his/her significant other, and types)

-Any changes in this relationship?

Name/Dates of birth of subject's children, spouse/significant other.

Describe the nature of subject's involvement with his/her children and the overall relationship maintained with children, (include frequency with which subject is known to have conversations about his/her children, and types of activities they share with children.

-Any changes in this (these) relationship(s)?

EMPLOYMENT

Describe subject's current employment, to include length of service, attitude about the job, attitude towards co-workers/superiors/subordinates. What are the subject's basic responsibilities in his/her job (re job function).

Characterize subject's job competence, and his/her reputation in the workplace (include level of social interaction with co-workers, recent promotions, demotions, conflicts at work).

Provide information regarding subject's significant prior employments and reasons for job changes (provide information regarding any military service, type of discharge and attitude toward military service).

What personal/professional impact would the subject experience if he were to lose his job?

EDUCATION

Describe the subject's formal educational background (include vocational/technical/specialized training).

Describe any other specialized training subject received (e.g. firearms, defensive tactics, ...)

Nature of any problems subject experienced in a formal academic setting.

Provide any available dates/time frames of significant academic achievement failures.

HEALTH

Describe the subject's current health status (include known diseases, congenital problems, general level of physical fitness). Have there been any changes in this area recently? Any physical complaints made by subject recently? When?

What is the subject's attitude about health and level of physical fitness? Has the subject's attitude regarding health/fitness changed recently?

Describe significant injuries/illnesses during his/her lifetime which may have a current impact on the subject's emotional/physical health.

Mental health history to include information regarding mental health treatment, diagnosed problems, and any general issues regarding current or past mental health status (include dates of treatment if possible).

•

Describe the nature of any known or suspected substance abuse, to include alcohol, with frequency and information about the impact on the subject's life.

Under what conditions does the subject use/abuse alcohol/drugs/cigarettes and has there been any recent changes in usage patterns?

Describe the subject's usual eating habits (balanced meals vs. junk food, type of restaurants used, etc.) Has there been absence or increase in appetite?

Describe the subject's usual sleep patterns. Any changes in sleep?

APPEARANCE:

Describe the subject's usual appearance, to include style and care taken in dress, and his/her attitude about appearance.

Has the subject experienced any recent changes in weight? When? Provide known/suspected reasons for this change.

Describe any physical characteristics (limp, speech problems, appearance, mannerisms, gestures, etc.) that could be viewed as unusual and/or are a concern for the subject.

Describe the usual mode of transportation to include types of vehicles owned/used and the subject's attitude toward method of transportation.

Is the subject status conscious? How is this presented by the subject?

PERSONALITY/BEHAVIOR

How would people who know this subject well describe him/her and how would this description differ from those who do not know the subject well?

Characterize the type of person the subject would select as a friend. Who (by name) are the subject's best friends?

What are the subject's:

Strength-

Weaknesses-

Life ambitions-

Life failures-

Describe the subject's intelligence level, to include "street sense."

Provide information regarding subject's criminal history.

What is the subject's general attitude toward law enforcement and other authority figures?

How does the subject react under stress?

Describe recent/ongoing stresses in the subject's life (emotional, criminal, financial, professional, etc.) Both negative (eg divorce, acute illness, death of family/friend) and positive (promotions, retirement, anniversaries).

Describe any significant mood changes that the subject experiences and the situations cause the subject to display positive or negative emotions. Who noticed this (these) change(s)?

What are the subject's religious beliefs and level that the subject practices/portrays those beliefs? Describe any recent changes regarding his/her religious beliefs.

What are the subject's sexual habits, practices, and attitudes? Any changes in this area recently in attitude and/or behavior.

Does the subject accept responsibility for his/her own acts or place blame elsewhere? Provide some examples.

Is the subject viewed by others as someone who can be trusted?

INTERESTS:

What hobbies/pastimes does the subject enjoy? Noticed any changes?

What types of literature/movies/music does the subject enjoy?

What groups/organizations does the subject belong to now or has belonged to in the past? Give dates of membership if possible/dues payment.

Can you suggest anyone else to be interviewed relative to this incident?

ADDITIONAL COMMENTS OR OBSERVATIONS YOU BELIEVE ARE SIGNIFICANT

***POSTMORTEM CHANGES AND
TIME OF DEATH/
IDENTIFICATION OF
UNKNOWN HUMAN REMAINS***

Postmortem Changes and Time of Death

By Arthur E. Westveer, Behavioral Science Unit, FBI

- I. Problems associated with the time of death
 - A. Life insurance policies
 - B. Implicating or excluding a suspect
 - C. Time of assault vs time of death
 - D. Always an estimate

- II. Necessary interdependent systems for life--order of shutdown
 - A. Respiratory system
 - B. Circulatory system
 - C. Central nervous system

- III. Time of Death Determination
 - A. The only accurate method of determining the time of death is to be there when it happens; and even then you have a small margin of error.
 - B. There is currently **NO SINGLE ACCURATE MARKER** of the time of death.
 - C. **USE CONSIDERABLE CAUTION** with time of death estimates.
 - D. Postmortem interval or window of death questions to be asked are:
 - 1. When could death have occurred?
 - 2. When was the deceased last known to be alive and when was the body found?
 - E. Observations to be made at the death scene
 - 1. Degree of rigor
 - 2. Amount and position of livor
 - 3. Body temperature
 - 4. Presence of fly eggs or larvae
 - F. Reasonable range of death
 - 1. Experience and caution of the investigator
 - 2. Classic death markers
 - 3. Well-established window of death

- IV. Early changes after death

- A. Cessation of respiration
- B. Cessation of circulation
- C. Skin pallor
- D. Muscle relaxation
- E. Eye changes--cornea, retina
- F. Blood coagulation and fluidity

V. Late changes after death

A. Algor Mortis (cooling of the body after death); one of the classic markers after death

1. Body temperature is a narrow range, not a fixed temperature
2. Activity, illness, decomposition, infection, absorption of heat can maintain or raise body temperature after death
3. Most accurate body temperature is in the liver
4. Bodies are cooled by radiation, convection, direct transfer; any factors that influence heat loss affect rate
5. The scene, clothing, victim size, and activity have to be carefully considered in estimating cooling time.
6. $(98.4 - \text{Measured Rectal Temperature}) \div 1.5 = \text{hours since death}$

B. Livor Mortis (discoloration)

1.

Red purple	= usual
Pink	= cyanide or cold temperature
Cherry red	= carbon monoxide
Brown	= nitrates
2. Color varies according to skin pigmentation
3. Livor mortis, when set, can indicate if a body has been moved
4. **Tardieu's spots**
 - a. Gravity causes capillaries in a small area to rupture, resulting in circular areas of skin hemorrhage
 - b. **Size is important:** 4-5mm or larger
5. **Petechial Hemorrhage:** suggestive of asphyxia; spots usually 1mm or smaller

5. Obtain samples of hair, blood, and/or body fluids for comparison with known samples of hair and results of prior studies for blood group and type
6. Obtain consultative assistance, as appropriate, for evaluation and interpretation of skeletal, dental, and radiographic findings
7. Examine, describe, record, and photograph the clothing and other physical evidence prior to release for other laboratory examinations
8. Review reports of missing persons, statements of witnesses and/or next-of-kin, and contents of passenger manifests provided by representatives of airlines following mass disasters or aircraft accidents.

B. Methods for Identification

1. Least reliable methods
 - a. Personal recognition by relatives or friends
 - b. Clothing - may be helpful in mass disasters
 - c. Personal effects - may be helpful in mass disasters
2. Scientific methods based upon comparison
 - a. Fingerprints: the most reliable method for identification in the United States since the establishment of a national repository for data by the FBI in 1924. Footprints, ear prints, and lip prints are also useful, provided appropriate records, or records prepared for latent prints are available for comparison.
 - b. Dental: the individual characteristics of teeth, compared with dental records and dental X-rays, provide an excellent means for identification, as well as information concerning the age, race, preexisting disease, habits, occupation. Teeth and prosthetic appliances are often resistant to the effects of trauma and heat.
 - c. Skeletal: bones are often resistant to the effects of environmental conditions and time, as well as the effects of heat. Depending upon the completeness of the skeletal remains, it is often possible to determine the age at death, sex, race, evidence of prior disease or injury, estimate of living stature, and other individual characteristics. Animal bones are distinguished from human bones.
 - d. Hair: Microscopic comparative examination of the cuticular patterns and cross sections of hair are helpful in the determination of race, as well as to identify hair from animals.

- e. Serologic and cytologic studies: blood group and Rh type, animal versus human blood, identification of species, Gm factor, sex chromatin, karyotyping.
 - f. Postmortem examination: occupational marks, evidence of preexisting diseases, congenital defects, tattoos, evidence of prior injuries, operative scars, and absence of organs due to prior surgical procedures provide the basis for comparison with medical and employment records.
 - g. Radiographic: films obtained during life are compared with postmortem films. Foreign materials and metallic fragments not observed during the postmortem examination may be detected. Comparison of dental radiographs. Radiographic evaluation of ossification and fusion of epiphyses, as well as of dental development, may provide estimate of age in children and young adults.
3. Association with or exclusion of remains from other remains based upon individual characteristics, sex, or other factors.

IV. Special Procedures

A. General

1. For each unknown remains, as well as for multiple remains, prepare diagrams and tables for comparison between the unknown and the known features.
2. Examine eyeglasses, including frames and lenses, for comparison with medical records.
3. Look beneath eyelids for contact lenses. Examine lenses with ultraviolet light for markings of manufacturer.
4. If there is a glove-like separation of the epidermis from the hands, the "glove" may be used to obtain fingerprints. If the epidermis is missing, it may be possible to fingerprint the denuded hands. If the hands are putrefied, desiccated, or charred, submit them to CJIS, FBI, for further study.
5. Examine clothing and describe the size, color, condition, and type of each garment. Record descriptions of laundry marks, labels, and name tags. Examine for invisible laundry marks with ultraviolet light.
6. Remove and examine dentures for name and identification number of individual that may be embedded in the denture base.

7. Examine personal effects such as rings, watches, belt buckles, and bracelets for engraved marking. Determine if keys found on the remains provide access to the home or automobile of the missing person.

B. Teeth

1. Compare antemortem and postmortem dental X-rays and records
2. Microscopic examination of ground sections of teeth to determine age

C. Bones

1. When there is commingling of skeletal remains, examine bones with short-wave ultraviolet light to segregate the bones.
2. Prior to examination of bones, arrange in anatomic order.
3. Obtain photographs and X-rays of bone lesions for comparison with antemortem films.
4. Examine pubic bones for parturition pits, indicative of prior pregnancy.
5. Determine estimate of living stature from accurate measurement of long bones and comparison with tables in textbooks.
6. Record degree of ossification and fusion of epiphyses for comparison with tables of ossification centers in textbooks.
7. Examine anterior surface of pubic symphysis in Caucasian male adults for comparison with models for estimate of age.
8. Microscopic examination of ground sections of teeth and cross sections of shafts of long bones for estimate of age.

- D. Hair and Fingernails
 - 1. Obtain samples of known and unknown fingernails and hair for comparison by neutron activation analyses.
 - 2. Comparison microscopic examination of linear striation of fingernails.
- E. Toxicologic Studies
 - 1. Retain tablets or capsules found in stomach for subsequent examination and identification.
 - 2. Obtain specimens as appropriate for alcohol, drugs, carbon monoxide, and other toxic agents prior to embalming. Preserve samples by freezing.
 - 3. In exhumed bodies, obtain samples of soil, water in grave, and fluids in casket for subsequent analysis.
- F. Microscopic Examinations
 - 1. Confirm gross pathologic findings
 - 2. Distinguish between antemortem and postmortem findings
 - 3. Estimate age of antemortem injuries by extent of inflammatory response or reparative processes
- G. Reconstruction
 - 1. Comparison of photographs of ears with antemortem photographs
 - 2. Restoration of the head from the skull and comparison with antemortem photographs
- V. Pitfalls (Dos and Don'ts)
 - A. Do
 - 1. Establish perimeter and maintain security during the on-the-scene investigation
 - 2. Have consecutive numbers for bodies and related personal effects in mass disasters
 - 3. Establish and maintain chain-of-custody for physical evidence

4. Obtain consultative assistance of physical anthropologists, dentists, radiologists, and other specialists, as indicated
5. Obtain photographs, X-rays, and other special studies required for identification
6. Obtain all available records for review and correlation with the investigative and pathologic findings
7. Examine, describe, record, and tabulate results of examinations for comparison with known information

B. Don't

1. Consider the burned, decomposed, mutilated, or skeletal remains as unsuitable for examination
2. Fail to recognize artifacts and postmortem injuries
3. Attempt to examine commingled skeletal remains. Instead, segregate the bones and arrange in anatomic order.
4. Rely upon personal identification by relatives or friends
5. Place specimens for toxicologic studies in formalin solution
6. Confuse the remains of animals with human remains
7. Fail to prepare a contingency plan for a disaster in your community.

- C. Rigor Mortis: classic marker for death. Heat accelerates the process, cold decelerates the process
 - 1. Mechanism: physical change
 - Onset: immediate
 - Manifested: 1-6 hours
 - Maximum: 6-24 hours
 - Disappears: 24-36 hours
 - 2. Rigor mortis interpretation is not reliable; it can be affected by:
 - a. illness
 - b. temperature
 - c. activity before death
 - d. physical conditions where the body is placed or found
 - e. may be poorly formed in the young or old
 - 3. Environmental factors that may have changed with time
 - a. sun shining on victim
 - b. air conditioner on body
 - 4. Cadaveric spasm
 - a. focal instant rigor
 - b. seen in sudden death
 - c. medicolegal importance
 - (1) grasping a weapon
 - (2) grasping evidence
 - (3) position

VI. Postmortem Tissue Changes

- A. Decomposition: Usually evident when the time of death is beyond 24 hours.
 - 1. Autolysis: The process after death by which digestive enzymes within the body cells break down carbohydrates and proteins.

2. Putrefaction

a. Stage 1

- (1) blue-green discoloration of the skin of the abdomen
- (2) 24 to 36 hours
- (3) less time = less color

b. Stage 2

- (1) marbling or green-black discoloration that follows a vascular distribution
- (2) progresses to dark purple coloration of the skin

c. Stage 3

- (1) bloating of the body
- (2) crepitus in many areas of loose skin (scrotum, penis, eyelids)
- (3) normal conditions 36-48 hours
- (4) generalized distribution 60-72 hours

d. Stage 4

- (1) loosening of hair and nails and shedding of skin on the hands and feet
- (2) "sock" and "glove"
- (3) occurs within 4 to 7 days

B. Skeletonization

1. Removal of soft tissue
2. Flies, beetles, and animals
3. Forensic entomology

C. Mummification: Drying of the body or its parts, producing leather-like changes

D. Adipocere

1. Wax formed--not a soap
2. Hydrogenation of body fats
3. Specific requirements
 - a. moisture
 - b. anaerobic environment (no air or oxygen)

Standards Currently Employed to Determine Time of Death¹

I. Key Points in determining time of death

- The only accurate method of determining the time of death is to be there when it happens; even then, you have a small range of error.
- There is currently **no single accurate marker** of the time of death
- The closer to the actual time of death, the more accurate is the opinion possible from the scene and markers of death.
- The experience and caution of the investigator, coupled with the classic death markers **and** a well-established window of death can lead to a reasonable range of death.
- To determine the probable range of death:
 - First establish a window of death. When could death have occurred? When was the deceased last known to be alive and when was the body found? This difference is the range of time wherein death could have occurred.
 - Second, use those scene markers that allow some positioning of the death, within that window: morning newspaper read, phone calls made, type of meal consumed, place and state of dress.
 - Third, adjust this preliminary opinion by any additional data; e.g., that issue of the newspaper could have been available late the night before, the man works nights and sleeps days, etc. Consider environmental factors and factors that may have changed with time; e.g., sun shining on victim, air conditioner blowing on body. Use observation of the degree of rigor, amount and position of livor, body temperature, presence of fly eggs or larvae, etc., to further refine opinion. Use the temperature and vitreous potassium or other testing to further refine opinion.
- As a summation, use **considerable caution** on time of death determinations, as there can be factors that markedly enhance or retard the chemistry of death and its changes.
- Accentuate giving range of death and basis of determination.

¹This section was adapted from a paper presented by Dr. Patricia J. McFeeley, Chief Medical Investigator, State of New Mexico, Albuquerque, at the VICAP International Symposium at Quantico, Virginia, June 19-23, 1988.

- **Don't attempt to make your opinion more accurate than the data allow.**
- Ensure that you specify that these are preliminary findings or your final opinion, whichever is correct.

A. Rigor Mortis

One of the classic markers of death, its normal sequence is well documented in history. In Michelangelo's famous statue of Christ being taken from the cross, the flaccidity typical soon after death is clearly evident. Muscular relaxation immediately after death is followed by the onset of gradual rigidity without shortening of the muscle. Since muscle continues to metabolize for a short time after somatic death or from products built up during the death event, glycogen (starch used to create metabolic sugars) is converted into lactic acid (sugary milk released in urine after excretion). As the pH falls (acidic levels), the muscle protoplasm physically changes. Since ATP (Adenosine triphosphate, which is created during muscular exertion) does not regenerate in dead muscle, this process proceeds in one direction only. The solution is converted into a gel as the actin of the muscle is physically changed.

Perception of rigor is more rapid in the smaller muscles, leading to the misbelief that his process starts in the head and works down the body. All muscles are affected at a similar rate; rigor is more evident in the short, smaller muscles earlier than in the longer, larger muscle masses.

Since this is a chemical process, heat accelerates and cold decelerates the process. Acidosis (low acidic levels causing tissue malfunction, especially in the central nervous system), uremia (excess waste products in the blood), or other medical conditions promoting a lowered Ph accelerate the process.

The very perception of rigor depends on experience and condition. A very cold body may appear stiff because of changes in the fat layer.

Mechanism:	physical change
Onset:	immediate
Manifested:	1-6 hours
Maximum:	6-24 hours
Disappears:	12-36+ hours

Rigor is typically quantified by mild or early, moderate or mid, and full or complete as a descriptive statement of degree of change. This is totally subjective, and two observers may have different interpretations. Usually, perceived stiffness in motion of a joint is mild; difficulty, requiring force to move a joint, is moderate; and having to use great force is full rigor.

Once the physical change of the muscle is forced, that degree of change will not reoccur, so that if someone has broken the rigor, it will not reform if to completion. If only partial, some rigor will continue to form.

Rigor is an **unreliable method** of indicating the time of death. It is affected by illness, temperature, activity before death, and the physical conditions where the body is placed or found. It may be poorly formed in the young or the old. It is an aid in the general determination of death at best, and should not be relied on as a single indicator of the time of death.

B. Algor Mortis (Cooling down after death)

The metabolism of the tissue generates heat, which is very tightly regulated by the body to a narrow range. Cooling of the body after death is another of the classic markers of death. If the body always cooled at a uniform rate, that slope would enable an accurate determination of the time of death.

However, the body temperature is a narrow **range**, not a fixed temperature. Activity, illness, decomposition, infection, and absorption of heat can maintain or **raise** body temperature after death. The body cools by radiation, convection, and direct transfer so that any facts that influence heat loss affect rate. The scene, clothing, patient size, and activity and physical factors have to be carefully considered in interpreting cooling rate.

Over the years, there have been a number of formulas proffered that would, in theory, allow the calculation of the time of death. Glaister's:

$$\frac{98.4 - \text{measured rectal temp}}{1.5} = \text{hours since death}$$

In Fattah is the statement that the cooling of the body is the most reliable factor for the first 12-18 hours, but he points out that exercise or struggle could raise the temperature from 98.4° by 3-4°, sleep lowers, etc. He included the warning that degree of fatness, age, and ventilation all changed the rate, and that clothed bodies cool 66% slower and bodies in water 2 times as fast.

Marshall and Hoar, in a series of articles on this topic, stated that the rate was not uniform, but 1°/hour for the first three hours, then 2°/hr for the next six hours, then 1½°/hour for the next three, etc.

Spitz and Fisher caution that they had observed cases where 93° was reached in as short a time as 2 hours and as late as 6 hours. Temperature has to be considered in light of all the scene data, and any altering factor. For example, if a dead person was in a closed car all day with the sun shining on the car and then was discovered at night, the body could not be expected to have

cooled in the regular fashion; in fact, it may well have an elevated or normal temperature.

1. Livor Mortis (Synonyms: Postmortem hypostasis, lividity, suggillations, gravitation)

Known since antiquity, the settling of blood to the dependent parts of the body has been recognized as a change of death. When cardiac activity stops, the hydrostatic pressure of the liquid blood causes it to settle and distend the dependent capillary bed. The color of the dependent part will depend on the skin pigment and any additional compounds in the blood that may affect color, such as carbon monoxide, but it is generally dark blue or purple.

Livor begins at or very soon after death, since it is a function of blood flow and therefore cardiac activity. However, stasis can occur to some extent in shock and some degree of lividity can be present even while a person is technically alive.

Mechanism:	Settling
Onset:	Immediate
Manifested:	2-4 hours
Maximum:	8-12 hours
Disappears:	-----

There are factors that will accelerate or retard the onset of visible livor, and the disappearance rate is similarly variable.

Tardieu's Spots

When the accumulated area engorged with blood is large, gravity can cause capillaries in a small area to rupture so that larger, usually circular or rounded areas of skin hemorrhage occur. These have to be differentiated from the much smaller petechial hemorrhages more suggestive of asphyxia. Size is important since these areas are usually 4-5mm or larger in diameter, whereas petechiae are usually 1mm or smaller in diameter.

Livor will not usually develop where there is pressure from clothing or objects, so important information regarding whether a patient was clothed for a period of time after death or if his position was changed can be gained from a careful inspection of livor's distribution. Generally, time can at best be supported from observation of livor and comparison with the accelerating or decelerating factors affecting that scene.

C. Vitreous Potassium

A study of cell physiology reveals that the cell maintains an increased concentration of potassium in the intracellular fluid, 20-30 times the concentration in the plasma. This high concentration requires a balance between the electrical charges inside and outside the cell membrane and is maintained in this relatively high concentration by active metabolic forces that "pump" the electrolytes selectively across the membrane. A return to equilibrium occurs after death at a steady rate because the pumping mechanism is no longer active and the cell wall now becomes a semipermeable membrane that allows the potassium to leak through the membrane to approach equilibrium. The leak is at a steady rate because of the mechanical limits of the membrane. This steady rate provides a built-in clock that allows a projection back to the time of death. Since blood hemolyzes and loses potassium, it becomes unreliable for analysis. An ideal sample, protected from most trauma, is the vitreous fluid of the eye. The concept is valid, but it has to be interpreted in light of regional variations and with consideration for accelerating or decelerating factors.

II. Evidence for Estimation of Time of Death

Use a combination of all evidence available to you, giving weight to the more reliable/documentable. Be suspicious when some factors seem to vary considerably from the other.

A. Corporal Evidence: In the body

1. Stage of decomposition of organs vs exterior
2. Soot in airway
3. Medical conditions (previous surgery)
4. Alcohol/drug levels
5. Beard, nails, hair

B. Environment and Associated Evidence: In the vicinity and general surroundings

1. Uncollected mail, newspapers
2. Lights on/off
3. Alarm clock set
4. Food on stove/in refrigerator
5. Type of clothing
 - a. day/night
 - b. indoors/outdoors
 - c. seasonal (remote deaths)
 - d. condition of clothing (mold, leached dyes)
6. Sales slips, receipts
7. Animals in house

C. Anamnestic Evidence: Based on the decedent's ordinary habits and daily activities

1. Usual activities
2. Waking & sleeping patterns
3. Eating habits, times, type of foods
4. Appointments

D. Ocular Changes (All depend on lid position, temperature, humidity, and air currents)

Change	Eyes Open	Eyes Closed
Ophthalmoscopic Exam Boxcarring in vessels ?Time interval changes	Within 1/2 hour (indication of death) (Ref. Kevorkian; JFS 1961)	
Corneal film	minutes	several hours
Scleral discoloration "Tache noire"	minutes to several hours	
Corneal cloudiness	2 hours or less	12-24 hours
Corneal opacity		3rd post-mortem day
Exophthalmos (bulging)	with gas formation	
Endophthalmos (retraction)	advanced decomposition	

E. Food in stomach (cannot rely on amount of digestion)

Size of Meal	Time in Stomach (starts to empty within 10 minutes)
Light	1½-2 hours
Medium	3-4 hours
Heavy	4-6 hours (head of meal reaches cecum 6-8 hours)
Variations: Liquid faster than semisolid faster than solid Emotional state can affect rate: Psychogenic pylorospasm: prevent emptying for several hours Hypermotility: diarrhea (Study of condemned men following judicial execution: rate through small bowel = 6-7 ft/hr; reached cecum 3-3½ hours)	

III. Stages of Postmortem Decomposition

Decomposition Element	Time Frame
Blue-green discoloration of skin Right lower quadrant & left lower quadrant Entire abdomen	24 hours 36 hours
Marbling (green-black discoloration in blood vessel distribution--hemolyzed blood reacts with hydrogen sulfide. Extravasation diffusion (leads to generalized dark purple-black skin)	
Bloating (crepitus most marked in areas of loose skin--scrotum, penis, eyelids)	36-48 hours
Entire body decomposition	60-72 hours
Skin slippage (epidermolysis) with vesicle formation and collapse hair and nails loosen and shed "glove" formation of hands and feet	4-7 days
Saponification/Adipocere prolonged exposure to moisture in association with organisms (C. Welchii) involves subcutaneous fat oleic acid (unsaturated/liquid) hydrogenated to stearic acid (saturated/solid)	usually several months
Mummification drying precedes or interrupts decomposition (bacterial growth arrested with body moisture less than 50%)	
Skeletonization	weeks to years

IV. Factors Influencing Postmortem Decomposition

- A. Environmental factors: temperature, humidity, location (indoors vs outdoors), clothing
1. heat increases rate (intense heat may decrease--"heat fixation")
 2. cold decreases rate
 3. freezing/thawing
 4. insects and soil (work from outside in)
 5. micro-organisms (work from inside out)
 6. Body habitus: Newborns (sterile alimentary tract); obese vs thin
 7. Cause of death: Exsanguination (may delay); infection, CHF, anasarca (accelerates)

V. Extensively Decomposed/Skeletonized Remains

- A. Should be treated as any other case; i.e., careful examination and documentation of scene, collection of evidence, etc.
- B. Best approach is to plan ahead (another day at this stage will probably not change the scene significantly, but could make the final conclusion better)
- C. **Use the services of a forensic anthropologist liberally and early**
- D. Weathering of the bones depends considerably on:
 - buried or not buried
 - climate
 - moisture
 - elevation
 - terrain
 - protection
 - insects/animals (human) intervention
- E. Scene conditions should be photographed, sketched, measured, etc., for later interpretation. Collect plants when appropriate. Check weather bureaus for rainfall, temperatures, etc.
- F. Interpretation must take into account the local conditions--results vary widely with different areas of the country.

VI. Insect Infestation (Fauna) = Useful for establishing a minimum postmortem interval

- A. Body lice: outlive host by 3-6 days
- B. Blow flies (Diptera): may deposit ova before or at death
 - larva (maggot) hatch 18-24 hours (strongly proteolytic)
 - may exaggerate size/obliterate penetrating wounds)
- C. Insect/arthropods (temperature greater than 40° F)
 - Highly dependent on locale, temperature, season
 - Collect representative samples in preservative (85% alcohol) and take to an entomologist)

VII. Plant Life (Flora)

- A. Grass/plants beneath an object wilt, turn yellow or brown, and die (rate depends on type of plant, season, climate, etc.)

- B. Seasonal plants or remnants may help indicate a range of time
- C. Collect dead and dying grasses, twigs, flowers, etc., and take to a local botanist

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IDENTIFICATION

OF

HUMAN REMAINS

Identification

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Introduction

- A. The identification of unknown human remains is based upon comparison of known information derived from records with data obtained by examination of the victim.
- B. The consultative assistance of other forensic scientists, particularly physical anthropologists, dentists, radiologists, criminalists, and serologists, is often required for conclusive identification.
- C. The following records are useful for comparison with the investigative and postmortem findings.
 - 1. Reports of missing persons
 - 2. Fingerprints
 - 3. Dental records
 - 4. Health records, including past medical history, physical examination, and operative reports
 - 5. Laboratory records, including blood group and type
 - 6. Antemortem X-rays
 - 7. Employment records
 - 8. Police records
- D. The medical examiner or the coroner has the responsibility for the determination of the cause and the manner of death, as well as for the identification of unknown human remains and the estimation of the time of death.
- E. Accurate identification of unknown human remains is required for the following reasons:
 - 1. Completion of official records
 - 2. Notification of the next of kin
 - 3. Settlement of estates and insurance claims
 - 4. Establishment of the *corpus delicti* after homicide

F. Applications of procedures for identification

1. Antemortem identification
 - a. Comparative identification of wanted criminals or missing persons
 - b. Identification of criminal suspects by bite marks
 - c. Attempts at interchange of identity
2. Postmortem identification
 - a. Identification of single individuals
 - (1) Unknown, decomposed, mutilated, skeletonized, or incinerated remains
 - (2) Establishment of *corpus delicti* after homicide
 - b. Identification of mass casualties
 - (1) Accidental deaths: fire, explosion, vehicular accidents, aircraft accidents
 - (2) Military operations
 - c. Identification of remains after mass burial or after exhumation of single individuals

G. Objectives of the medicolegal investigation

1. Are the remains human or nonhuman?
2. If the remains are human, what evidence is available to determine the estimates of age and living stature, as well as the sex, race, and individual characteristics of the remains?
3. Based upon the investigative and postmortem findings, is it possible to provide an estimate of the time of death and/or the duration of time between death and the discovery of the remains?
4. What is the cause and the manner of death?
5. Were any injuries sustained after death?
6. Is there an indication of interchange of physical evidence between the victim and an assailant?

II. Preliminary Steps

A. On-the-scene investigation

1. Establish a perimeter about the scene to prevent disturbance of the remains and the physical evidence.
2. Maintain security for the area and require identification procedures for personnel entering the area.
3. Establish and maintain a chain of custody for all physical evidence.
4. Assign consecutive numbers to bodies.
5. Provide a system for communication between investigators on the scene and central offices.
6. Maintain the relationship between clothing and personal effects found at the scene and the respective remains.

B. Determine jurisdiction for investigation

1. State or local jurisdiction
 - a. State or local law enforcement agencies
 - b. Medical examiner or coroner
2. Federal jurisdiction (Federal Aviation Act of 1958)
 - a. Federal Aviation Administration (FAA)
 - b. National Transportation Safety Board (NTSB)
 - c. Federal Bureau of Investigation (FBI)
 - d. FBI Disaster Squad
3. Military jurisdiction
 - a. Commanding officer of nearest military installation
 - b. Judge Advocate, or legal officer, of nearest military installation

C. Determine special requirements for facilities and assistance

1. Communications
2. Consecutive numbers and disaster bags for remains
3. Transportation to remote areas
4. Facilities for postmortem examination and preservation of remains

- a. Rental of refrigerated vans
 - b. Building suitable for temporary morgue
5. Laboratories for examination of physical evidence and/or completion of toxicological studies, depending upon jurisdiction
- a. State or local crime laboratory
 - b. Medical examiner or coroner
 - c. FBI Laboratory
 - d. Army CID Crime Laboratory
 - e. Military hospital or area laboratory
 - f. Civil Aeromedical Institute (FAA) - commercial carrier or general aviation accidents
 - g. Armed Forces Institute of Pathology - military aircraft accidents
6. Consultants
- a. Physical anthropologist
 - b. Radiologist
 - c. Dentist
 - d. FBI Disaster Squad
 - e. FBI Criminal Justice Information Services (CJIS) [formerly Identification Division]--FBI Fingerprints
7. Support for black-and-white or color photography on the scene as well as during the postmortem examination
8. Facilities for radiographic studies of remains including dental X-rays and total body X-rays
9. Facilities for special studies such as neutron activation analysis

III. Postmortem Procedures for Identification

A. Immediate Action

1. Obtain all available records for comparison with the results of the examination. (See Section I.C. [Comparison=Identification])
2. Obtain photographs of remains, clothing, and physical evidence
3. Obtain selected X-rays, dental X-rays, and/or total body X-rays, as appropriate, for comparison with antemortem X-rays
4. Obtain fingerprints for comparison with existing records

FORENSIC ENTOMOLOGY

FORENSIC ENTOMOLOGY: INSECTS IN THE INVESTIGATION OF VIOLENT CRIME

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The remains of a 48 year old female in a moderately advanced stage of decomposition were found in a brush-filled ditch in a predominantly industrial area outside of Honolulu, Hawaii. The body was lying face up across the ditch, which was partially filled with water. The skull was largely devoid of flesh and the mandible was separated from the skull. Three toes of the left foot were missing. The left hand was missing below the wrist, but the right hand was intact, although mummified. The remains were clothed in a blackened skirt. Upper, exposed portions of the remains were dry and partially mummified, while the lower, partially immersed, portions presented the appearance of the advanced decay stage of decomposition. Both feet were dehydrated, as were the right hand and arm. The rib cage was exposed, with some shreds of skin attached.

Further examination of the remains at the morgue revealed a largely skeletonized body lacking internal viscera and having only portions of parchment-like skin covering the neck, face and lower extremities. With the exception of a fractured hyoid bone, no evidence of antemortem traumatic injury was found, although there was some evidence of postmortem vertebrate animal depredation. Due to the presence of the fractured hyoid bone, cause of death was determined to have been manual strangulation.

Collection of arthropods associated with the remains was made during autopsy. The portions of the body that were immersed in water yielded blow fly and flesh fly larvae. The former were identified as *Chrysomya megacephala* and this identification was confirmed by rearing representative larvae to the adult stage. The flesh fly larvae were not successfully reared and the species identity remains uncertain.

A greater variety of arthropods were present on the drier portions of the remains. Larvae of the Piophilidae, *Piophilidae casei*, were present in moderate numbers along with emergent third instar larvae of a green bottle fly, *Phaenicia cuprina*. Empty puparial cases of another blow fly, *Chrysomya rufifacies*, were attached to the exposed

ribs and leg bones. Adult dermestid beetles (*Dermestes maculatus*) were present on the external surfaces of the remains and examination of the body cavities revealed a large number of both early and late instar larvae of this species. Clerid beetles, *Necrobia rufipes*, also were present on the external surfaces of the remains.

Analysis of the insect taxa and stages of development resulted in a postmortem interval estimate of 19.5 days. This estimate was based on the total assemblage of insects present on the remains and fit well with the last confirmed sighting of the decedent 20 days prior to the discovery of the remains.

The arthropods of primary significance in the post-mortem interval estimate in this case were *C. rufifacies* and *D. maculatus*, as these were the species indicating the longest period of residence on the remains. On the island of Oahu, *C. rufifacies* requires 10-12 days for development under ambient temperatures. This species is one of the first to arrive at remains and oviposition continues for the first 4-5 days of decomposition. Presence of only empty puparial cases of this species indicated a minimum postmortem interval of 16-17 days. Dermestid beetles associated with remains in the Hawaiian Islands appear between days 6-8 in habitats similar to those of this case. Late instar larvae of *D. maculatus* in the body cavities were consistent with the 19-20 day postmortem interval. Also consistent with this time period were puparia of *P. cuprina* in the soil near the remains and the clerid *N. rufipes* on the drier portions of the remains.

The partial immersion in water of these remains served to keep them in a condition suitable for oviposition by adult flies longer than would be usual in a purely terrestrial environment.

This case vividly illustrates how insect evidence collected from in, on, and around the body of a victim of untimely death, when properly collected, preserved and analyzed by an experienced and appropriately trained forensic entomologist, can provide an accurate estimate of the victim's time of death, as well as other forensi-

cally valuable information concerning the circumstances surrounding the victim's demise.

Within the United States and around the world insect scientists (entomologists) are being called upon with increasing frequency to apply their knowledge and expertise to criminal and civil proceedings and to become recognized members of forensic laboratories and medical/legal investigation teams. This need has given rise to an entomological sub-specialty termed forensic entomology.

CHARACTERISTICS OF INSECTS

Insects are members of the class Insecta in the invertebrate phylum Arthropoda. As a group, insects are probably the most successful and numerous creatures on earth. Over 900,000 species are known and it is estimated that this represents only 1/5 to 1/10 of the insect species that actually exist. Currently, there are about three times as many known insect species as there are species of all other animals combined. In just the Nearctic region (that part of North America lying north of Mexico), the insect fauna includes an estimated 125,000 to 150,000 species. In contrast, only about 3,200 species of mammals are known in the entire world.

Insects are highly adaptable creatures and can be found in nearly every conceivable habitat and situation. Annually, insects destroy millions of dollars worth of agricultural crops. They serve as vectors for the causative agents of many of the worst diseases of man and domestic animals. In addition, they bite, sting and attack man and animals directly, causing irritation, blood loss and in some cases even death.

Insects, however, are also extremely beneficial, providing such products as bee's wax and honey, silk, shellac and many of the basic components of cosmetics. For many years insects have been used extensively in the scientific laboratory and have greatly enhanced progress in nearly all aspects of biological and medical research. In certain regions of the world insects are even valued as a protein-rich food source.

Although there is much that can be said both for and against insects as they relate to man, the vast majority of insects are quite neutral, neither bestowing any great benefit nor causing any great harm.

Insects include such well known creatures as flies, mosquitoes, grasshoppers, cockroaches, termites, beetles, butterflies and moths, wasps and bees, fleas and lice. Insect adults can be differentiated from most other animals by several rather distinct traits. Among these are a hardened outer body called an exoskeleton, which is subdivided into a distinct head, thorax and abdomen; three pairs of jointed legs attached to the thorax; a single pair of antennae located on the head; large compound eyes; and one or two pairs of wings.

With few exceptions, adult insects lay eggs. Immature insects emerging from some eggs look very much like their parents, except that they are smaller in size and wingless. These immature insects, called nymphs, periodically cast their skins (moult), as they increase in size. Each stage between moults is termed an instar. Eventually, nymphs pass through a final moult and display all of the characteristics of adults. Grasshoppers, cockroaches and the young of several other groups grow in this gradual fashion.

Most insects, however, pass through three very dissimilar stages during their development, namely egg, larva and pupa. None of these stages bears any resemblance to any other stage or to the adult. Larvae, which hatch from these eggs, are often soft-bodied and resemble caterpillars, maggots, or grubs. As they grow, these larvae can cast their skins (moult) as they increase in size. The number of larval moults varies dramatically from insect group to group. Eventually, however, these larvae surround themselves with a hardened cocoon-like outer skin in which they undergo their final pre-adult development. This stage is called the pupa. Fully formed adult insects eventually emerge from the pupal enclosure. Butterflies, moths, flies, beetles and numerous other insect groups develop in this manner. Most of the forensically important insect species pass through this latter type of development.

INSECTS AND HUMAN DECOMPOSITION

Apart from the bacteria and fungi, insects are the most important processors of dead animal remains. A wide variety of carcass-frequenting specialists utilize decomposing materials both as a food source and as a place to rear their young. Animal studies have shown that carcasses left uncovered and freely exposed to insects lose up to 90% of their weight within a week during summer months. In contrast, carcasses covered with mesh to prevent insect access, gradually dry out and mummify over a period of more than 100 days.

Because decomposing animal remains occur relatively infrequently and are widely scattered throughout the environment, insects which specialize in utilizing these resources have evolved highly developed methods of carcass detection (smell) and locomotion (flight). Initially, strong flying insects, particularly flies, are attracted to the odors produced by gases and body fluids oozing from the natural body openings and to blood escaping from wounds. In time, the skin, underlying organs, flesh and bone become attractive to other groups of scavenging insects. Insects are responsible for the consumption of virtually all parts of the carcass except the skeleton. As a carcass decomposes, therefore, it can be viewed as a succession of habitats each attractive

to, and supporting, a different group of specialized insects. Although the exact species may differ from country to country, from habitat to habitat, and from season to season, the basic pattern of the succession of insect decomposers is remarkably constant around the world.

Human corpses, whether they have been produced naturally or as the result of foul play, are processed by these insect decomposers in the same manner as any other piece of animal carcass. Forensic entomology, therefore, is based on the analysis of the insects and other invertebrates which sequentially colonize a corpse as decomposition progresses and on the rates at which the various stages of their offspring develop. Entomological information can be extremely useful in determining manner of death, movement of a cadaver from one site to another and length of the post mortem interval.

THE IMPORTANCE OF BLOW FLIES

While a wide variety of insect species are attracted to decomposing remains and play an active role in the decay process, two groups, the flies (Diptera) and beetles (Coleoptera) are of major importance in most circumstances. Diptera (flies), whose larvae are capable of living in a semi-liquid medium, are the first insects to be attracted to and colonize decomposing remains. Fly larvae (maggots) are responsible for the dramatic consumption of the cadaver's organs and tissues. Only much later, when the corpse has to a large extent dried out, do the species of other insect groups, notably Coleoptera (beetles) move in and continue the process.

Large, strong flying, highly mobile flies are typically the first insects to be attracted by the faint aromas emanating from a fresh corpse. Blow flies (family: Calliphoridae) frequently arrive within minutes to a few hours after death and are generally the first individuals to arrive at a crime scene. Blow flies arriving at a corpse either begin to lay eggs immediately, or first feed on the protein-rich fluids emanating from the corpse and then begin oviposition. Initially these flies feed and lay eggs in the natural body openings (ears, eyes, nose, mouth, and if exposed, the anus and genitalia). This is due to the fact that blow fly adults have soft, tongue-like mouth parts which are not capable of piercing human skin. Natural body openings also provide moist, humid cavities which enhance egg hatching and larval survival.

Blow fly eggs are small (2-3 mm), whitish-yellow and somewhat elongate. They are frequently packed into natural body openings in large numbers and are easily visible to the naked eye. During colder months, however, their numbers may be few and they may be difficult to locate, being hidden in more cryptic sites such as under the eyelids or within the nostrils. Blow fly eggs

will typically hatch within one to three days, depending on species and environmental conditions.

When blow fly eggs hatch, they produce small, relatively featureless, worm-like creatures called larvae or maggots. Blow fly larvae have a tapered anterior end containing a pair of mouth hooks which the larvae use in feeding and also for locomotion. Posteriorly the larvae bear a pair of flattened nostrils called spiracles, through which they breathe. These features, along with the larvae size and shape, provide important diagnostic features.

The larvae grow rapidly, passing through three moults (instars) before becoming fully grown. Large numbers of larvae typically hatch together and move around the corpse as a group. Blow fly larvae are responsible for disseminating bacteria and secreting enzymes which enable them to consume virtually all of the soft tissues contained within the corpse. Blow fly larvae become fully grown within several days to several weeks depending upon species, environmental conditions and the number of larvae present.

After reaching the third instar, larvae undergo a dramatic behavioral change in which they crawl away from the corpse, burrow down into the soil and pupate. As previously mentioned the process of pupation involves the secretion of a hardened outer skin or casing around the body of the larvae. Within this pupal case the larvae undergoes complete physical reorganization and eventually emerges bearing all of the adult fly characteristics. Blow fly pupae are small, football-shaped structures which are reddish to dark brown in color. Pupal cases are extremely resilient and will in some cases remain in the soil beneath the corpse for hundreds of years. Blow fly pupal cases can supply valuable information long after the remains of the body have decomposed. Only through careful examination of the soil, either the corpse or at a site where a corpse is reported to have decomposed, will this valuable entomological evidence be found.

Blow fly species differ in their abundance from region to region, from habitat to habitat and from season to season. In the northern U. S. for example, the blue blow fly, *Calliphora vicina*, is most abundant during the cooler parts of the year whereas the bronze blow fly *Phaenicia sericata*, dominates corpses during the warmest parts of the summer. Similarly the green blow fly, *Lucilia illustris*, frequents corpses located in open, brightly lit habitats whereas the black blow fly, *Phormia regina*, prefers shaded localities.

The careful analysis of the physical characteristics of the various developmental stages of the blow flies inhabiting the corpse, when coupled with the detailed knowledge of their ecology, and the environmental conditions to which they are exposed, can provide forensic

investigators with meaningful information concerning the time of death, movement of the corpse from one site to another and manner of death.

BETTERLES AND THEIR ALLIES

Following the invasion of the corpse by blow flies, a wide variety of other types of insects also colonize the remains. Carrion beetles, rove beetles, clown beetles, sap beetles, checkered beetles, scarab beetles and dermestid beetles all become members of the host corpse community feeding and rearing their young on the drier remaining tissues and on the large maggot mass. Additionally, other types of flies including house flies, flesh flies, skipper flies, fruit flies and coffin flies also colonize the remaining tissues. The corpse eventually comes to support a complex and diverse community of insects often numbering hundreds of species and thousands of individuals. These insects, while far less numerous than the blow fly larvae which originally colonized the remains, can be seen flying, crawling and scurrying about the corpse itself and in the soil beneath the remains.

As previously mentioned these insects are attracted to the corpse in an orderly, progressive fashion. The successive nature of the colonization process enables forensic entomologists, when supplied with a representative sample of the insects present, to provide investigators with forensically meaningful information concerning the circumstances surrounding the demise of the individual. Essentially, by knowing the players on the field at the time that the corpse was found, forensic entomologists are able to determine the inning of the game.

COLLECTION AND PRESERVATION OF SPECIMENS

Accurate forensic determinations depend upon the proper collection, preservation, and rearing of entomological specimens. In order to accomplish this, investigators must be able to recognize adult and immature stages of locally abundant, carrion frequenting insects and be familiar with the proper techniques for collecting and preserving these animals. Representative samples of all adult and immature insects should be collected from on, in and beneath the corpse. Flying insects can be collected with the standard insect or short-handled hand net. It is important to make collections as soon as possible as specimens of adult flies may leave the area surrounding the corpse when human activity becomes evident. Once collected adult specimens can be retained indefinitely for analysis. Adult flying insects can be immediately placed in 70% ethanol or isopropyl alcohol diluted 1:1 with water. Higher concentrations of isopro-

pyl alcohol may cause specimens to become brittle. Do not use formalin to preserve insects, unless no other preserving fluid is available. Insects preserved in formalin should be transferred to 70% alcohol as soon as possible. A small hand net and preserving fluid can easily be carried as part of standard equipment.

Crawling insects from the surface of and within the corpse should be collected using forceps or the fingers. During sampling, hands should be protected with surgical gloves at all times. Smaller specimens (under 5 mm) can be collected with a small artist's paint brush dipped in a preserving fluid. Crawling insects located on the ground beneath the corpse can most easily be collected by scooping up the top few centimeters of soil and placing it in a plastic bag. The plastic bag containing the soil should be chilled, if possible, until the insects are extracted and preserved to prevent further growth and possible predation or asphyxiation. This is particularly important when large numbers of fly larvae are present.

As previously mentioned, some insects, particularly mature fly larvae and beetles, will burrow into the soil beneath the corpse. A careful examination of the soil beneath the corpse is important particularly in cases of advanced decay. This analysis is most easily accomplished by removing large samples of soil from beneath the area where the corpse was located. These samples should be placed in plastic bags and refrigerated until they can be processed by a trained entomologist or laboratory technician.

When skeletal remains are encountered in the field, a close examination of the bones and surrounding soil must be made prior to skeletal removal. Close examination of bone cavities will usually produce numerous insect remains. The skull should be most closely examined, particularly inside the cranial vault. The skull should be placed on a white sheet or large piece of white paper, and the eye orbits, nasal openings, cranial vault and auditory meatus probed with a pair of forceps and a penlight. The interior of the skull can then be gently washed inside and outside with water, while being held over a small collection screen or cheese cloth.

Immature and soft-bodied insects, particularly the larvae of blow flies, are critical to an accurate forensic analysis. Representative samples of fly larvae, including the largest individuals present, should be collected and immediately subdivided into two subsamples. One subsample can be preserved immediately and the other should be saved alive for rearing to adult stages. Sufficient numbers of individuals should be collected to ensure that a representative sample of the insect population is present. Samples of fly larvae to be immediately killed can be preserved by placing them in hot water (77°C) for two to three minutes and then transferring them to 70% ethanol. Various alternative larval preservatives can be

used, depending upon the availability of the chemicals. Specimens for rearing should be placed alive in small ice cream cartons or similar containers 1/4 to 1/2 filled with a coarse inert material such as vermiculite. Moist soil can be used if other materials are not available. Do not put living specimens to be reared in sealed plastic bags or sealed vials for longer than 12 hours, since they do poorly in such environments, especially in warm weather. Transport living material by the fastest possible means to a rearing facility. Use of the regular mail service usually is not suitable for transporting living material.

Immature flies can be successfully reared on diets of beef liver, or on small pieces of musculature obtained from the corpse. Larvae should be gently transferred with forceps onto the dietary material which has been previously placed atop a 4-8 cm deep container filled with damp, coarse soil or vermiculite. Small glass dishes, 8-10 cm in diameter, or beakers are suitable. These cultures should contain 15-25 larvae each. Larval activity should be checked daily and a record of larval size and instar recorded. Additional liver can be added to these cultures as needed. Mature larvae will migrate downward into the substrate and pupate. Adult flies will eventually emerge, crawl to the surface and attempt to fly away. Because of this, rearing containers should be placed inside standard insect-rearing cages or other mesh containers that will prevent adult flies from dispersing.

Whenever possible, fly larvae should be reared in climatic conditions approximating those to which the corpse was exposed. Environmental chambers are useful, if available. Temperature is the most critical factor. Calculations of the average time interval required for each developmental stage (larval instars, pupa and adult emergence), allow accurate determination of corpse colonization and time of death.

It may be helpful to allow emerged adult flies to feed for 24 hours on a cotton pad or ball soaked with a small amount of Gatorade®. This insures that their outer skins will harden and accurate species identifications can be made. Emerged adult flies can be placed in 70% ethanol or pinned and stored in insect boxes. Immature beetles need not be reared and should simply be placed in 70% ethanol for identification.

Additional observations concerning any other kinds of animals and plants found in and around the corpse may provide supplemental information about the time, cause and location of death. Collect samples of any unusual specimens such as ants, fleas, body lice, seaweeds, etc. Likewise, representative samples of specimens encountered at autopsy should be collected for analysis. Any specimens collected during the autopsy can be processed as previously described. Marine and aquatic plants and animals are best preserved in 10% neutral buffered formalin.

Containers which contain preserved and living specimens should be labeled in the following manner.

- 1 — Date collected
- 2 — Time collected
- 3 — Location of remains (as precise as possible)
- 4 — Area of the body infested
- 5 — Name, address and telephone number of the collector

If specimens are to be shipped long distances for analysis, package containers and vials of preserved specimens in well-cushioned boxes to avoid breakage and ship by the most convenient means. If shipped by regular mail, wrap each vial individually in a padding material such as cellu-cotton and place each vial individually in a box surrounded by styrofoam chips on all sides. This will minimize the possibility of breakage during shipping. Clearly mark the box "Liquid in Glass". This will generally receive gentler handling by the Post Office.

Containers of soil samples and other living specimens should be kept in relatively cool, well ventilated environments. Time is critical if accurate information is to be obtained from living material. Thus, these materials must be shipped by the most rapid means.

As with other types of physical evidence, take care to insure a continuous, well documented chain of legally acceptable evidence possession.

DESCRIPTION OF LOCALITY

An accurate, detailed description of the habitat in which the corpse was found is important to forensic entomologists. Whenever possible, written descriptions should be accompanied by a complete set of crime-scene photographs which illustrate the general habitat type, the terrain, the type of vegetation, type of soil and the extent to which the corpse is exposed to sunlight.

Detailed photographs of the corpse are also necessary including photographs which illustrate the sex, age, height and weight of the remains, the presence and extent of clothing, the orientation of the corpse when found, the extent of trauma, the extent and degree of decomposition and close-up photographs of the inhabiting insects.

Because climatic conditions have a profound affect on the development of immature insects, the most accurate data available describing these conditions at the location where the corpse was found is of critical importance. Whenever possible, record maximum and minimum temperature values at the scene as soon as possible after discovery. Obtain climatic data from the nearest National Oceanic and Atmospheric Administration (NOAA), weather station, for the entire estimated post mortem period and for a two to three week interval

before the estimated time of death. Additionally, any information available concerning daily rainfall, cloud cover and wind speed and direction should be obtained if available.

ADDITIONAL CASE HISTORIES

In early Spring, the fully-clothed body of a young, white male was found in a sandy, shrub habitat, in the southwestern U. S. The victim had died of multiple gun shot wounds to the chest and back inflicted by a small caliber hand gun. While little evidence of decomposition was evidenced externally, a small amount of blood was observed to have oozed from the victim's left nostril and partially coated his left eye.

Crime scene investigators noted and collected a small atypical granular mass from the surface of the victim's left eye. Examination of this substance in the crime laboratory a short time later revealed the material was a small mass of blow fly eggs and that several had hatched.

The newly hatched blow fly larvae were allowed to grow and were subsequently identified as *Cochliomyia macellaria*, commonly known as the secondary screw worm. Based on the climatic conditions to which the corpse was believed to have been exposed and a knowledge of the developmental biology of this fly, it was determined that the eggs had most likely been laid on the corpse for 24 to 36 hours prior to the time the body was found. Subsequent investigation determined the victim's identity and the fact that he had last been seen alive in the company of a male companion approximately 36 hours prior to the time his body was found. It was later determined that the victim had been murdered by his companion about 36 hours prior to his detection.

In this case, blow fly eggs, collected from the remains and analyzed in a timely manner, provided investigators with an accurate estimate of the post mortem interval and allowed them to more narrowly focus their investigative efforts enhancing their ability to identify the victim and to bring the case to a reasonable solution.

Similarly, in early summer, the body of a young, unidentified white female was found at the end of a logging road in a rural section of the northeastern U. S. Investigation revealed that the unidentified young woman had died from a single gunshot to the right side of the head inflicted by a 12 gauge shotgun. While processing the crime scene, investigators collected representative samples of adult and larval blow flies which had infested the area of the wound.

These specimens proved to be mature larvae and adults of the black blow fly (*Phormia regina*). Following an indepth review of climatic conditions, habitat characteristics and crime scene photographs, entomolo-

gists estimated that the young woman had been killed about five days prior to her discovery and that her body had been placed in that location close to the time of her death.

Based in part on the entomological analysis, investigators circulated requests for reports of missing persons fitting the deceased's description who had disappeared five days prior to the corpse discovery. Eventually, the young woman was identified and her boyfriend became the prime suspect. Just prior to his arrest, however, he was found hanged in a motel. A suicide note revealed that he had murdered the victim five days before her remains were found and had committed the homicide at the end of the logging road where she was discovered.

In late summer, a 37-year old black male was found in Kawainui Marsh, a swamp located approximately 1.6 km from the ocean on the windward side of the island of Oahu, Hawaii. The elevation for the site was only slightly above sea level. The body was clothed in blue jeans and a t-shirt. There was a gunshot wound to the right frontal skull.

The corpse was in an advanced state of decay. The skull was largely devoid of flesh, although some was present on the lateral surfaces and the ears were relatively intact. The cervical area was largely devoid of flesh and the vertebrae were clearly visible. The groin area was largely decomposed and contained a large number of Diptera larvae. On autopsy, no penetration of the abdominal cavity by larvae was observed. Collections of insects from the remains yielded two species of Calliphoridae larvae. *Chrysomya megacephala* was represented by third instar larvae from the chest, groin, and legs, while *Chrysomya rufifacies* was represented by second instar larvae and third instar larvae from the chest. None of the larvae from either species were in the prepupal stage.

Temperature data were obtained from the nearest weather station and climatic information from this station was analyzed for the time period in question. This analysis, when coupled with the developmental stages of the specimens collected, suggested a minimum postmortem interval of approximately 117 hours.

A subsequent investigation revealed that the decedent had last been seen at about 6:00 p.m. six days previously as he departed for work. He failed to arrive at work as scheduled at 8:00 p.m. When his remains were discovered they were placed into a refrigerated crypt. As species *Chrysomya rufifacies* do not form dense maggot masses, activity for this species would have ceased shortly after the remains were placed into the refrigerated crypt. The post mortem interval based on insect age in this case was about 117 hours and fit well with the last sighting of the decedent and his failure to report for work.

In the southeastern U. S., police were called to investigate a foul smelling odor which was emanating

from a small single family home in a rural section of town. Investigating officers soon discovered the badly decomposed body of a young, black female in a shallow grave in a dirt basement of the dwelling.

The victim had died of a single gunshot wound to the head, inflicted with a small caliber rifle. Subsequently, a careful examination of the corpse and a detailed excavation of the soil in and around the grave site revealed the presence of numerous larvae of the blue blow fly, *Calliphora vicina* and larvae and pupae of a relative of the house fly, *Synthesiomyia nudesita*.

Specimens collected from the scene were reared in the laboratory to adults. Supplemental information including climatic data and soil temperatures were reviewed in an effort to determine the climatic conditions to which the developing flies were exposed. Using information on the developmental biology of both of these species of flies, forensic entomologists were able to estimate that the victim had died and was colonized by flies approximately 15 days prior to the time that she was found.

Once provided with this information, investigators were able to target their investigation in and around the time of the victim's demise. Shortly thereafter a suspect was developed and this individual eventually confessed to having killed the victim 28 days prior to the time the body was located and having attempted to bury the victim in a shallow grave located in the basement of the house shortly after committing the homicide.

The remains of a female child (30 months of age) were recovered from a shallow grave on a narrow ledge on the side of Koko Head Crater, Oahu, Hawaii. The skeletonized remains were buried in dirt and gravel and some bones were partially exposed. Other bones were scattered on the surface. The skull was facing upward and the mandible was located several feet from the skull. Also present in the grave were four small stuffed dolls.

Examination of the remains at the morgue revealed largely skeletonized material. Present were the skull and mandible, most of the ribs, many thoracic vertebral bodies, the mostly skeletonized pelvis and lower extremities, the left humerus, radius, ulna and scapula. Absent were many of the cervical vertebrae, right upper extremity and scapula. Small bones of the left foot appeared to have been chewed and showed signs of postmortem animal depredation, as did the bones of the left forearm. Apparent scalp hair remaining adjacent to the skull was blond and straight and measured up to 15 cm in length. Clothing accompanying the remains in which the corpse had been buried were a hooded jacket and a pair of running shoes. A second search of the dangerously precarious burial site the day following the recovery of the remains yielded the right scapula and arm as well as additional vertebrae.

Examination of the remains at the morgue yielded a limited assortment of arthropods. Empty puparial cases of the calliphorid *Chrysomya rufifacies* were attached to the skull under the scalp, which had been largely eaten away. Adult dermestid beetles, *Dermestes maculatus*, were present on the bones and the late instar larval skins of that species were observed in areas under the scalp, inside the cranial cavity and on the femurs. These cast larval skins of *D. maculatus* were in good condition and did not appear to have been exposed to weathering effects for any period of time. Larval scenopinids (Diptera) were collected from the skull near the bases of the hair. Adult clerids, *Necrobia rufipes*, were recovered from the bones of the left foot. A silverfish (Thysanura: Leptismatidae) was recovered from the body bag.

In the hood of the jacket, there was a quantity of soil associated with the remains. This was processed in a Berlese-Tullgren funnel and sorted by hand. This sample yielded additional larval scenopinid and adult *D. maculatus*. There was an adult histerid beetle which represents an undescribed species. Mites associated with this sample included species in the families Acaridae, Histiostomatidae, Macrochelidae, Pachylaelapidae, Uropodidae and Winterschmidtidae.

Comparison of this assemblage with results of earlier decomposition studies conducted in xerophytic habitats on the island of Oahu resulted in a postmortem interval estimate of 52-76 days. This estimate was lowered to slightly over 52 days, based on the condition of the cast larval skins of *D. maculatus*. In the decomposition studies used for comparison, the last observed larval activity for *D. maculatus* was on day 51. The cast larval skins of *D. maculatus* disintegrate quite rapidly when exposed to weathering. The fact that these skins were in excellent condition and easily identifiable to species level indicated that they had been shed recently.

The window fly larvae (Scenopinidae) were all late instars and of a size comparable to those collected from decomposition studies on day 51 in one study and day 48 in another. This tended to reinforce the estimate of slightly over 52 days. The mites recovered also were consistent with this time frame and the absence of any beetle mite species was indicative of the shorter portion of the computer estimate. The final postmortem interval estimate of slightly over 52 days for this case fit well with the interval established independently by confession of the suspect in the case.

Several years ago a young woman was attacked and brutally raped in a suburban Chicago wood lot by a man wearing a ski mask. Investigators quickly developed a suspect and armed with a search warrant seized a ski mask similar to the one described by the victim from the suspect's apartment. When questioned about the ski mask, the suspect informed investigators the ski mask was

indeed his but that it had not been used since the previous winter.

Investigators observed large numbers of cockle burrs and other vegetation attached to the surface of the mask. The mask and its associated vegetation was brought to a forensic entomologist for analysis. Following a careful dissection of the cockle burrs attached to the mask, the entomologist was able to locate several small caterpillars inside the vegetation. The insects were subsequently identified and information concerning their development collected and reviewed.

It was subsequently determined that the caterpillars within the cockle burrs had a one year life cycle, with adults being active in the spring, laying eggs in early summer, larvae or caterpillars developing within the cockle burr vegetation during mid to late summer, undergoing pupation during the winter and emerging as adults the following summer. The entomologist was thus able to inform investigators that the ski mask had been present in the outside environment during mid to early summer of that year around the time the rape occurred. Armed with this information, investigators confronted the suspect and he subsequently confessed to having committed the rape.

In this case analysis of vegetation associated with evidence collected from a crime scene enabled investigators to accurately link the suspect to the crime at or about the time of the crime.

Recently, several small children were brought to a local hospital emergency room suffering from widespread diaper rash, malnutrition and generalized neglect. A physical examination revealed that the anal and genital areas of these children were infested by fly larvae. Samples of the invading fly larvae were collected, preserved and forwarded to forensic entomologists for examination.

An analysis of the fly larvae infesting the young children revealed that they had been present on the children for a minimum of four to five days. This information was used as an indicator of the minimum amount of time which had passed since the children had their diapers changed and were properly cleaned and cared for. The entomological information was the only data available which provided quantitative information accurately determining the length of time the children had been without care. The entomological evidence provided crucial information in subsequent hearings concerning the welfare of the children.

CONCLUSIONS

Forensically important insects can be a powerful tool in investigations of homicide, untimely death and other violent crimes. Accurate forensic determinations are possible, however, only when representative specimens are recognized, properly collected, preserved and forwarded in a timely manner to qualified forensic entomologists for analysis. Prosecutors, police, pathologists and others involved in solving violent crimes should become fully aware of the complex ecology of the decay process, the important role which insects play in decomposition and necessity of collecting representative specimens and supplemental field data.

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Entomotoxicology

A New Area for Forensic Investigation

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Insects and other arthropods can be valuable tools in death investigations. In addition to their use in the estimation of postmortem intervals, insects may serve as reliable alternate specimens for toxicological analyses in the absence of tissues and fluids normally taken for such purposes. Recent research has also demonstrated that the presence of drugs and/or toxins in decomposing tissues may alter the rate and patterns of development in arthropods using such tissues as food, thus potentially altering estimates of the postmortem interval. Current advances in the use of arthropods as alternate toxicological specimens and the effects of various drugs and toxins on arthropod development are reviewed here.

Key Words: Drug analysis—Insect development—Diptera—Coleoptera—Postmortem interval—Toxicology.

Over the past decade, an increase in drug-related deaths has been reported in the United States and other countries. In many instances, these deaths are not reported immediately to authorities and the remains go undiscovered for several days or more. As a result of decompositional processes, estimations of the postmortem interval are based on analyses of entomological data. The data most frequently used are those associated with insect development rates and succession patterns (1-5). Recently, the accuracy of these estimates has been questioned in deaths involving narcotic intoxication. However, few studies are available detailing the effects of drugs, such as cocaine and heroin, in decomposing tissues on the rates of development of carrion-feeding insects. Additionally, data dealing with the effects of other tissue contaminants, such as toxins and environmental pollutants, in decomposing tissues on the rates and/or developmental patterns of insects using such tissues as food are generally lacking. Interest also has focused on the potential for use of carrion-feeding insects as alternate toxicological specimens in situations where more traditional sources, such as blood, urine, or organs, are not available. These two basic areas of investigation comprise entomotoxicology.

Basic to understanding the applications of entomological evidence to toxicological problems is an overview of the life cycles of carrion-frequenting insects. The insects most frequently involved in the estimation of the postmortem interval are the true flies or Diptera, and these taxa are most frequently used in drug analyses. The predominant species encountered are in the families Calliphoridae (blow flies), Sarcophagidae (flesh flies), and Muscidae (house flies).

The Calliphoridae, Sarcophagidae, and Muscidae are highly motile, strong-flying insects and are typically the first insects to arrive at a body. Calliphoridae and Sarcophagidae may arrive within

Received May 10, 1993; accepted June 4, 1993.

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minutes following death, particularly in tropical environments. In more temperate climates, fly arrival may require several hours or days, depending on the habitat. Studies of carrion communities have demonstrated that muscoid flies generally delay colonization until the late fresh or early bloat stages of decomposition (5). Once a suitable source is located, adult flies will either begin to lay eggs (oviposit) immediately or feed on the various protein-rich fluids seeping from the body and then begin to oviposit. On corpses that have not suffered traumatic injury, the initial sites for oviposition will generally be the natural body openings (eyes, ears, nose, mouth, and, if exposed, anus and genitals). Wounds or blood may provide preferential sites for oviposition, although this attraction will vary depending on the species of fly involved and the degree of injury.

Blow fly eggs are small (2–3 mm), elongate, and white to yellow. They are typically laid in large clusters and, during warmer parts of the year, may completely fill natural body openings and wound sites. During cooler periods, when adult fly populations are smaller, the eggs may be few and more difficult to locate, being hidden in cryptic sites such as the inside of the nose or behind eyelids. Typically the egg stage for blow flies lasts 1–3 days.

When the eggs hatch, they produce larvae, commonly referred to as maggots. These are small, somewhat peg-shaped organisms. The anterior end has a pair of mouthhooks that are used in feeding and locomotion. The posterior end bears a pair of flattened spiracles through which the maggot breathes. These features, along with size and shape, provide important characters for identification. Maggots grow rapidly, passing through three stages or instars before reaching full size. Eggs laid on a body will typically hatch synchronously, resulting in a mass of maggots that move about a body feeding as group. This group feeding behavior results in the dissemination of bacteria and production of digestive enzymes that enable the maggots to consume most of the soft tissue on a body in a highly efficient manner. Maximum maggot size is reached in a period varying from several days to weeks, depending on the species involved, numbers of maggots present, and environmental conditions.

After reaching maximum size, maggots undergo a dramatic change in behavior. Feeding ceases and the maggots begin to migrate away from the corpse. This migration is typically to a drier area where the maggots burrow into the substrate and begin pupariation. During pupariation, the outer skin of the maggot becomes hardened and forms a protective encasement. The resulting reddish to dark brown

puparium somewhat resembles a small football. Within this protective case, the maggot undergoes a cellular reorganization and eventually emerges as the adult fly. The period required for this transformation varies depending on the species of fly and environmental conditions, particularly temperature. The puparial case itself may remain intact in the soil surrounding the corpse for hundreds of years. Blow fly puparial cases can supply valuable forensic information long after the body has decomposed (6).

The life cycle of the Sarcophagidae or flesh flies is quite similar to that of the blow flies, with one important difference. Flesh flies associated with decomposing remains do not lay eggs (oviposit) but rather deposit first-instar larvae (larviposition) on remains. This process requires that the developing fly larva be retained in the body of the female longer than an egg. Thus, the numbers of offspring produced per female are less for the Sarcophagidae than for the Calliphoridae or Muscidae. In total numbers of maggots present on a body, generally the Sarcophagidae are far outnumbered by other species of flies. There are exceptions to this in specialized circumstances, as may occur in corpses found indoors (7) or exposed to severe environmental conditions (8).

Careful analyses of the species of flies present on the corpse and their developmental stages, combined with a knowledge of fly biology and local environmental conditions, can provide forensically meaningful information regarding the postmortem interval, movement of the body after death from one locale to another, presence of antemortem injury, and, as will be discussed here, drugs and/or toxins present in the remains.

DETECTION OF DRUGS AND TOXINS

Several publications detail the detection of various toxic and controlled substances through analyses of arthropods. In these reports, the arthropods have generally been homogenized and then processed in the same manner as other tissues or fluids of toxicological interest. Analytic procedures have included radioimmunoassay (RIA), gas chromatography (GC), thin-layer chromatography (TLC), and high-performance liquid chromatography–mass spectroscopy (HPLC–MS).

Nuorteva and Nuorteva (9) described the recovery of mercury from various species of calliphorid maggots fed on fish tissues containing known concentrations of mercury. In this study, it was noted that there was a definite bioaccumulation of mercury by maggots and this accumulation was related

to the presence of mercury in methylated form. In maggots reared on tissues in which 94% of the mercury was methylated, there was a bioaccumulation in which the concentration of mercury in the maggots was 4.3 times greater than in the tissues. In fish containing lesser amounts of methylated mercury, the concentration detected in maggots was only 1.5 times greater than that in the tissues. The mercury ingested by maggots was retained through the pupal stage and was detectable in emerging adults. Once the adult stage was reached, mercury was rapidly eliminated. After 2 days, adult flies contained only 50% of the mercury levels of the larvae. A more detailed analysis revealed that mercury was excreted into the meconium of the hindgut during the pupal stage (9). During these studies, no ill effects were generally exhibited by the adult flies or maggots, although some individuals were observed having difficulty in pupation.

Maggots that had been fed on tissues containing mercury were fed to a staphylinid beetle and a secondary bioaccumulation was noted in these predatory beetles. Although no ill effects were noted for *C. maxillosus* (L.), subsequent work by Schott and Nuorteva (10) showed a decrease in activity for the tenebrionid beetle *Tenebrio molitor* L. fed dried maggots with a high mercury content. Nuorteva and Nuorteva (9) had previously noted the occurrence of "Minimata-like symptoms" (consisting of irregularities in motor control and muscular coordination) for adults of *T. molitor* fed on mercury-containing maggots. No change in life span was noted for beetles fed on mercury-containing maggots in either study.

In a similar manner, Sohal and Lamb (11,12) demonstrated the accumulation of various metals, including copper, iron, zinc, and calcium, in tissues of adult house flies, *Musca domestica* L. As with the mercury studies cited here, no detrimental effects to the adult flies were associated with the bioaccumulation of these metals.

One example of the application of these types of data to forensic situations was given in a case presented by Nuorteva (13). In this instance, adult flies reared from the badly decomposed body of an unidentified woman discovered in the rural area of Inkoo, Finland, were analyzed for mercury content to determine the geographic origin of the victim. The low mercury content of the adult flies (0.12–0.15 ppm) indicated that the individual came from an area relatively free from mercury pollution. When the victim was identified, she proved to have been a student from the city of Turku, an area relatively free from mercury pollution.

Utsumi (14) observed that rat carcasses varied in

their attractiveness to flies, depending on the poison causing death, but this research did not include any attempt to detect the toxins in the maggots that eventually did develop on the rat carrion. Leclercq and Brahy (15) noted the detection of arsenic poisoning through analyses of species of Piophilidae, Psychodidae, and *Fannia* in a case from France.

Detection of the organophosphate malathion was reported by Gunatilake and Goff (16). In this instance, a 58-year-old man with a history of previous suicide attempts was discovered in the crawl space under his mother's home in Honolulu. Adjacent to the remains was a bottle of Malathion-50 with ~177 ml missing. Both tissues and maggots of two species of Calliphoridae were analyzed for malathion by using GC. The fat tissues of the corpse had malathion detected at 17 mg/kg. The combined sample of maggots of *Chrysomya megacephala* (F.) and *Chrysomya rufifacies* (Macquart) showed malathion at a concentration of 2,050 µg/g. It is significant that the developmental stages of both *Chrysomya* species in this case were indicative of a 5-day postmortem interval, because the individual had last been seen alive 8 days prior to the discovery of the body. The presence of malathion in the tissues of the corpse might have delayed oviposition for a period of several days. This is supported by the presence of only two species of fly larvae on the corpse. In outdoor situations in the Hawaiian Islands, a far greater number of species should have been present on the corpse at either a 5- or 8-day interval. Typically other species of flies and predatory beetles in the families Staphylinidae and Histeridae would have been expected to have invaded the remains and the surrounding substrate.

Beyer et al. (17) detailed a case of a 22-year-old woman whose decomposed remains were discovered 14 days after she had last been seen alive. The individual had a history of five suicide attempts. An empty prescription bottle of phenobarbital (no. 100), filled 2 days before she was last seen alive, was found in a purse adjacent to the remains. As there were no tissues remaining on the almost completely skeletonized body available for analysis, larvae of the calliphorid fly, *Cochliomyia macellaria* (F.), found feeding on the remains, were analyzed for drug content. Phenobarbital was detected by GC and confirmed by TLC at a concentration of 100 µg/g.

Kintz et al. (18) have described other cases where prescription drugs were detected through analyses of maggots. In one case, the subject was a man with a determined postmortem interval of 67 days. Identifiable organs present for toxicological analyses using liquid chromatography included heart,

lung, liver, spleen, and kidney, in addition to bile. Calliphoridae maggots also were analyzed. Results of analyses showed five drugs present in the maggots as well as in the bile, heart, liver, and lung: triazolam, oxazepam, phenobarbital, alimemazine, and clomipramine. Triazolam was not detected in the spleen or kidney, although the other drugs were present. In this case, a correlation could not be established between concentrations of the drugs in maggots and human tissues, but Kintz et al. (18) observed fewer endogenous peaks in chromatograms obtained from maggot extraction than from human tissues. Kintz et al. (19) were also able to detect bromazepam and levomepromazine in maggots obtained from human remains. Using CG-MS, Wohlenberg et al. (20) were able to detect nortriptyline from maggots infesting the nearly skeletonized remains of a 40-year-old man. Similarly, Goff et al. (21) demonstrated amitriptyline and nortriptyline in maggots that had been fed tissues from rabbits that had been administered amitriptyline, and amitriptyline was also detectable in empty puparia.

Studies by Introna et al. (22) detailed the results of analyses of maggots fed on liver tissues from 40 cases in which opiates had been detected during postmortem examinations. In this study, opiates were effectively detected through RIA analyses of maggots that had fed on opiate-contaminated tissues. A significant correlation between the concentrations of opiates in liver tissues and the paired maggot samples also was observed. While the qualitative relationship was quite clear from their results, the quantitative results were less clear and further research in this area is suggested. Similar results were presented by Goff et al. (23,24) in studies using known varied dosages of cocaine and heroin administered to rabbits.

Nolte et al. (25) used toxicological analyses of maggots to determine cocaine intoxication in the almost completely skeletonized remains of a 29-year-old male intravenous drug user that were discovered almost 5 months after he had last been seen alive. His girlfriend indicated that she believed he had used intravenous cocaine immediately prior to his disappearance. Associated with the remains were numerous maggots and puparia of *Calliphora vicina* (R.-D.), a species frequently associated with carrion during cooler portions of the year. Skeletal muscle was also present on the remains. Maggots and muscle both tested positive for cocaine and its major metabolite benzoylecognine by using GC. As in previous cases mentioned, the sample from the maggots had less interference from by-products of decomposition and provided more suitable samples for quantitation. Empty puparial cases were sub-

sequently found to be weakly positive for cocaine and/or benzoylecognine, indicating that these substances deposited in the protein matrix of the puparial cases may be detectable for years following death. The extraction method used for the puparial cases in this instance was similar to that for human hair (26,27). In a somewhat similar situation, Manhoff et al. (28) were able to detect cocaine at a concentration of 0.090 mg/L from beetle feces and Calliphoridae larvae collected from a set of decomposed human remains by using GC-MS. Lord et al. (W.D.L., personal communication, 1992) have detected both amitriptyline and nortriptyline from Phoridae puparial cases and Dermestidae cast skins and feces associated with the skeletonized remains of a woman by using modified hair-extraction techniques.

EFFECTS OF DRUGS IN TISSUES ON DEVELOPMENT OF INSECTS

Although the previous studies documented the potential use of maggots as alternate specimens for toxicological analyses, they did not address the effects of these substances on the rate of insect development. In the estimation of the postmortem interval, particularly during the first 2-4 weeks of decomposition, it is assumed that insects, particularly Diptera, will develop at predictable rates for given climatic conditions. That this might not always be the case was first demonstrated by Goff et al. (23) during their studies on the effects of cocaine in decomposing tissues on the rate of development of the sarcophagid *Boettcherisca peregrina* (R.-D.). In this study, domestic rabbits were administered dosages of cocaine based on body weight representing 0.5, 1.0, and 2.0 times the median lethal dosages. The rabbits receiving the lethal dosages were allowed to die as a result of the action of the drug, and the animal receiving the median sublethal dosage and the control were killed in a carbon-dioxide chamber. The presence of cocaine and/or benzoylecognine were confirmed by analyses of blood and liver tissues. Livers and spleens were removed from the rabbits after death and exposed to a colony of *B. peregrina* for larviposition. Samples were measured at 6-h intervals and were removed at 24-h intervals for drug analyses. Samples of all maggots fed on tissues from rabbits receiving cocaine were positive for the drug and/or its metabolite. Control liver and maggots were both negative. In this study, two patterns of development were detected. The control and sublethal dosage colonies developed at approximately the same rate, as indicated by total

body lengths of the maggots. By contrast, beginning at hour 36, the lethal and twice lethal dosage colonies developed more rapidly. This difference was observed to continue until hour 76. Pupariation was first observed in the twice median lethal dosage colony, followed by the median lethal, median sublethal, and control colonies. No significant variation in the duration of the puparial period was observed and no differences in puparial mortality were detected. Adults from all colonies produced viable offspring when supplied with liver 13 days after eclosion of adults. The colonies were followed through four generations and no abnormalities were observed.

Similar studies were conducted by Goff et al. (24) on maggots feeding on decomposing tissues from rabbits administered dosages of heroin that were calculated to represent 0.5, 0.75, 1.0, and 2.0 times the median lethal dosages. Rates of development, as indicated by total body length of maggots, were not significantly different until hour 18. At that point, maggots from all colonies fed on rabbits receiving heroin began to develop at rates significantly faster than those observed for the control colony. These differences continued through hour 96, when maximum lengths were recorded for maggots in all colonies. Maggots fed on tissues containing heroin (as morphine) were significantly larger than maggots in the control colony. Duration of the puparial period also was significantly longer for the maggots fed on tissues containing heroin and was observed to be directly proportional to the concentration of the drug (as morphine) in the tissues. This study indicated that an estimate of the postmortem interval based on the normal development of *B. peregrina* could have an error of up to 29 h, if based on the larval stage and 18–38 h, if based on duration of the puparial stage.

Studies conducted by Goff et al. (29) on the effects of methamphetamine on the development of another species of sarcophagid fly, *Parasarcophaga ruficornis* (F.), exhibited some similarities to the above studies on cocaine and heroin, but also some significant differences. These studies, although somewhat preliminary, showed similar increases in rate of development for colonies fed on decomposing tissues from the 1.0 and 2.0 median lethal dosaged animals from hours 24–60, while the median sublethal and control colonies developed at approximately the same rate. Following hour 60, the rate of growth for the median lethal dosage colony slowed and only the 2.0 median lethal dosage colony continued to develop at a rate significantly faster than that observed for the other colonies. The maggots reached maximum sizes earlier in the me-

dian lethal and twice median lethal colonies, but the greatest observed sizes were in the control colony. Unlike the situation with heroin, there were no significant differences in the durations of the puparial stage among colonies fed on tissues from the animals administered dosages of methamphetamine, although all of these colonies had puparial periods that were significantly shorter than observed for the control colony. Puparial mortality rates for the drug-treated colonies appeared to be inversely proportional to the dosage administered to the animal model, with the puparial mortality for the control and twice median lethal colonies approximately equal. Unlike the situation observed for cocaine and heroin, there were effects in the reproduction of the 1.0 and 2.0 times median lethal dosage colonies. The median lethal dosage colony failed to reproduce during the first generation and the 2.0 times median lethal dosage colony failed during the second generation. In both cases, nonviable larvae or eggs were produced.

In recent studies concerning the effects of the tricyclic antidepressant amitriptyline on the developmental patterns of *P. ruficornis* by Goff et al. (21), no significant differences were observed among colonies in the rate of development to maximum size or larvae reared on tissues from animals receiving 0.5, 1.0, and 2.0 times median lethal dosages by weight of the drug when compared with the control colony. In colonies fed on tissues from animals that had received the drug, a prolonged postfeeding period was observed once maximum size had been attained. Larval mortality was also significantly greater in the treated colonies. Puparia sizes were significantly greater both in terms of length and in weight for colonies reared on tissues from the animals receiving the 1.0 and 2.0 times median lethal dosages. There were no significant differences observed in puparial mortality among the colonies, although duration of puparial stage was significantly longer for the 1.0 and 2.0 times median lethal dosage colonies when compared with the median sublethal and control colonies.

Although there have been, to date, few applications of these data to actual cases, Lord (30) details a case that serves to illustrate the potential significance of these alterations in rates of larval and puparial development. The body of a Caucasian woman, approximately 20 years old, was discovered in a pine woods area northeast of Spokane, Washington. The body was physically in the early bloat stage of decomposition, with an extensive population of maggots on the face and upper torso. Maggots were submitted to the entomologist after 5 days of refrigeration and reared to the adult stage

on beef kidney. Two species were identified; *Cynomyopsis cadaverina* (R.-D.) and *Phaenicia sericata* (Meigen). Typically, *P. sericata* oviposits within 24 h and *C. cadaverina* oviposits 1–2 days following death. Three classes of maggots were present, based on total body length. The first consisted of maggots measuring 6–9 mm in total length that were consistent with a postmortem interval of 7 days. The second consisted of smaller maggots, indicative of multiple broods under development. The third consisted of a single maggot from the nasopharyngeal area, measuring 17.7 mm in total length and indicating a period of ~3 weeks. This period did not appear to be possible, given the other data associated with the case. The possibility that the maggot had migrated from another nearby source was eliminated, because no other carrion were located by the investigators and the probability that more than one maggot of that size would have been found. An alternate explanation was that the maggot's growth had been enhanced by a particular pocket in the nasal region containing a concentration of cocaine. A subsequent investigation showed the victim had a history of cocaine abuse, and a witness later testified that the victim had snorted cocaine shortly before her death.

CONCLUSIONS

Insects and other arthropods can prove to be valuable tools in investigations of homicide, suicide, or other unattended deaths. In addition to estimations of postmortem intervals, insects can serve as reliable specimens for toxicological analyses in the absence of tissues and fluids normally taken for such purposes. In cases of decomposed remains, analyses can provide more reliable qualitative results than can the decomposed tissues. Although data currently available addressing the effects of drugs and toxins in tissues on the developmental rates of Diptera larvae are limited in scope, it is not unreasonable to assume that other substances in tissues also produce changes in developmental rates and patterns in cases where drugs or toxins are to be a factor. It is essential that the forensic entomologist be made aware of any data indicating the presence of these substances in the remains. This will allow for needed corrections to the life-cycle data, based on the substances involved, and result in more accurate interpretations of postmortem intervals.

Acknowledgment: We thank Drs. James L. Luke, Edward T. McDonough, and William C. Rodriguez for their critical review of this manuscript. This is Journal

Series no. 3817 of the Hawaii Institute of Tropical Agriculture and Human Resources.

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***AN OVERVIEW OF BLUNT
FORCE INJURIES AND THEIR
EFFECTS ON THE BODY***

CLOSED HEAD INJURIES

An Overview of Blunt Force Injuries and Their Effects on the Body

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Definition

Wounds caused by blunt impact, as opposed to wounds caused by cutting and stabbing. Blunt force tears, shears, and crushes.

II. Types of Wounds

A. Contusions (a bruise)

1. May be patterned
2. May be difficult to see in dark-skinned people
3. More easily produced in some people than others--obese people, blonds, chronic alcoholics.
4. Color changes: occur from the edge of the bruise to the center
 - a. swelling initially
 - b. light bluish-red within a few hours
 - c. dark purple within one week
 - d. greenish-yellow, then brown

B. Laceration or Tear

1. Usually occurs where skin is taut over bone (skull, knee, elbow, etc.)
2. Frequently surrounded by a contusion
3. Laceration usually will have an irregular shape, undermined edges, bridging of tissue, nerves, and vessels.

C. Abrasions

1. Scraping injury--superficial destruction of skin by friction
2. May be patterned
3. Caused by sliding across paved surface
4. Traffic accident victim
5. Linear abrasions (scratches indicate direction of force)

D. Hematoma: A localized swelling caused by leakage of blood from damaged blood vessels.

E. Simple Fracture: A broken bone without fragmentation

F. Comminuted Fracture: A broken bone with fragmentation

- G. Compound Fracture: A broken bone protruding through skin or just under broken skin.

III. Blunt Injury to Head

- A. Concussion: A state of temporary unconsciousness--no hemorrhage or laceration. A disturbance of the electrical activity of the brain.
- B. Epidural Hematoma: Hemorrhage between dura and skull, pressing the brain.
- C. Subdural Hematoma: Beneath dura, pressing on brain.
- D. Subarachnoid Hemorrhage: Bleeding beneath arachnoid. Slight subarachnoid hemorrhages are common in trauma.
- E. Coup Contusion: Bruise of the brain directly beneath site of impact to the head.
- F. Contrecoup Contusion: Bruise of the brain distant from the site of impact to the head.
- G. Cerebral Hemorrhage: Hemorrhage within the brain itself.

IV. Blunt Injuries of Neck

- A. Fracture of Cervical Spine: Caused by impact on top of the head or violent bending of neck forward or backward. (Dive into shallow water, auto accident, fall, etc.)
- B. Fracture of Larynx or Cricoid Cartilage: Direct blow to the neck.
- C. Fracture of Hyoid Bone: manual strangulation

V. Blunt Injuries of Chest and Abdomen

- A. Aorta: Laceration - upper chest - rapid death
- B. Heart: Puncture from rib or laceration with hemorrhage
- C. Lungs: Puncture from rib hemorrhage or escape of air into chest cavity. Lung could collapse.
- D. Liver and Spleen: Laceration of surface membrane. Bleeds internally. Death within a few hours.

VI. Blunt Injuries of Extremities

- A. Major blood vessels: lacerated by jagged ends of broken bones. Seldom causes death.
- B. Fracture of Bones: bumper fractures from autos.

VII. Complications of blunt trauma

- A. Hemorrhage: from lacerations of blood vessels or organs; can be fatal.
- B. Shock: Rapid or delayed aspiration of blood - Tracheobronchial tree.
- C. Air Embolism: Air enters lacerated veins; can interfere with blood flow to lungs.
- D. Fat Embolism: Fat from marrow of fractured bones may enter veins: interfere with blood flow.
- E. Infection of Wound
- F. Pneumonia
- G. Pulmonary Embolism: blood clots may travel to lungs, obstruct blood flow.

BLUNT FORCE INJURY

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TERMINOLOGY

ABRASION - scrape or brush partially removing epidermal surface
CONTUSION - bruise with damage to subcutaneous tissues / vessels (skin intact)
LACERATION - rip or tear skin due to shear / crush at impact point with bridging
SPLIT - a rip or tear due to tension adjacent to impact point

CONTUSION (**BRUISE**)

ARTIFACT

tear vessels with lifting (esp. upper extremities in obese)
microscopy - true hemorrhage infiltrates all skin layers

HEMORRHAGE CONFINED - tracks along fascial planes

WIDE SMOOTH WEAPON and / or PROTECTED AREA

BATTLE SIGN - blood behind ear leaking down

SPECTACLE HEMATOMA - "raccoon eyes"

PELVIS → thigh

JAW → neck

PARIETOTEMPORAL → occipital scalp

DATING BY COLOR - gradual procession (all are rough relative descriptions)

hours - light blue-red

<1 week - dark purple

1 week - green-yellow

>1 week - brown

2-4 weeks - disappear

ABRASION (**SCRAPE**)

PRE-MORTEM vs. POST-MORTEM - hemorrhage

DRYING - brown / black

indistinct when body wet

TYPES

GRAZE

SCRATCH

BRUSH BURN - broad surface area (often with motor vehicle -pedestrian)

ROPE BURN - friction

LIGATURE BINDING - incise over bony prominences

LACERATION (**TEAR**)

TISSUE BRIDGING

ABRASION - central area corresponding to impact point

SPLIT - abundant bridging without abrasion

FORCES

kinetic energy = KE = $\frac{1}{2} mv^2$

DEGREE - difficult to assess to an exact degree based solely on wound(s)

example forces - (*consider how data were obtained & merit of experinients*)

LIVER

CAPSULE - 30 foot-pounds

SUPERFICIAL PARENCHYMA - 100 foot-pounds

PULPEFACTION - 300 foot-pounds

SKULL FRACTURE - 33 to 75 foot-pounds

modifiers include

tissue(s) struck

relative deceleration

intervening materials.

weapon characteristics

impact area

victim factors

decomposition

DIRECTION

ABRASION - may have heaped margin at end opposite initial impact

LACERATION

may have abrasion border wider on margin of initial impact

may have undermining on edge opposite initial impact

DISTRIBUTION

total surface area involved in energy exchange (road & flat vs. edge)

more severe with smaller impact point (concentrates force)

TARGET - relative absorbency of force (ability to withstand a blow)

bone prominences with fixed skin - laceration

abdomen - \pm contusion with internal injury

DATING OF WOUNDS - difficult at best (microscopy more reliable)

GENERAL TISSUE REACTION

eschar (scab)

<2 hours - no reaction

4~6 hours perivascular PMN (acute inflammatory cells)

8 hours PMN zone subjacent (beneath wound)

12 hours three layers (fibrin / RBC , PMN, collagen)

12-30 hours collagen infiltrated by PMN

3-72 hours epithelial regeneration

3-5 days granulation

12 days remodeling

INTRACELLULAR PIGMENT (Prussian blue / Gmelin stains)

HEMOSIDERIN - ~ 24 hours

HEMATOIDIN - \leq 1 week

PATTERNED INJURIES

RECOGNITION

"Over that unseen, the heart grieves not." - John Upshaw Downs, Sr.

CONTUSION - blood forced to impact edges leaving outline impact point

ABRASION - stamping of impact area into skin surface

LACERATION - reconstruction is a prerequisite

may contain elements of forming object (embedded trace materials)

PRESERVATION - documentation

photography

overlays / xerography

videography

computer enhancement

INTERPRETATION - uniqueness

no absolute definition determining consistency of weapon and wound

increased data points increases confidence in opinion

complicated / multifaceted weapon

unusual features

examination results in an opinion:

"The wound was caused by the suspect weapon or a weapon having similar physical characteristics."

MODIFIERS

decomposition

may obliterate wound detail

severely limits interpretation

disease - i.e. alcoholism

PATTERNS

DEFENSE WOUNDS - extremities

DEFENSIVE vs. OFFENSIVE

usually abrasion / contusion (> laceration > fracture)

may document fractures with radiographs (x-rays)

usually dorsolateral (side & back) upper extremities

lower extremities - often with sexual elements to assault

consider sexual homicide

ALCOHOLICS

multiple injuries of varied ages

predominately involve joints and protuberant areas

often with relatively minimal external injury and subdural hematoma

clotting factor abnormalities - extensive hemorrhage

INJURY MECHANISM

MOTOR VEHICLE - see later
DRIVER VS. PASSENGER
PEDESTRIAN

FALL - *involves protuberant areas, typically in hat band distribution*

FROM STANDING - injury may be extensive with fall from erect position

TO BACK OF HEAD - large circular abrasion surrounds laceration
extensive undermining
radiating fracture lines without depressed fracture
contre coup cerebral contusion

FROM HEIGHT

more KE involved with modification by transmission at impact
drive tibiae through soles of feet
OVERSTRETCHING of skin

SURFACE IMPACTED - absorbcency (more significant with lower KE)

ALTERCATION - *involves recessed areas as well as protuberances*

BLOW

linear laceration with fine marginal abrasion
minimal undermining
depressed skull fracture
coup cerebral contusion

ABUSE - multiple injuries of varying ages

see child abuse section
also domestic / elder abuse are considerations

SPECIFIC ORGANS (see DiMaio & DiMaio)

BONE - FRACTURES

basically a fracture is a laceration of bone
assess degree of osteoporosis

SKULL

LONGITUDINAL
TRANSVERSE (HINGE)
RING

EXTREMITY LONG BONES

DIRECT
 FOCAL
 CRUSH
 PENETRATING
INDIRECT
 TRACTION
 ANGULATION
 ROTATION
 COMPRESSION
 COMBINATIONS

PELVIS - a ring which must break in at least two places when fractured

COMPRESSION
ANTEROPOSTERIOR -symphysis & sacroiliacs
LATERAL
 ipsilateral ramus (base of pubic bone) \pm contralateral ramus
 ipsilateral (same side) sacroiliac impaction
SHEAR
COMPLEX - multiple fractures

RIBS - a pliable and discontinuous ring

PLIABILITY - fractures less common in young
TYPES
 IATROGENIC - from resuscitation efforts
 PATHOLOGIC - from underlying prior disease
 DIRECT - local trauma applied
 INDIRECT - distant trauma with force transferred via bone
 COMPRESSION - usually lateral (press front-back)
 DIRECTIONAL - usually midline

HEALING - a gradual sequence of events

HEMORRHAGE
CALLUS
REMODELING

HEART - usually other chest structures also damaged
CHIN-STERNUM-HEART SYNDROME impact with severe neck flexion
injure chest & heart by driving jaw into sternum → fractures skull at jaw

AORTA - transverse laceration

ARCH (origin at heart) - compression force acting on fluid column

DESCENDING (aorta within chest going to abdomen) - deceleration

LUNGS

SPONTANEOUS

occasionally burst surface of lung → collapse (atelectasis)

IATROGENIC - with resuscitation efforts

TRAUMA

CONTUSION - due to transferred impact energy

FLAIL CHEST - multiple fractures → “free floating” chest wall

LACERATION - lung collapses

PUNCTURE - lung collapses

ABDOMEN

evidence of traumatic event may not be externally evident

RECTUS SHEATH HEMATOMA - artifact (usually anticoagulant therapy)

IATROGENIC - usually not spleen

ORGAN TYPE

SOLID - crush / laceration

HOLLOW - burst (more vulnerable when distended)

jejunum > ileum > stomach & duodenum

transverse colon

SEQUELAE - residual disease state following initial event

HEMORRHAGE

SHOCK

FAT EMBOLI - fat particles within blood

usually not lethal

quantity 10-120 ml

usually CPR artifact

usually with interval to death - does not preclude immediate death

autopsy findings

petechiae - armpits, conjunctivae, brain, kidney

pulmonary edema and congestion

INFECTION - local and iatrogenic

DEEP VEIN THROMBOSIS

blood clots form in leg veins due to immobilization

clots break free & travel to lungs → death

CRUSH SYNDROME - eventuates in acute tubular necrosis

TRANSPORTION FATALITIES - most common form of blunt force injury

ACCIDENT RECONSTRUCTION

- eyewitnesses unreliable
- police accident reports
- consider all available information
- avoid drawing definitive conclusions from injuries to reconstruct events
- usually not possible to determine specific cause for each and every wound

KINETIC ENERGY

$$KE = \frac{1}{2} mv^2$$

- even at low speed (30 MPH) force may exceed 100 g
- energy represented by momentum - unrestrained victim moves forward
- energy transfer represented by
 - injuries (to occupants)
 - damage (to vehicle)

consider stages of impact

PRIMARY

- vehicle impact with relatively stationary object
- body remains in motion - 0.1 sec

SECONDARY

- victim impact with relatively stationary object
- viscera remain in motion - 0.02 sec

TERTIARY

- viscera impact relatively stationary object
- deceleration complete

AUTOMOBILES

CAUSES OF MVC (motor vehicle collision)

DRIVER - 2/3 to 3/4 MVC caused by driver

DRUG / ETHANOL

- >1/2 drivers who are killed are DUI I DWI
- 10-15% of dead drivers with positive drug screen
- test all vehicle occupants
- external exam only - **femoral blood** desired sample
- if survival for some period of time consider alternate sample
- vitreous - eye fluid
- hospital admission blood (chain of custody)
- subdural clot - represents blood level when formed

CARBON MONOXIDE

- often overlooked as potential contributing factor
- usually results from defective vehicle exhaust system

HUMAN - speed / reckless / fatigue

ENVIRONMENT

DISEASE - uncommon

usually without severe MVC injuries (driver slows in anticipation)

TYPES OF MVC DEATHS:

PEDESTRIAN

OCCUPANT - driver / passenger

OCCUPANT

OCCUPANT INJURIES

representation of interaction between kinetic energy transfer / object / victim
less extensive injury on striking close object as opposed to distant
restraints and intact cabin - marked decrease in MVC fatalities

CABIN VIOLATION

crush with pelvic injury
traumatic asphyxiation

RESTRAINTS

rarely cause significant injury but do prevent injury & death
> 1/3 decrease in fatalities
> 1/3 - 2/3 decrease in serious injuries

belt injuries

LAP BELT

lacerate mesentery / omentum (bowel)
abrasion / contusion

SHOULDER BELT - abrasion / contusion

AIR BAGS

protect chest and prevent whiplash with frontal impact
deploy at very high speeds
unsafe with child in rear-facing child seat in front seat
may be dangerous to very short individuals

DICING INJURIES

result from shattered tempered glass
angled superficial cuts
usually head / upper extremity
caution in determining driver vs. passenger - may be thrown about cabin

DETERMINING DRIVER VS. PASSENGER

see later in this section

PEDESTRIAN

CLOTHING

often trace evidence exchanged between vehicle and victim

- paint chips
- glass fragments
- hairs / fibers
- grease

IMPACT TYPE AND RESULT

1) INDUCED PROPULSION (victim thrown)

due to impact point relative to center of gravity (varies with age)

a) CHILD

center of gravity is low

victim propelled **forward and down** (run over)

hard braking: impact point (bumper) drops

→ victim thrown forward

may remain on impact surface

carried short distance → fall

b) ADULT - center of gravity is high relative to typical auto

victim propelled **up**

TRUCK / BUS

center of gravity relative to impact as for child

impact point always above center of gravity

2) RUN OVER

TREAD MARKS

pattern injury corresponding to vehicle tires

squeezed between tire (imprint) and road (brush abrasion)

documentation of suspect vehicle tires with scale if possible

may have shearing of skin flap from fascia

may have overstretch striae

TRACE EVIDENCE - may be transferred to / from undercarriage

i. e. hair clothing fibers grease

obtain control samples for comparison

CRUSH - loss of consciousness due to acute ethanolism

impact evidence absent

victim with tread marks opposite brush abrasion

3) PROPELLED - struck below center of gravity

HIGH SPEED - late / absent braking → victim thrown in air

usually dent bumper and hood

may hit roof / trunk / rear bumper

may land behind vehicle (50-60 MPH)

injuries often extensive with mutilation

may have striae of groin / neck skin opposite impact point

MODERATE SPEED or HARD BRAKING

victim scooped onto hood & slides onto windshield

may have trace evidence transferred victim - vehicle

TYPICAL PEDESTRIAN INJURIES - distribution indicative of specific mechanism

1) BRUSH ABRASION - superficial scraping abrasion due to friction with road surface
usually involves protuberant areas
no hemorrhage

2) IMPACT POINT

A) BUMPER FRACTURE

speed varies:

elderly - fracture at lower speeds

healthy young adult

>14 MPH usually fracture legs

> 25 MPH with multiple severe fractures

fracture level

male pedestrian - bumper roughly at or just below knee

typically involves mid to lower calf

average bumper height 14-15 inches

most protuberant area of bumper ~18-19 inches

photograph injuries with a yard stick / tape

remember to measure pedestrian's footwear heel thickness

usually driver brakes: impact point is lower and speed is decreased

front of car dips (lower impact point)

poor shock absorbers - impact may be at heels

walking / running - fractures at different level on each leg

higher level injury on weight bearing leg

victim may have no grossly apparent injury

calf incision for all pedestrian MVC as indicated

document ± soft tissue / muscle bruise / laceration

vehicle skidding / braking

area may be protected by clothing

if no bumper injury - pedestrian ran into side of car

WEDGE FRACTURE (tibia)

has the apex indicating direction of force

often displaced fracture with laceration opposite impact

B) POCKET

tangential force directed at level of upper thigh / buttocks / hip

usually walking with pivot about axis of weight bearing leg

subcutaneous shearing creates large pocket

may have copious hemorrhage

especially prominent in obese

may not be appreciated visibly but easily palpated

may entrap trace evidence within pocket

C) OVERSTRETCH - rear impact

STRIAE - low speed impact (< 30 MPH)

no hemorrhage

LACERATION - high speed (>45 MPH)

may have associated avulsion of viscera

D) PELVIC FRACTURES

pubic ramus - opposite hip / buttock impact

ilium (especially sacro-iliac joint) - same side as impact

shattered pelvis / groin laceration - high speed (> 45 MPH)

3) WHIPLASH - occurs with rear impact

upper cervical / atlanto-occipital injury

pontomedullary rent (laceration / tear)

one of the few truly instantaneous causes of death

all other injuries post mortem

VEHICLE SPEED vs. INJURY

SPEED (MPH)

<25

25-30

50-60

VEHICLE DAMAGE

not significant

dent hood / break windshield

dent bumper / grill / fender

PEDESTRIAN INJURY

thrown forward / sideways

thrown up & slide off → ground impact

thrown up & over → ground impact

LETHAL INJURIES

CNS (brain) - most common (on the order of 85% of fatalities)

head injuries and cervical spinal fracture / subluxation

various other visceral injuries

MVC IMPACT TYPES

1) FRONTAL IMPACT - most common (>1/2 of all MVC)

A) WINDSHIELD

safety glass - three layers (two glass with central plastic core)
designed to prevent ejection through windshield
side & rear windows still *tempered glass* (shatters) → dicing
facial cuts

superficial parallel vertical incisions - forehead / nose
impact windshield with shattering of glass
usually low speed (< 30 MPH)

deep incisions - parallel / horizontal / diagonal
head perforates windshield and bobs within defect
usually high speed (>45 MPH)

CNS - typically closed head injury and / or hinge skull base fracture
atlanto~ccipital / cervical fracture / subluxation (dislocation)
significant brainstem laceration uncommon

B) STEERING WHEEL

transverse sternum fracture
bilateral rib fractures
cardiac contusion - diagnosis of exclusion as cause of death
visceral laceration(s)

DESCENDING AORTA horizontal transection (complete tear)
just distal to ligamentum arteriosum (anchor)

LIVER / SPLEEN

acute abdominal or gradual subcapsular bleed
possible delayed rupture (slow bleed → pressure)

C) DASH - lower extremity fracture / subluxation

patella acts as wedge between distal femur malleoli (ankles)
femoral neck (proximal thigh bone)

D) SEAT - fracture / subluxation of ankles / feet due to sliding forward

2) SIDE IMPACT - typically "T-bone" at intersection

more severe injuries usually in impacted vehicle
driver injuries typically more severe on impact side

aortic transection
visceral lacerations - heart / liver / spleen / kidney
basilar skull / neck fracture

belts less effective than in frontal impact
possible complete partial ejection

3) ROLL OVER

more lethal than side impact
unrestrained
unpredictable movement within cabin
± complete / partial ejection

4) REAR IMPACT

least commonly fatal - both vehicles with a *crush zone*
impacted vehicle with trunk / cabin
impacting vehicle with engine
impacting vehicle occupants with less injury than impacted vehicle occupants
often involves civil litigation (*whiplash*)
SUBMARINING - slide over top of seat

5) COMBINED

SPECIAL CONSIDERATIONS MVC

- 1) SUDDEN NATURAL DEATH
 - about 1/5 all MVC
 - MVC of relatively minor extent

- 2) VEHICULAR SUICIDE
 - consider with head on impact into fixed object*
 - check driver's shoes for pedal imprints
 - absence of braking
 - possible psychiatric history / prior suicide attempt(s)

- 3) DRIVER vs. PASSENGER
 - injury pattern - *passenger injuries less uniform than driver injuries*
 - dicing
 - steering wheel injury
 - flail chest / sternum fracture (dash injuries may be similar)
 - possibly microscopic heart injury
 - facial laceration (especially below nose)
 - unrestrained driver impacts steering wheel
 - belt injuries
 - intra-cabin protrusions (door handles, window cranks, etc.)
 - trace evidence
 - hairs / fibers
 - need questioned & control of all parties involved
 - blood
 - possible DNA match
 - spatter interpretation may be relevant
 - need questioned & control of all parties involved
 - pedal imprint

- 4) EJECTED OCCUPANT
 - determine primary collision injuries
 - lethal injuries result from impact of head with ground

- 5) MULTIPLE VEHICLE STRIKES (pedestrian) - *which was the lethal impact?*
 - establish presence or absence of typical impact point
 - likely to be standing for initial impact and down for subsequent strike(s)
 - look for bumper fracture / stretch striae / pattern injury legs
 - question may be "Was the victim dead when hit by second (etc.) vehicle?"

- 6) VEHICULAR FIRE - which occurred first, injury / death or fire?
 - very uncommon (<0.5% of all MVC)
 - usually fuel fed - rollover or rear impact
 - carbon monoxide <10 % - death due to blunt force injury
 - flash fire rare with MVC*
 - carbon monoxide may be from exhaust system and not from fire*

NON-AUTOMOBILE MVC

1) MOTORCYCLE "Give your son a bike for his last birthday." - anonymous

CAUSES

ethanol / drug

impairment may be more obvious with lower concentration

environment

reckless

other drivers

INJURIES: intrinsically dangerous - occupant(s) always ejected

passenger may be thrown off prior to impact

HEAD INJURY - usual cause of death (more than neck)

typically basilar skull fractures due to ground impact

sagittal - forehead impact

transverse - temporal / chin impact

whiplash

due to rapid deceleration

instant death with pontomedullary rent

HELMET - weak front protection (none really protect chin)

low speed - significant decrease in head injury

high speed - no protection

PATTERN INJURY

driver: legs forced into gas tank with contusion / abrasion

handlebars - sudden violent turn may lacerate viscera

due to bike landing on top of body

chain abrasion

muffler burn

decollement - shear off layer of skin (wheel turning)

AMPUTATION - objects crossing roadway become hazard

LEATHERS - some decrease brush abrasion

2) TRAIN

almost all are side impacts of train hitting vehicle

driver may try to beat the train

often involve positive driver blood ethanol

rarely car stalls on tracks or car runs into train

extensive injury due to marked kinetic energy of train (large mass)

mass disasters may occur with this (or any and all modes of mass transit)

3) PLANE - covered in detail elsewhere (see reference texts)

LIGHT NON-COMMERCIAL PLANES

usually seen by non-military medical examiner

major concerns are

identification of deceased

why crash occurred

investigation requirements - same as for larger disasters only easier

fewer victims

relatively good conditions

still need to determine significant causal / contributing factors

positives more likely than commercial

natural disease

drug / ethanol

often plane crashes are due to poor judgement (*flying in inclement weather*)

human factors account for >3/4 of all plane crashes

often involves civil litigation - questions regarding pain and suffering

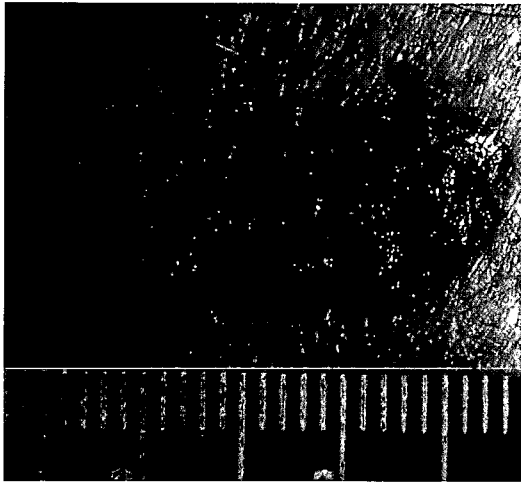
remember: as for auto, light plane may be used in the commission of suicide

survivability determined by

cabin compromise

crash force

post - crash environment



← Abrasion

Tag of skin at upper left-hand corner indicates blow was directed from lower right corner.



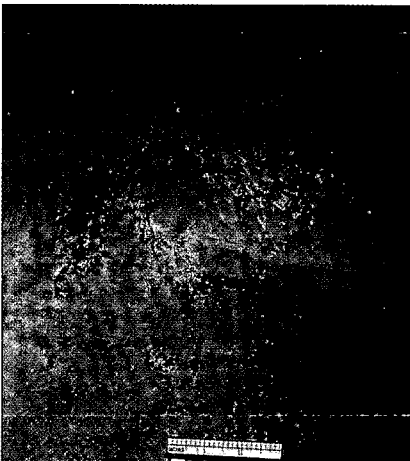
← Brush Abrasion

Relatively bloodless (yellow-pink) abrasion extending across chest. Typical injury for pedestrian struck by motor vehicle.



← Commotio cordis.

Blunt force injury to center of chest (struck by tree limb) by a second person. Rarely, this may trigger an irregular heartbeat and cause death. An additional finding is the therapeutic incision (horizontal) with a therapeutic artifactual abrasion on the left shoulder.



← Impact abrasion.

Jumped from 16 stories height, sustaining severe wounds. The front of the chest at the point of impact had the weave of the clothing imprinted as abrasions.



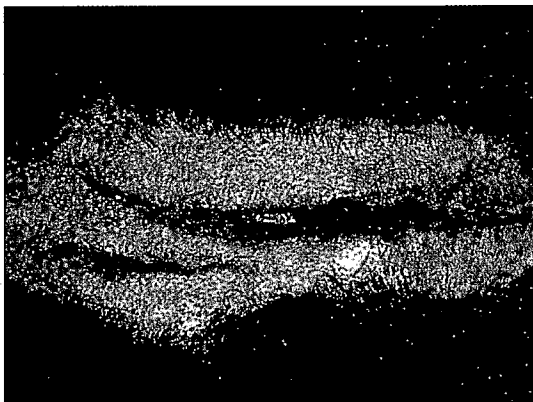
← Impact laceration.

Jumped from 16 stories height. Gaping laceration, with tissue bridging, on forehead.



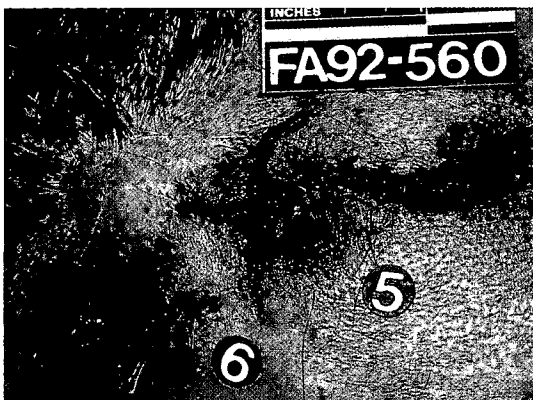
← Multiple blunt force injuries (overkill).

Wound "E" demonstrates typical laceration caused by a firm, linear blunt object (baseball bat, lamp, etc.) The edges have marginal abrasion as the more rounded peripheral edges of the weapon (right & left in photo) do not extend as far into tissue as centrally.



← Chop wound.

A hybrid between true sharp & true blunt force wounds as the tissue is crushed as it is divided. Tissue bridging is present and the wound edges lack marginal abrasion. Suspect weapon would include a dull, thin, hard surface (machete).



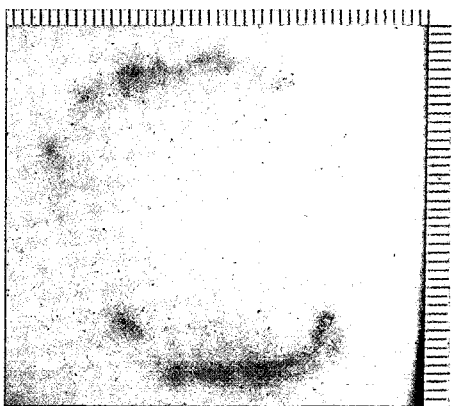
← Pattern injury.

Stellate (star-shaped) lacerations with broad central rounded abrasions. Multiple wounds (overkill) repeating the same pattern. (Cue ball wrapped in a sock)



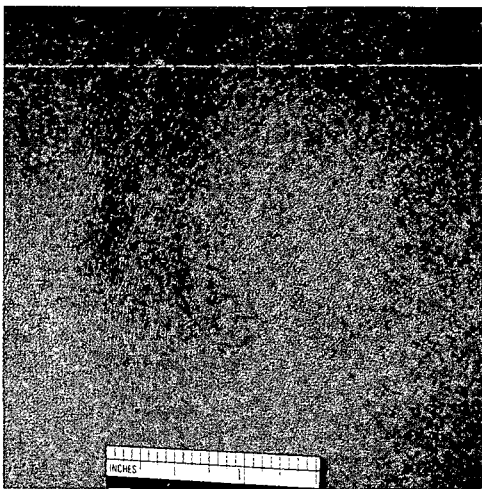
← Pattern injury (alcoholic).

Multiple injuries in multiple stages of healing to protuberant body parts (elbows, knees, etc.) The scene may be very bloody as alcoholics may have problems with blood clotting factors.



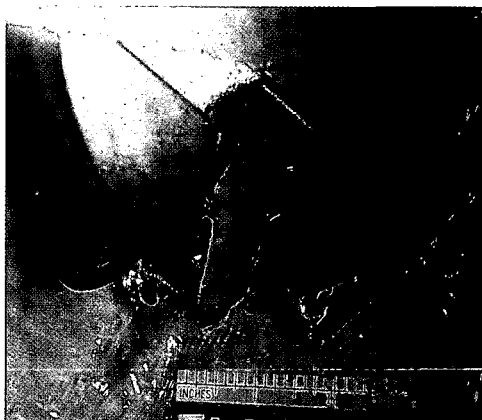
← Pattern Injury (bite mark - full bite ring) [see section on bites]

Bites to the victim's body suggest a sexual element may be involved in the crime. Appropriate specimens should be collected & the victim should be excluded as a possible contributor of the mark, if indicated.



← Pattern injury (crescent wrench).

Death from commotio cordis due to blows to the front of the chest with a 12" crescent wrench. A suspect weapon should be sought at the scene.

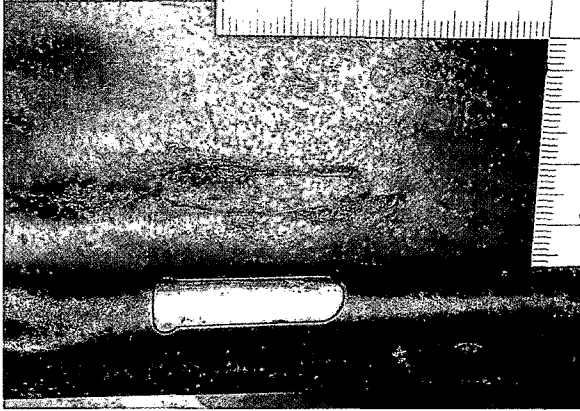


← See above (crescent wrench).



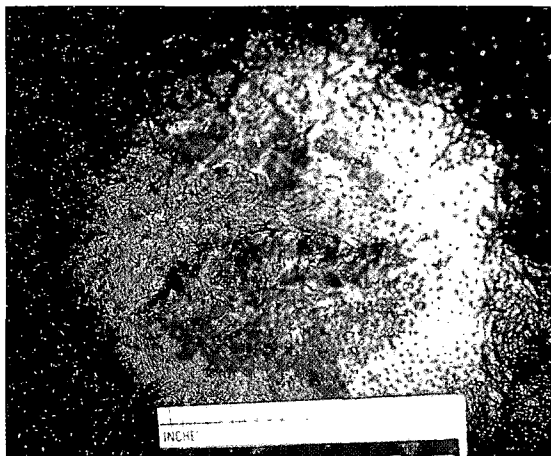
← Pattern injury (barrel .22 rifle)

The deceased was shot four times in addition to having this injury to the left face. The originally gaping wound was re-approximated to demonstrate the pattern of the striking object. The lower picture shows the magazine port on the underside of the barrel. The concordance between the suspect weapon (recovered at the scene) and the wound is obvious. Also present, although indistinct in the right hand side of the photos, was a typical patterned contusion consisting of two parallel linear bruises with central clearing, corresponding to the width of the barrel.



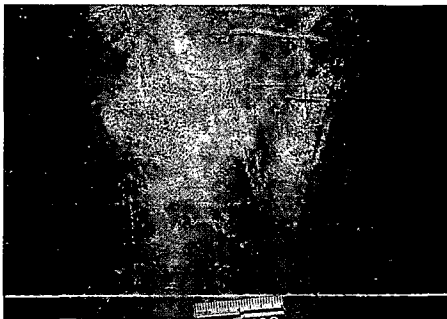
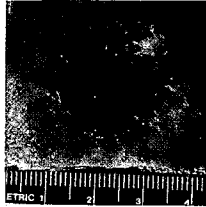
← Pattern injury (hoe handle).

Multiple injuries (>100 in toto) representing patterned contusions & abrasions from long linear object. Note central clearing as the central tissue in each is crushed & the bruises occur on the borders of the blow (the width of the clear space suggests that of the suspect weapon).



← Pattern injury (fall to back of head).

A typical scalp laceration resulting from a fall. The injury is in a “hat-band” distribution and consists of a small central linear laceration with extensive undermining and a larger surrounding abrasion. A similar pattern may also result from a blow to the back of the head by a large flat object (a board). The two would be differentiated by examination of the brain: a fall would have brain injury opposite the blow (contre coup) & a blow would have brain injury under the blow (coup).



← Pattern injury (hammer).

Multiple injuries (overkill) with a claw hammer. The injuries in the lower left and upper right corners are an abrasion & lacerations, respectively, caused by the head of the hammer. The paired vertical abrasions (center) are from the claw end of the hammer.

← A section of bone retained as evidence (collected from the back of the head at autopsy) was later matched back to a suspect weapon.

← Pattern injury (hoe handle).

Multiple injuries (>100 in toto) representing patterned contusions & abrasions from long linear object. Note central clearing as the central tissue in each is crushed & the bruises occur on the borders of the blow (the width of the clear space suggests that of the suspect weapon).

← Pattern injury (propeller chop).

Parallel grouped chop wounds on body recovered from water. Distinction between pre-mortem & post-mortem infliction may be an issue.

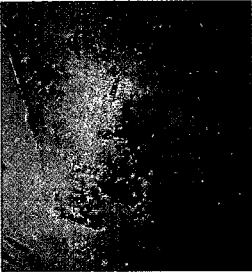
← Pattern injury (1 inch wire cable).

Cable broke, striking victim in the face & splitting the skull. The width of the patterned abrasion suggests the width of the suspect instrument. The slightly oblique vertical striations correspond to the weave of the wire.



← Pattern injury (driver).

Shattered tempered glass impacting the left side of the face causing multiple fine squared superficial incised wounds (“dicing”).



← Pattern injury (driver).

Outer left thigh of victim in motor vehicle crash. The pattern is somewhat indistinct but represents a window crank handle on the driver’s side door.



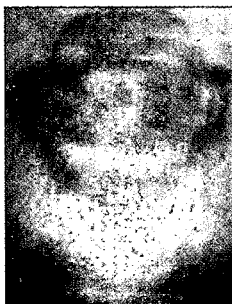
← Pattern injury (driver).

Oblique linear abrasion-contusion extending downward across the left chest represents an injury caused by the seat belt at the time of the impact.



← Pattern injury (pedestrian).

Victim found down in the middle of the road after having been struck by multiple vehicles. The pattern injury to the back was caused by the initial impact & can be matched back to the initially impacting vehicle (the victim had to be standing when this wound was inflicted, however he was subsequently down for the following impact(s)).



← Pattern injury (pedestrian).

Back of thigh in victim struck from rear by a braking Nissan pick-up truck. The circular design purple contusion is an imprinted (mirror-image) pattern of the logo from the front grill of the truck.

BLUNT FORCE INJURY - Downs

NOTES

REFERENCES

Blunt force injuries:

Forensic Pathology, 1989, D. J. DiMaio, M. D. & V. J. M. DiMaio, M. D., Chapters 4, 5, & 6

Medicolegal Investigation Of Death, 1993, W.U. Spitz, Chapter 7

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Transportation fatalities:

Forensic Pathology, 1989, D. J. DiMaio, M. D. & V. J. M. DiMaio, M. D., Chapters 9 & 10

Medicolegal Investigation Of Death, 1993, W.U. Spitz, Chapter 14 & 15

Handbook Of Forensic Pathology, 1990, R.C. Froede (ed.), Chapter 23 & 24

***AN OVERVIEW OF INJURIES
FROM EDGED WEAPONS AND
THEIR EFFECTS ON THE
BODY***

An Overview of Injuries from Edged Weapons and Their Effect on the Body

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Introduction

A. Edged weapons can be used to inflict wounds by

1. stabbing
2. incising
3. chopping

B. 92% of police injuries are caused by edged weapons

1. Most injuries to police officers from edged weapons occur on "disturbance" calls
2. The most common weapon used to inflict these injuries is a screwdriver
3. The minimum safe distance from an assailant wielding an edged weapon is 21 feet

II. Stab Wounds

--A wound inflicted with a sharp object that is deeper than it's length on the skin surface.

A. Instruments

1. Flat and thin--files, knives, scissors, etc. Cuts and divides as it penetrates.
2. Sharp and slender--hat pins, needles, screwdrivers
3. Sharp and thick--ax, pitchfork

B. Characteristic in:

1. homicides
2. suicides
3. accidents

C. Cause of Death:

1. Hemorrhage, massive, vital structure perforated/penetrated. Example: arteries of the neck, heart, lungs, and aorta
2. Air embolism
3. Pneumothorax
4. Infection
5. Asphyxia due to blood aspiration

D. Factors of medicolegal importance

1. Instrument(s) used
2. Directions of wound track
3. Depth of penetration
4. Width of knife
5. Number of wounds

E. Caution

1. Serrated knife--stab wounds not usually distinguishable from nonserrated knife wounds
2. The same knife may produce wounds with different appearances
3. Angulated wounds may result from:
 - a. two separate thrusts
 - b. assailant twisting knife
 - c. victim twisting after knife entered the body

III. Incised Wounds

--A wound that is inflicted with a sharp object that is longer on the skin surface than it is deep.

- A. Razor blade, sharp glass, knives, etc.
- B. Structure similar to stab wounds

IV. Chop Wounds

- A. Meat cleavers, axes, machetes, etc.
- B. Structure of wound is obvious (e.g. decapitation)

SHARP FORCE INJURY

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TERMINOLOGY

INCISION - a cut which is longer than it is deep (a slicing wound)

STAB - a penetrating wound which is deeper than it is long

TRACK - path corresponding to the stab (i.e. depth of the wound)

HILT MARK - an abrasion corresponding to the handle guard impacting the skin

misnomer since knives do not have hilts (actually edge of handle at blade)

KNIFE VS. WOUND

<u>BLADE</u>	<u>WOUND</u>
length	depth
width	length
thickness	width

MEASUREMENTS

multiple measurements of multiple wounds increase accuracy

single sharp-edged blade typically produces a wound with one sharp & one blunt edge

width of the flat edge (from blunt side of blade) corresponds to blade thickness

only thickness is not affected by angle at which blade enters body

VARIABLES

RICASSO - the blunt base of the sharp edge of the blade

may create a squared wound (with complete blade penetration)

LINES OF LANGER - elastic tissue bands which cause wounds to gape open

requires re-approximation of wound edges if wound perpendicular to lines

WOUND RECONSTRUCTION METHODS

manual, tape, super glue, or subcutaneous sutures

a re-approximated wound is typically longer than it was when gaping open

BONE & CARTILAGE

maintain dimensions of weapon far better than skin & viscera

pathologist may retain involved fragments for later tool mark comparison (if indicated)

FASCIA & ORGANS

may be used to give fairly accurate estimate of blade thickness

especially more rigid organs (heart, liver, & brain)

CLOTHING

may maintain weapon characteristics far better than viscera & skin

especially leather & synthetics

defects corresponding to wound(s)

suicides may expose area in which stabbed

if absent - was victim undressed?

sharp force injuries often a component of sexual homicide

*****treatment may alter wound(s) or introduce artifact(s)***

ATYPICAL STAB WOUNDS

MOVEMENT- creates relative motion between blade & skin
may occur with

weapon entry / exit (twisting blade)

victim / assailant motion (struggle)

typically with a chevron / "V" / "L" / "Y" wound and/or a dog-ear

PENETRATION

gives relative idea of blade length

usually depth exceeds actual blade length

track may be greater than, less than, or equal to actual blade length

less than two pounds of force are required for skin penetration

shallow or deep wounds caused by similar forces

full penetration is not an indicator of extreme force used

variables: blade sharpness, tissue resistance, clothing, track length, etc.

tissues are elastic & body surface can be deformed (indented)

organs may not be in same location in life as at autopsy

when erect, gravity pulls tissues downward

at autopsy, body is horizontal

suggest blade penetrated to its maximal depth

HILT MARK

CONTUSION adjacent to stab

RIB FRACTURE adjacent to stab

DIRECTION

determined with certainty only at autopsy

dissect down to & follow wound track

hilt mark - may suggest direction

perpendicular - equal hilt mark centered on stab wound

angled - hilt mark on edge opposite path

SCENE INVESTIGATION

may provide better indication of activities than autopsy

should consider degree of incapacitation caused by wound(s) & effects on potential activity

ideally all blood evidence should be typed by serology / DNA if indicated

seldom practical or warranted

circumstances of individual case indicate relative needs of evidence processing

weapon location

usually present at suicide scene

usually absent at homicide scene

rarely knife may be left within body

weapon may be one of opportunity (found by assailant at scene) or intent (brought)

INTERPRETATIONS:

1) SUSPECT WEAPON

generally can only determine if weapon *could have* been used

Are wound measurements consistent with the suspect weapon?

able to exclude obvious mismatches between blade and wound

blade may twist and turn or enter at an angle - wound may be larger than weapon

only certain suspect knife caused wound if piece broken off in wound

2) ORDER OF WOUNDS

limited interpretation at best

prior vs. recent wound

sequence

pre-mortem / agonal / postmortem

wounds may ooze post-mortem (small quantity compared to pre-mortem)

consider incapacitation and survivability - may not be immediately incapacitating

BLOOD EVIDENCE

at scene blood spatter may be minimal unless extremity / head / neck

blood infiltrating tissues is best indicator of a pre-mortem wound

blood may leach out of tissues with submersion

3) ATTACKER HANDEDNESS / POSITIONON

difficult to scientifically defend an absolute opinion

a weapon may be held in dominant or non-dominant hand

the blade may extend medially or laterally from the hand

the attack may occur from above or below / front or rear

4) ALTERCATION

FINGERNAILS

scratch / superficial incision.
collect clippings as evidence in all close combat situations

WIELDING

slash (incision)
unable to implicate specific weapon or determine direction
may have superficial incision at trailing end
***most homicidal slashing occurs from behind (Spitz and Fischer)*

SKIPS - sharp edge skips over skin surface
(bony prominence / dull blade / atrophic skin)

MARKS FROM CLOTHING / JEWELRY

DEFENSE WOUNDS

offensive vs. defensive - more consistent with warding off blows or grabbing blade
upper extremities- dorsolateral (warding off)
i.e. ULNAR & EXTENSOR FOREARM
palms / fingers (grip blade)
lower extremities
especially female / nude victim
supine victim
consider sexual element

TORTURE

difficult for pathologist to medically defend interpretation of assailant intent
pattern and / or nature of wounds may suggest that interpretation

5) "OVERKILL"

pre-mortem vs. post-mortem injuries (overkill vs. mutilation)

HOMICIDE - often involves a domestic relationship (spouse, lover, etc.)

may involve other elements

homosexual

stimulant drugs (cocaine)

psychiatric (schizophrenic)

MUTILATION

psychiatric vs. sexual vs. hindering identification

patterns: axe / hand saw / chain saw

SUICIDE - may have multiple sharp force injuries

usually non-dominant extremity i.e. FLEXOR / RADIAL FOREARM

HESITATION MARKS - superficial sawing motion on wrists or neck)

multiple superficial punctures with one or two deep stabs

DETERMINATION - slashing (uncommon)

look for scars of prior attempt when performing a suicide autopsy

SYMPATHY CUTS - seen with drug addicts in attempt to get pain meds

6) PAIN

skin has all type pain receptors (viscera respond to crush / stretch)

degree of pain is unrelated to wound depth

COMPLICATIONS OF SHARP FORCE INJURY - regardless of interval if caused by wound

exsanguination - bleeding to death (internally or externally)

cardiac tamponade - ≥ 150 ml. blood into sac around heart (heart cannot fill)

asphyxiation - hemorrhage into tracheobronchial tree (cannot get air into lungs)

air embolism

especially with major neck wounds

air gets into vessels - unable to provide delivery of oxygen to tissues

hemo-pneumo thorax - blood / air into chest cavity (lung collapses → no air)

infection - any wound potentially can be complicated by infection

ATYPICAL WEAPONS

serrated blade - usually indistinguishable from typical blade

trailing or leading serrations may leave pattern

screwdrivers

marginal abrasion (any elongate semi-dull weapon)

Phillips may be indistinguishable from standard head

letter opener

survival knife

serrated spine may abrade skin as flat edge passes surface

protrusions / recesses may create adjacent / contiguous wound

scissors

when open create pattern of overlapping obliquely angled paired wounds

when closed create a pattern of a rectangle with abraded edges

may have central marginal abrasion corresponding to the screw

fork - pattern may be represented by number of tines

relative distance(s) between tines may indicate direction

usually 3-4 tines with typical fork

kitchen forks do not usually penetrate skin

ice pick - may resemble central line stick, small caliber GSW, or small pocketknife

ovoid or slit wound

broken glass - sharply incised and ragged gaping wound without abraded edges

may have grouped wounds

foreign material may be embedded in wound depths

stick - puncture with abraded edges

CHOP - combination blunt and sharp (cutting action with tissue bridging) leaving gaping wounds

appears incised on quick glance

typically caused by a dull blade or a relatively sharp blunt surface

examples:

machete

bayonet

propeller

axe

meat cleaver

angle iron

pry bar



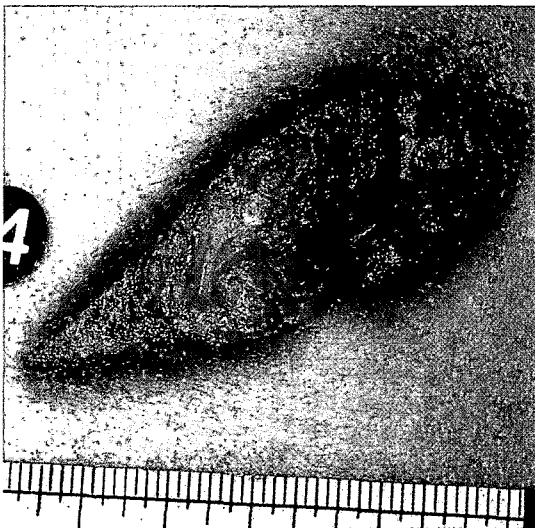
← Sharp force injury
(stab wound).

The wound gapes due to the wound perpendicularly crossing Langer's lines of connective tissue. This artifact renders such a wound difficult to interpret without re-approximation of the wound edges (see below)



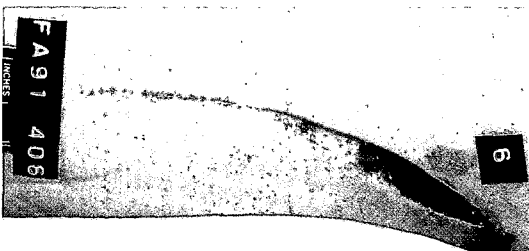
← Sharp force injury (stab wound)

This is the same wound as shown above. The edges have been re-approximated thus clearly showing the nature of the wound. The blunt edge is now visible in the upper right corner & the sharp edge in the lower left. Re-approximation allows determination of the width of the wound which correlates to the blade thickness (see text). Several different methods may be used to re-approximate the wound edges: super glue, subcutaneous sutures, adhesive tape (photo), & manual pressure.



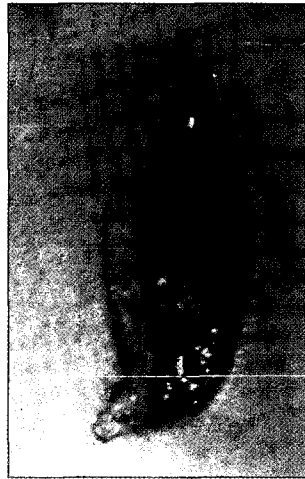
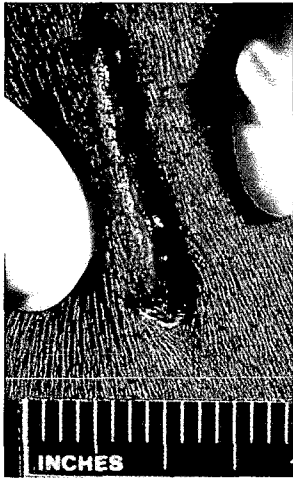
← Sharp force injury
(incised wound)

An incised or cut wound is superficial in that it is longer on the skin surface than it penetrates into the body. The absence of blood indicates this is a post-mortem injury.



← Sharp force injury
(incised wound)

An angled entry (lower right corner) with a trailing incised wound. This demonstrates that the knife edge was at one point oblique to the skin surface - it may occur as the blades goes in or as it comes out.



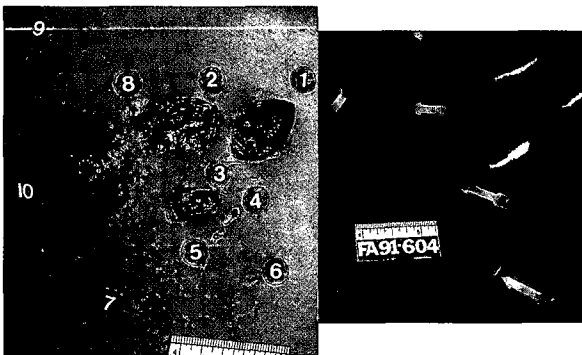
← Sharp force injury
(stab wound)

A dog-ear on the edge of a stab wound (lower left corner in both cases) indicates relative motion between the three involved elements: victim, assailant, & blade. Such marks are also known as “skirmish marks.”

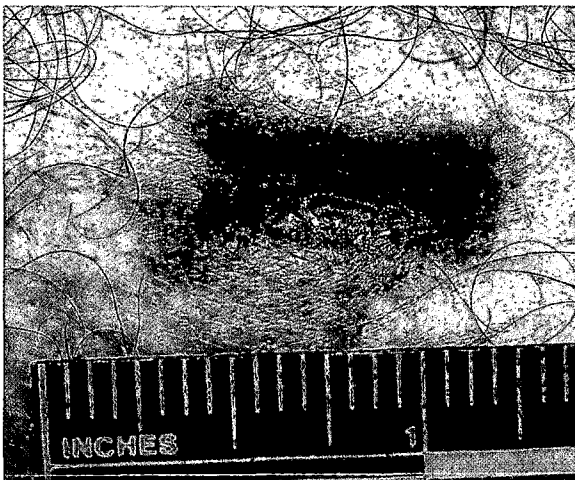


← Sharp force injury
(stab wound)

A hilt mark indicates that the blade has penetrated the body to its maximal depth, such that the edge of the grip has caused an abrasion on the skin adjacent to the stab (lower right edge of wound).



← Multiple sharp force wounds to breast. Two separate weapons were used; wounds #1, #2, & #3 are typical gaping stab wounds from a knife. The remaining, smaller wounds resulted from a sharp instrument with a narrow diameter (an icepick). Multiple close contact wounds to a sexually significant area - consider sexual motive. Multiple defects in shirt from case above. Both the knife & ice pick defects are clearly demarcated in the fabric & are consistent in placement with the wounds to the body. The deceased was dressed at the time these injuries were inflicted.



← Stab wound (flat head screw driver).

Stab to the mons pubis with extensive laceration of the vaginal pouch in an elderly female. With wounds in a sexually significant area, a sexual motive was suspected (and later confirmed).

NOTES:

REFERENCES

- Forensic Pathology, 1989, D. J. DiMaio, M. D. & V. J. M. DiMaio, M. D., Chapter 7
Medicolegal Investigation Of Death, 1993, W.U. Spitz, Chapter 8
Handbook Of Forensic Pathology, 1990, R.C. Froede (ed.), Chapter 28

Closed Head Injuries

by Arthur E. Westveer, Behavioral Science Unit, FBI

- I. "The Coup-contrecoup Mechanisms" coup-type injuries are those produced by focal compressions of the skull (with or without the area of impact). The smaller the contact area, the greater the likelihood of a coup contusion. The effects are immediate, producing contusions (bruises) and hemorrhaging.

An impact from a flat surface usually does **not** cause a coup contusion.

A blow to the **resting, movable head** produces coup-type injuries.

- II. Contrecoup brain contusions occur **opposite** a point of cranial impact, independently of skull fractures. Contrecoup brain contusions are sustained when the moving or falling/accelerating head strikes a solid object. There is no proof that human coup-contrecoup injuries are ever produced by any other mechanism than impact of the moving head against a solid object.

- III. Principles concerning coup-contrecoup head injuries are as follows:

- A. A blow to the resting movable head produces brain contusions **beneath** the point of impact (coup-type injuries)
- B. A moving head strikes a firm or unyielding surface, resulting in brain contusions opposite the point of impact (contrecoup-type injuries)
- C. A moving head sustains mild or **no** coup-type injuries (with **rare** exceptions) from an impact
- D. A resting head sustains mild or no contrecoup-type injuries (with **rare** exceptions) from an impact
- E. The typical contrecoup lesions have **never** been produced in man unless the head was in motion at the time of impact
- F. Occipital trauma (i.e., hitting the back of the head) for a moving head **often** results in frontal and temporal (contrecoup) brain injury (at least in part because the front base of the skull is rough)
- G. Frontal trauma (hitting the front of the head) for a moving head rarely results in occipital (contrecoup) brain injury (at least in part because the back and back base of the skull is smooth)

- H. A head fixed against a firm surface will sustain both coup and contrecoup type injuries when struck on the free surface (this is related to the elastic properties of the skull)
- I. When trauma is sustained to the upper jaw or temple in a moving head, the major lesions are always contrecoup, coup lesions being lesser or even absent
- J. Contusions of the brain surface can result from the edges of fractured bones impacting the brain surface. In severe skull fractures, differentiating fracture-contusions from coup-contrecoup injuries may be difficult or even impossible.

***BLOODSTAIN PATTERN
ANALYSIS***

Bloodstain Pattern Analysis

by Arthur E. Westveer, Behavioral Science Unit, FBI

Blood is one of the most significant and frequently encountered types of physical evidence associated with the forensic investigation of death and violent crime.

Bloodstain pattern interpretation may be accomplished by direct scene evaluation and/or careful study of scene photographs with a measuring device in view. A visit by the analyst to the scene is by far the preferable choice.

Photographs

In those cases when photographs must be relied upon: detailed sketches, diagrams, reports of the crime scene investigators, autopsy report(s), and laboratory reports should be reviewed.

Reconstruction Of The Crime Scene

Bloodstain pattern interpretation may provide information in the following areas:

1. Origin of the bloodstains.
2. Distances between impact areas of blood patterns, spatter patterns and their origin at time of bloodshed.
3. Type and direction of impact.
4. Object(s) that produced particular pattern.
5. Number of blows or shots.
6. Position of victim, assailant, or objects at the scene.
7. Movement and direction of victim, assailant, or objects at the scene.
8. Support or contradict statements given by suspect or witnesses.
9. Additional information for estimation of postmortem interval, correlation with other laboratory and pathology findings relevant to the investigation.

Be conservative—do not over-interpret bloodstain evidence.

Physical Properties Of Blood

Physically—fluid mixture—cellular components and plasma.

When blood is exposed to the external environment as the result of trauma and subjected to various forces, it will behave in a predictable manner according to the principles of physics.

The Application Of The Physical Properties Of Blood:

1. Viscosity
2. Specific gravity
3. Surface tension

The principles of fluid in motion form the basis for the study and interpretation of the location, shape, size, and distribution of bloodstains relative to the force or forces that produced them.

What Blood Can Reveal:

1. Human or animal blood.
2. Type A, B, or O blood.
3. Presence of drugs.
4. Individuality (DNA).
5. Reconstruction of events.

What Can Bloodstain Pattern Interpretation Tell Us?

1. Origin of bloodstain.
2. Distance between impact area and origin at the time of impact.
3. Type of impact that produced the pattern(s).
4. Object(s) that produced pattern(s).
5. Direction blood was traveling.
6. Number of blows, shots, etc.
7. Movement and direction of victim, assailant, or others during and/or after the assault.
8. Additional information in determining time of death.
9. Position of victim and assailant at time of assault.
10. Support or disprove statements given.

When attempting to reconstruct the events from bloodstain patterns, it is extremely important to accurately record the following (among other things):

1. Shape of the stain.
2. Location of the stain.
3. Direction of the stain.
4. Size of the stain.
5. Surface area of impact.

Free-Falling Blood:

Source: open wounds, saturated objects

Force of gravity exceeds the surface tension causing drops of blood to separate from the main source in the form of drops.

As gravity forces the blood to separate, the blood takes on a tear drop shape, but once free, it quickly assumes a spherical shape to minimize surface area.

Surface Tension:

The molecular cohesive forces that cause the surface of a liquid to resist penetration and separation.

The spherical drop will not separate or sub-divide while falling unless coming in contact with a force other than gravity.

The size of the drop will depend upon the balance gravity of the source and the object it is dropping from.

The texture of the surface that falling blood strikes dictates the degree of distortion of the bloodstain.

The diameter of a bloodstain depends on:

1. Volume of the blood.
2. Distance of the fall.
3. Surface texture.

Terminal Velocity:

A drop of blood normally reaches its terminal velocity of about 25 feet per second after falling a distance of approximately 20 feet.

The smoother the surface, the more uniform the edge character of the bloodstain.

Blood dropping on nonhorizontal surfaces or striking surfaces at an angle will produce a more oval, elongated bloodstain.

The greater the angle of impact, (between the surface the the blood flight path) the greater the elongation of the bloodstain.

The end displaying the greatest degree of distortion of the striking bloodstain will point in the direction of travel.

The angle in which blood struck a surface can be determined by dividing the length into width of the bloodstain and consulting a sine table.

Point Of Convergence:

A common point to which individual bloodstains can be traced.

Point Of Origin:

Location from which the blood producing the bloodstain originated.

Drops of blood falling into a pre-existing liquid blood surface will produce irregular pools with small (0,1 - 1.0 mm) round or oval satellite spatters on its perimeter.

Crime Scene Processing For Bloodstain Patterns:

Equipment:

1. Lights and light stands.
2. Protractor and compass.
3. String and tape.
4. Ring stands
5. Magnifier and reticule.
6. Meter stick and tape measure.
7. Workshop manual, graph paper, ruler.
8. Camera, lens, tripod, film.

Blood Clotting

Blood is essentially comprised of plasma and cells. When clotting takes place, the gel-like clot mass retracts causing a separation of the serum (clear yellow to red liquid).

High Velocity Impact Spatter Bloodstain Pattern

1. High energy/velocity force of impact.
2. Size of individual bloodstain usually 0.1 mm and smaller.

Medium Velocity Impact Spatter Bloodstain Pattern

1. Moderate energy/velocity force of impact.
2. Size of individual bloodstain usually 1-4 mm.

The Greater The Energy The Smaller The Spatter

Misting — spatter less than 1 mm — HVIS
Fine — spatter less than 3 mm.
Medium — spatter 3-6 mm.
Large — spatter greater than 6 mm. — LVIS

Considerable overlap can occur.

Blood That Is Subject To An Energy Greater Than Gravity:

- Blow
- Gunshot
- Vomiting
- Arterial gushing
- Cast off

Transfer Blood

- Swipe — bloody object transferring blood to another object.
- Wipe — object that wipes blood from an object.
- Smudge — bloodstain altered by contact with non-bloody object.

Splashed Blood (Free Fall)

When large quantities of blood fall to a surface.

Large central area with elongated rather than round peripheral spatter.

Bloodstain Pattern Evidence and the Evaluation of Violent Crime Scenes

Source: The Prosecutor, Volume 28, #3, May/June, 1994.

INTRODUCTION

THE LOSS OF BLOOD DURING A VIOLENT crime often produces blood patterns which may provide valuable information about the events which took place to create those patterns. A source of blood receiving one or more high energy impacts may be dispersed into smaller volumes and be deposited as spatter (not splatter) on various target surfaces within range. The bloody shirt belonging to the individual who found the battered homicide victim was stained, we may be told, by contact with the victim when he found her, picked her up, and held her in his arms to make her more comfortable just before she died. The shirt and the blood on it take on a new significance when we recognize that the bloodstaining on the shirt is not that of a contact nature, but is clearly impact spatter. Such staining, caused by an impact applied to a source of blood, would have resulted from the shirt being adjacent to a source of blood at the time of impact.

A transfer of blood from a blood-bearing object may leave a pattern identifiable with the original object still bearing blood and later found in the possession of a suspect. Found next to a stabbing victim is his jacket which bears contact bloodstains clearly outlining the unique shape, size, and edge detail of a knife which may have been used to stab the victim. Investigation leads to an uninjured suspect who has in his possession a bloody knife which can be shown to match in all observable detail the stains on the jacket. Here, blood types of the victim's blood at the scene may be of little value, but



by
Robert P. Spalding

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“THE SHIRT AND THE BLOOD ON IT TAKE ON A NEW SIGNIFICANCE WHEN WE RECOGNIZE THAT THE BLOODSTAINING ON THE SHIRT IS NOT THAT OF A CONTACT NATURE.”

blood typing of the blood on the knife and the features of the stain patterns on the jacket are of considerable importance.

The ultimate objective of studying bloodstain patterns and related information then, is to as nearly as possible reconstruct those events which led to the deposition of the stain and stain patterns associated with a crime scene. Observation of data involving spot size, quantity, shape, distribution, location, angle of impact and target surface character may provide valuable insight into the events which took place. Stains indicating movement of or masking by an object and transfer of blood between persons or objects would likewise be observed, documented, and studied to identify any probative information available.

The purpose of this discussion is to increase awareness among prosecutors with respect to bloodstain spatter interpretation, and to provide some guidelines for scene evaluation, documentation, and evidence collection. With this, hopefully, will come a recognition of the possibilities for bloodstain pattern analysis to not only provide valuable information but to also save time and effort for the investigator, whether in the laboratory or on the street. Even with these objectives met

however, there is the critical need for communication. Effective communication between member of the investigative team from the crime scene officer to the investigator to the laboratory analyst to the prosecuting attorney is essential to any thorough, well-prepared in

vestigation and prosecution. Communication is a two-way process; not simply a flow of information in one direction.

THE STUDY OF BLOODSTAIN PATTERNS IS NOT NEW

THE STUDY OF BLOODSTAIN PATTERNS at crime scenes dates back to the 1890s. Bloodstain pattern interpretation is a field of study which relies on the fact that blood, as a fluid, follows certain physical laws and, as such, will form reproducible patterns under separate sets of similar circumstances. If the original conditions and environment of the incident are sufficiently reproduced, then subjecting blood to forces and actions similar to those originally used in the crime will result in stains and patterns similar to those found at the scene. We need "only" identify those forces and actions.

This reproducibility of bloodstain patterns has been shown not to be significantly affected by the age, sex, or disease state of the bleeder. Nor does the blood alcohol, drug, or anticoagulant content present serious problems as long as these substances are present in clinical amounts. Further, temperature and humidity (within reasonable limits) do not significantly affect the reproducibility of these patterns. Experimentation can be a useful tool in studying and recreating stains. An analyst may rely on knowledge gained through previous experience as well as data observed during experiments based on the specific circumstances of the case at hand to evaluate a scene and evidence.

WHAT CAN BE DETERMINED THROUGH BLOODSTAIN PATTERNS?

OBVIOUSLY, EVERY CRIME SCENE HAS ITS OWN UNIQUE SITUATION and specific problems. Generally speaking, however, determinations made from a study of the scene and the evidence taken from that scene may help to confirm or refute assumptions or allegations concerning the events which took place to produce the stains observed. Some questions which may be answered include:

- What was the position of the victim or suspect (sitting, standing, lying down, etc.)?
- Does the scene show evidence of a struggle (blood smears or trails, footprints, fabric impressions, etc.)?
- Are there areas where there is a lack of staining, particularly spatter—voids in patterns? Was someone or something—the suspect, the victim, the weapon—blocking the flight of blood?
- Are there in-line stain patterns where blood was cast from a bloody object being swung? What was swung—the weapon, the victim?
- Is there a particular sequence of events indicated—smearing of a transfer or spatter pattern subsequent to the initial deposition of the blood?
- How many impacts are indicated? Is there blood spatter which indicates the nature of the impact(s)?
- Is there any information or bloodstaining to indicate that the scene was altered before bloodstain examinations were begun? Before the crime scene examinations were begun?

Additionally, an analyst may be able to confirm or refute statements made by suspect(s) or victim(s) in a case:

- Are the stain patterns on the clothing of the suspect(s) and at the scene consistent with each person's story? Are there *any* stains visible on the clothing of the suspect(s)?
- Are the stain patterns on the victim(s), the clothing of the victim(s), and at the scene consistent with the stories of the victim(s) or witness(es) or the suspect(s)?
- Finally, it may be possible to determine information which may eliminate the need for time-consuming investigation or laboratory analysis which might otherwise be routine in such an investigation. As an example, investigation might disclose that the scene, the witnesses, and the evidence indicate an event or action could have happened in one of two or three different ways. A bloodstain pattern evaluation might then establish that, given the available information and based on the patterns present, only one of the suggested possibilities is actually possible. The need for extensive determinations of "Whose blood is where?" through conventional blood typing might then be unnecessary.

DO YOU NEED BLOODSTAIN PATTERN EXAMINATIONS?

IT FOLLOWS THEN, that an *extremely important point* for a prosecutor to consider in deciding on the need for bloodstain pattern analysis examinations is: *based on knowledge of the crime and the scene, what realistic, specific questions can a bloodstain pattern analysis answer?* In conjunction with the questions set forth above, one might ask, Is it important; do I need to know?

Whenever a blood-splashed and spattered crime is encountered, an examination of the scene and the available evidence by an individual experienced and qualified in bloodstain pattern interpretation should be considered. Frequently it is nearly the last thing to be considered as an investigative resource. When this occurs at the expense of valuable stain patterns, the results are limited at the outset. Immediate (telephonic or in person) contact with a laboratory which has expert personnel available may help to determine the extent to which a bloodstain pattern examination is needed, or indeed, if such an examination may be of value at all. Often such contacts will mean a saving of time and effort for everyone and result in either a more efficient submission of evidence to the laboratory or a more complete on-scene examination by an analyst. The laboratory analyst should be ready to provide information and make analytical needs known to the investigators. Both the investigator and the analyst invariably will already have a full workload. The prosecutor needs to understand the resources, limitations, and frustrations they face.

THE ANALYST SHOULD VISIT THE SCENE

WHEN BLOODSTAIN PATTERN INTERPRETATION is to be employed on a case, it is best initiated by one or more analysts on the scene rather than on evidence sent to a laboratory. Certainly, when an analyst can study the scene, personally be involved in the evidence collection process,

(Continued on page 16)

and inspect undisturbed stain patterns at the scene, there is the greater likelihood of the needed information being gathered with the minimum of difficulty. It may be, of course, that available resources or another reason will preclude such a visit. The suggestions presented later in this discussion are intended for use either before the arrival of an analyst at the scene or in the event an analyst cannot attend the scene at all. Talk to the analyst to determine what needs to be done.

If it is determined that an analyst will be able to examine the scene, any advance preparation the prosecutor's investigator can accomplish will ultimately benefit your case. Assembling in advance some of the material discussed below will go a long way to simplifying the work both will have to carry out. The analyst may wish to personally cover photographic documentation of the scene. Photography by the prosecutor's department, while it may largely be a duplicate effort, will give the perspective of a second photographer which can often provide information not otherwise obtainable.

SENDING EVIDENCE TO A LABORATORY

IN THOSE CASES WHERE NO SCENE EXAMINATION by an analyst is possible, the call to the lab is all the more important. A careful evaluation of the evidence to be sent should be carried out to determine, insofar as possible, that examination of the items sent will provide information meaningful to the prosecution of the case. Of course, it is not always possible for the investigator to thoroughly evaluate the evidence. Discussing the case with an experienced examiner will often be beneficial. It should be recognized that this type of examination can be extremely time consuming (sometimes more so than many of the more conventional serological examinations). The questions to be answered should be probative and pertinent to the investigation and not of the

"IN THOSE CASES WHERE NO SCENE EXAMINATION BY AN ANALYST IS POSSIBLE, THE CALL TO THE LAB IS ALL THE MORE IMPORTANT."

"Gee, what if . . ." variety, perhaps other areas of expertise will provide information of greater value in the end. Of course, there are times when there are no specific ideas or logical directions to pursue—no leads, a dead end. Similarly, there are situations where the only answer is to examine the item of evidence. Call the lab and talk it over with someone. Carefully consider the advice you get in light of the investigation as you know it.

"NOR IS IT BEING SUGGESTED THAT LARGE VOLUMES OF EVIDENCE BE PACKAGED AND SENT TO THE LAB TO 'LET THEM FIGURE IT OUT.'"

The categories of evidence set forth below are intended to be helpful in organizing the submission. Having as much as possible of the materials and the information outlined below on hand will make matters easier and avoid having to go back to get that forgotten photograph or measurement. This is *not* to say that huge submissions of evidence are best. Nor is it being suggested that large volumes of evidence be packaged and sent to the lab to "let

them figure it out." Often excessively large amounts of evidence include many unnecessary items accompanied by information inadequate to allow the analyst to determine appropriate forensic objectives. *Try to imagine yourself as knowing nothing about the scene and the investigation and identify what key information and*

evidence would be most helpful to you to get a clear picture of it. The laboratory analyst will try to develop a mental picture of the crime scene that is as good as (or possibly better than) the one you yourself have. The quality, not necessarily the quantity, of the evidence available will often determine the final result.

Crime scene administration, that is, command and control, is a subject beyond the scope of this discussion; however, it should be stressed that the prosecutor's investigator who is involved with the activities below should not be hampered with the responsibilities of protecting the scene and directing the activities of others. Whatever the situation, control of the scene must be maintained.

"DURING THE SEARCH OF THE SCENE, OBJECTIVES WHICH SHOULD BE MAJOR PRIORITIES INCLUDE: PRESERVATION, DOCUMENTATION AND COLLECTION."

During the search of the scene, objectives which should be major priorities include: *preservation, documentation, and collection* of the stains, patterns, and physical evidence at the scene. While this is, in principle, no different from any other crime scene, the uniqueness of bloodstain patterns adds a new dimension to the task at hand. More than likely, the fruits of the efforts of the prosecutor's investigator will fall within more than one of the categories below.

EVIDENCE TO CONSIDER

Graphic Information

GRAPHIC INFORMATION in the form of clear, informative sketches, diagrams, drawings, maps (topographical, road, or hand-drawn as appropriate), with dimensions, should define the crime scene. Sketch and locate stains and stain

patterns to static features of the scene such as corners of rooms, walls, floors, ceilings, attached cabinets, etc., using two measurements, each taken from fixed points. Where it may be necessary to reproduce objects for courtroom presentation (graphically or physically), remember to record length, width, and height and any unique features about the objects. Scale drawings can be very helpful and are certainly preferred. Computer graphics programs are now available in many departments and can often be a great help to all concerned. In any event, it should be remembered that crime scene sketches supplement, but cannot replace, photographs and vice versa.

Narrative Information

COMPREHENSIVE AND DETAILED CRIME SCENE REPORTS prepared by crime scene specialists are not a routine procedure in many departments. Often the volume of work and available resources preclude this. Such reports, however, include valuable information on the events thought to have occurred, the features of the scene itself, physical descriptions of the individuals involved, and the injuries sustained. Such information as right or left handedness, association with drugs or alcohol, medication, and infectious diseases is also of value. Narrative coverage should also include a description of the scene (in- or out-of-doors) and weather or environmental conditions such as temperature, winds, precipitation, presence of oscillating fans, and open windows. Observations of any blood pools and stains should also be recorded (wet, drying, dry, mixed with other substances or fluids, etc.) in a crime scene report.

Investigative reports often contain recorded interviews with witnesses which detail particular actions or scenarios. Additionally, any information on events which are supposed not to have happened should be documented. When providing narrative information, avoid large amounts of information which reflect unproductive investigation, such as interviews of persons who may not have seen or contributed anything of value.

An autopsy report is normally prepared by a medical examiner or pathologist to record the observations made during the post-mortem examination of the deceased. It will usually include a description of the body and the specific nature of the injuries sustained. A review of the autopsy report is often helpful in gaining a picture of the wounds and the manner, angle, and direction in or from which they were inflicted.

Photographic Information

PHOTOGRAPHIC DOCUMENTATION of the scene with large format color photography will not only make it possible for an analyst to better "learn" the scene, but will eventually provide an opportunity for the jury to view the scene as

well. Color prints (eight-by-ten-inch) and the original negatives should be provided for examination. Too many photographs are usually better than not enough. If a departmental limitation exists as to the number of photographs that may be taken at a scene, some reconsideration may need to be done. *Small instant print format cameras rarely provide the detail and clarity required for the analysis of blood-stain patterns.* Negatives of sufficient size to allow clear, sharp enlargements should be the objective. Normally, this will mean 35 mm or larger format. Photographs should both supplement and complement the sketches and narrative information.

The scene should be photographed as soon as possible and without people (and people's feet) in the way. Any delay in completing the photography process may allow time for evidence to be relocated or contaminated, whether inadvertent or not. Include recognizable scales and the identification date wherever possible. Such scales should have sufficient contrast to photograph well. Standard measure may be used for medium or more distant photographs, but metric is preferred for close-up views of bloodstains and patterns.

With video recording technology as readily available as it is, a natural thought is to videotape the scene. In many departments this is standard operating procedure. Videotaping will often provide useful information; however, it should be recognized that normally-available video equipment (both recording and playback) is not capable of producing the highly-resolved detail desirable for the analysis of individual stain patterns. Thus, videotaping can

be helpful to gain an overall perspective of the scene, but the specific detail of stains and stain patterns can be better recorded with still photography.

A. Outdoor Scenes

- Use of distance photographs will help to document and establish the location of the scene by including landmarks and unique features in the immediate vicinity. In approaching the scene, a logically organized photographic record is often far more informative than random photographs taken of features as they are encountered.
- Medium range photographs should be used to record relative positions of more closely related items and larger stain patterns within the scene itself.
- Close-up photographs of individual items will establish the nature of the items as found and the presence of any bloodstains or stain patterns. Remember to include a scale and some means of relating the photographs to the scene for later orientation.

B. Indoor Scenes

- As above, the use of distance photographs will help to document and establish the location of the scene by including landmarks and unique features in the immedi-

"VIDEOTAPING CAN BE HELPFUL TO GAIN AN OVERALL PERSPECTIVE OF THE SCENE, BUT THE SPECIFIC DETAIL OF STAINS AND STAIN PATTERNS CAN BE BETTER RECORDED WITH STILL PHOTOGRAPHY."

ate vicinity. In indoor scenes it is even more important to have a logically organized photographic record rather than random photographs. When entering a room, for example, it may be helpful to take an initial series of photographs sequentially in a clockwise or counterclockwise fashion, documenting the overall features of the room before concentrating on specific details. The specific order in which the photographs are taken is not critical, but using a photographic log with an organized approach will help ensure that the scene is completely documented.

A recent case encountered by the author involved a victim whose body had been moved during the photodocumentation process but no log was kept of the photos or the activities. Only a small number of photographs were provided for examination. Bloodstains in different photographs were inconsistent, with no explanation available. Such an approach is best avoided.

- Photographs of rooms and other interior areas from typical observation points with various lenses (wide angle, telephoto, zoom, etc.) will help establish relationships between objects in the room. Views of an area from the same vantage point using different magnification can be very useful in gaining an overall perspective of the area of study.
- Close-up views with appropriate scales should be used to show details on individual items and particular stains and patterns. Remember, a photograph of a stain with nothing to relate it to its original position and orientation in the overall scene is rarely of any significant value.

C. Photographs of Stains and Stain Patterns

- Take photographs perpendicular to the surface bearing the stains whenever possible and include a scale. *Be aware, however, that a flash used carelessly may wash out stain pattern detail or reflect from a scale with a reflective surface.*
- Insure that a deceased individual is photographed from all vantage points *before* the body is moved. Any movement of the body should then be documented with photography. Bloodstains on the body surface or in the immediate vicinity of the body (particularly bloodstains which can be shown to have fallen vertically to the surface bearing them) may be the result of blood dripping from a weapon or an injured attacker.
- Be alert to such features as voids (an absence of bloodstains within a pattern which might indicate an object masking or shielding a surface from the deposition of blood). In-line cast-off stains such as might be thrown from a blood-bearing object being swung may be present on walls or ceilings (*always* look overhead).

Physical Evidence

IT WILL PROBABLY BE NECESSARY to secure, collect, and package items of physical evidence (clothing, weapons, etc.) bearing blood or trace evidence to prevent loss. This should be accomplished with as little disturbance as possible to bloodstain patterns present. It may be necessary to document or collect some patterns immediately to avoid their distortion or destruction. A good photographic record may be sufficient. Normally, however, bloodstains should be allowed to dry as much as possible before movement of evi-

dence (and packaging), to avoid creating new stains not related to the commission of the crime. Drying of bloodstains also helps to arrest the biological degradation of the biochemical constituents of the stains which are important to serological and DNA analysis.

Physical evidence bearing bloodstain patterns which might crack or flake off (particularly those on non-absorbent surfaces) should be thoroughly described and photographed (with a scale) to document the stains in their original condition and orientation. Valuable stains can be lost completely with a gust of wind. Patterns on such surfaces *which are not to be used for any other analysis including latent fingerprints* may be sprayed gently with clear polyurethane to adhere the stains to the surface before collection of the evidence. *Be aware* that this will probably interfere with future efforts at latent fingerprint and biochemical analysis, so consider your options.

If bloodstain lifts are necessary for preservation and later examination, they should be made only by or with the specific advice of an individual trained and experienced in bloodstain pattern examinations. Often the spraying technique described above is preferable to lifting tape. When such lifts are made for examination away from the scene, they *must* contain some indicators (arrows, measurements, etc.) to orient accurately the stains within the overall scene.

Chemical Visualization of Bloodstain Patterns—Luminol

OCCASIONALLY THE QUESTION of detecting bloodstain patterns with luminol arises. Luminol is an organic compound

which may be used as a presumptive blood identification test. Like any presumptive test, it cannot be interpreted as a positive identifier of blood; however, it does provide strong evidence to indicate blood is present. The test is based on a chemical oxidation reaction which results in a blue-white to yellowish glow in darkness when blood is present. It is very sensitive and is best used when blood is thought to be present but cannot be seen (normally due to cleaning efforts). When the luminol preparation is sprayed over a suspected bloodstained area in darkness, an immediate glow which may last for 30 seconds will indicate the presence of blood residues. The advantage of the glow, which can be photographed, is in the definition, configuration, and distribution of the bloodstain patterns present.

While luminol represents an advantage in processing large areas at crime scenes, it should not be used on clearly-visible bloodstains until samples are taken for analysis. Stains that are clearly visible will, in all probability, be sufficient in quantity to allow biochemical analysis (blood typing and DNA analysis) to determine possible origin. Stains too limited to be seen will probably not represent sufficient amounts to allow further characterization. Addition of luminol to an already visible stain will thus potentially interfere with subsequent biochemical analysis. Robert Grispino, in an article published in *The Prosecutor* several years ago (see References), presented a more lengthy treatment of the subject of luminol.

CONCLUSION

THE ABOVE GUIDELINES FOR PROSECUTORS, prosecutors' investigators, and law enforcement agencies, will apply in many cases whether the scene and evidence are examined in place by an analyst or all of the information and evidence is collected and sent to a laboratory. While considerable detail is involved, the material is not intended to be all-inclusive. There will be situations not covered by the foregoing discussion which may require independent action or communication with a bloodstain pattern analyst. Finally, it should be recognized by the prosecutor that an important point in the process is arriving at a well-founded decision that bloodstain pattern work will provide probative information and aid the investigation. Once that decision is made, the more routine time and effort required will be well invested.

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Peter R. DeForest, Robert E. Gaensslen & Henry C. Lee, *Forensic Science, and Introduction to Criminalistics* (1983).
Terry L. Laber and Barton P. Epstein, *Bloodstain Pattern Analysis* (1983).
Zweidinger, "Photography of Bloodstains Visualized by Luminol," 18 *Journal of Forensic Sciences* 296-302 (1973).

Determination of Angle of Impact

Blood droplets which impact a surface at an angle other than 90° (perpendicular to the surface) will produce an elliptical stain. The more acute the angle of impact, the more extreme the ellipse. Determination of the angle of impact involves measurement of the major axis (length) and minor axis (width) of this elliptical stain. When the length is divided into the width, the resulting value is the sine of the angle of impact.

Measure length and width of each of the bloodstains. See figure detailing proper measurement of stains.

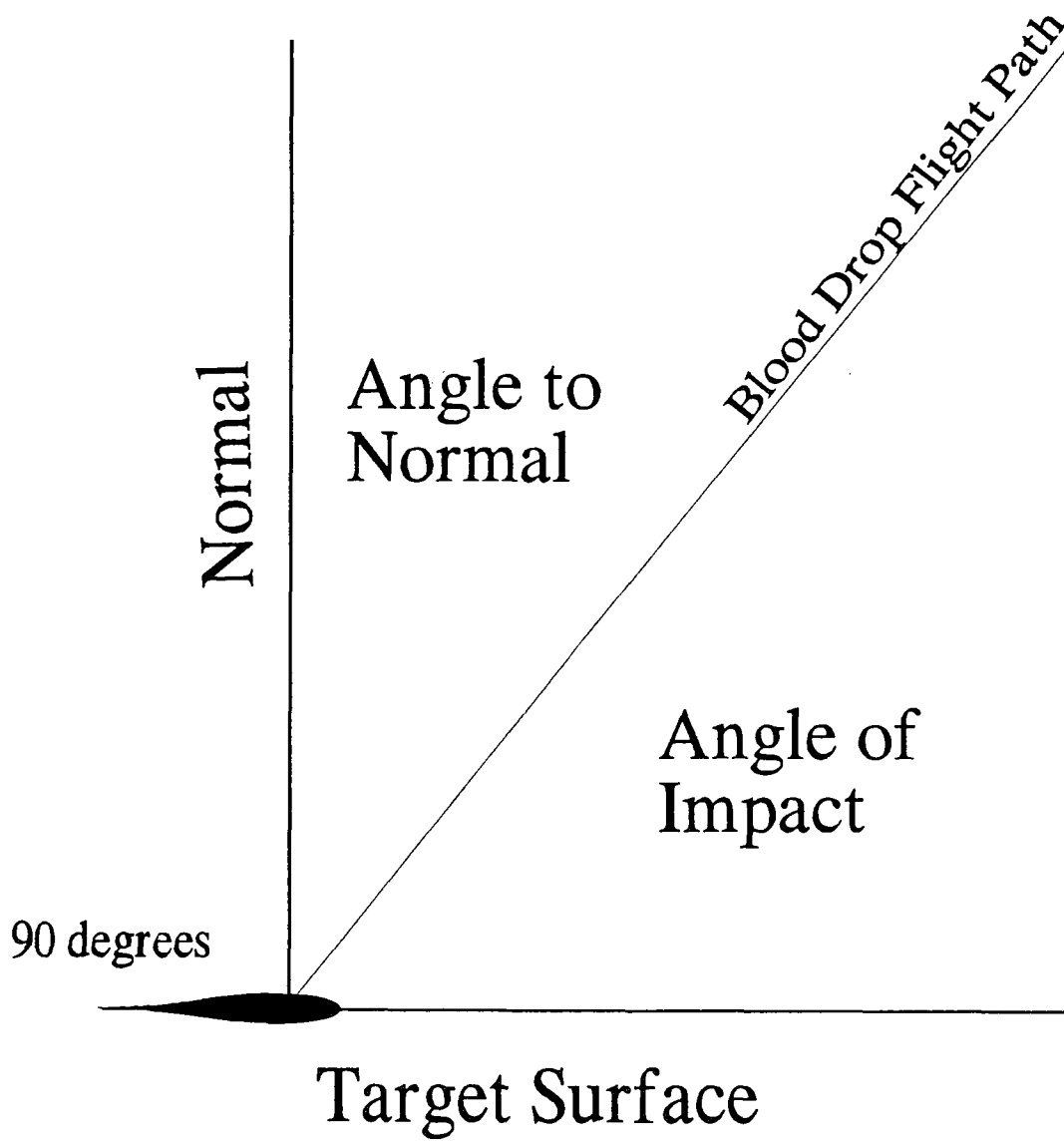
Divide width by length to get sine of the impact angle:

$$\text{Sine of impact angle} = W/L$$

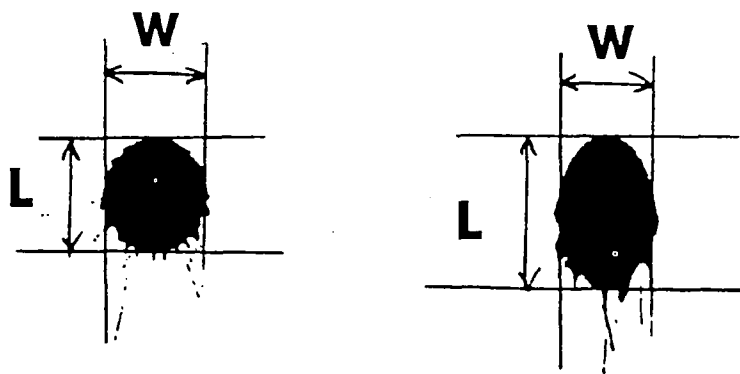
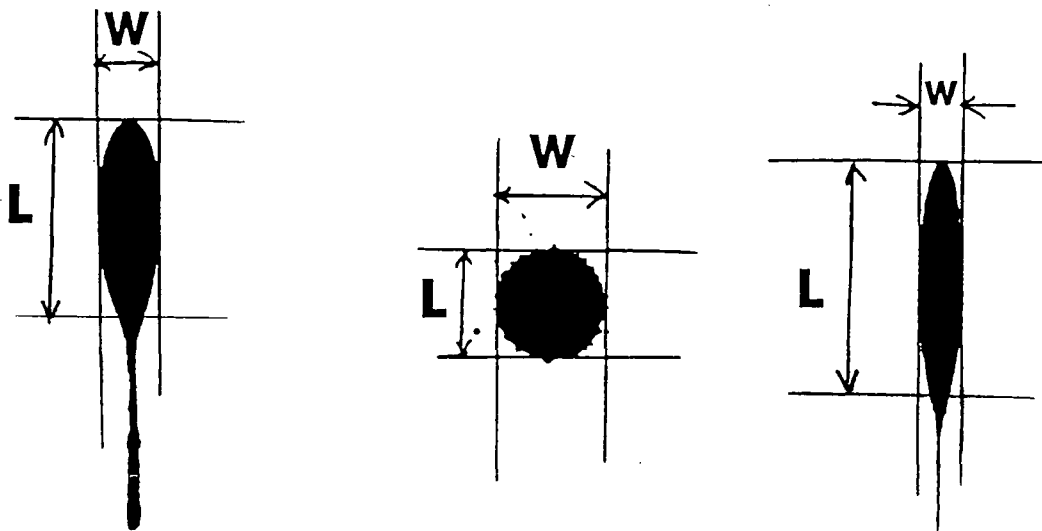
Use the data table to record your results and confirm them with the instructor.

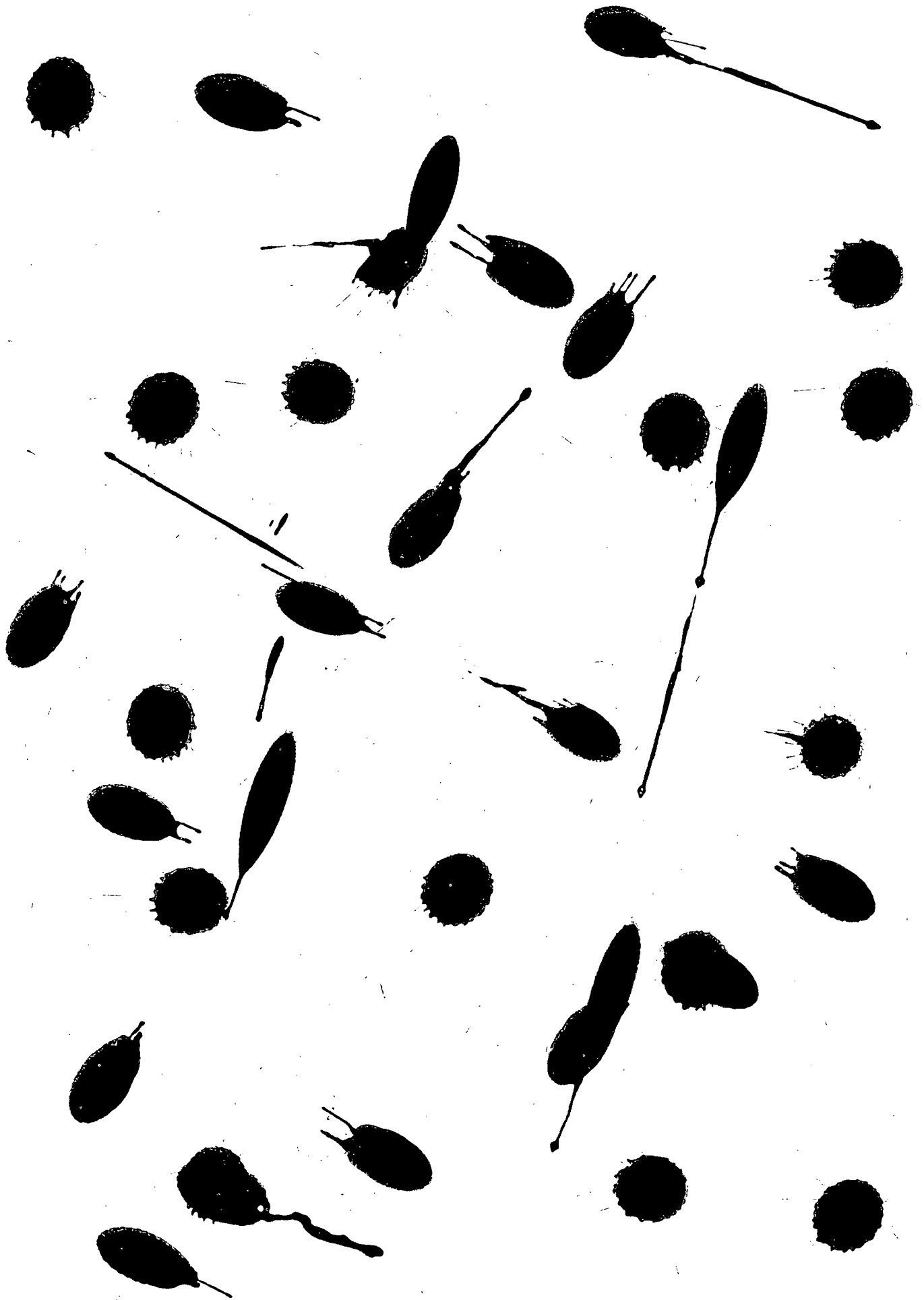
Extreme care should be taken to avoid measuring the length too long. Practice is necessary to gain the ability to recognize the curvature of the ellipse covered by the leading edge distortion.

Angle of Impact



Measuring Length and Width of Bloodstains

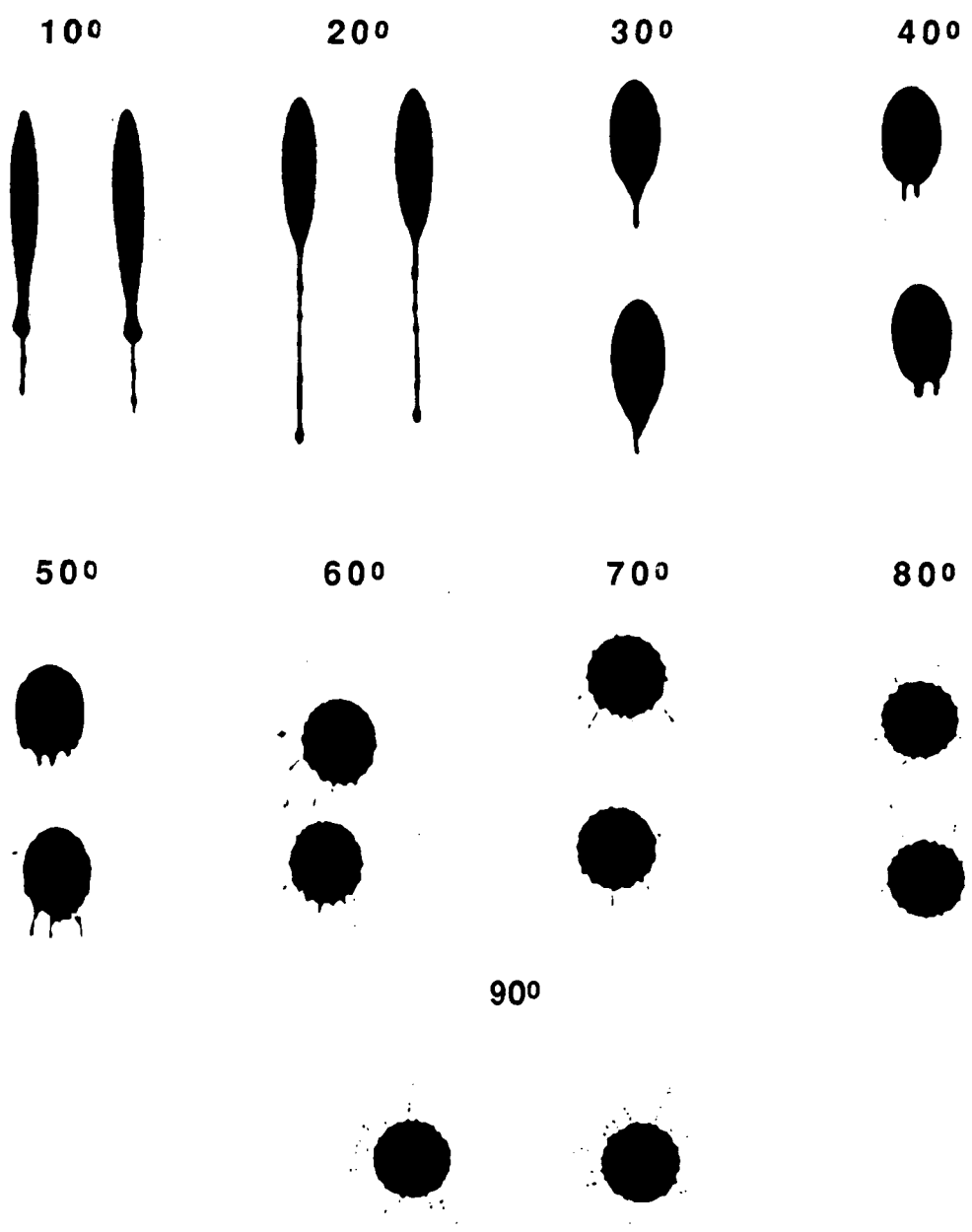




WORKSHEET - BLOODSTAINS OF UNKNOWN IMPACT ANGLES

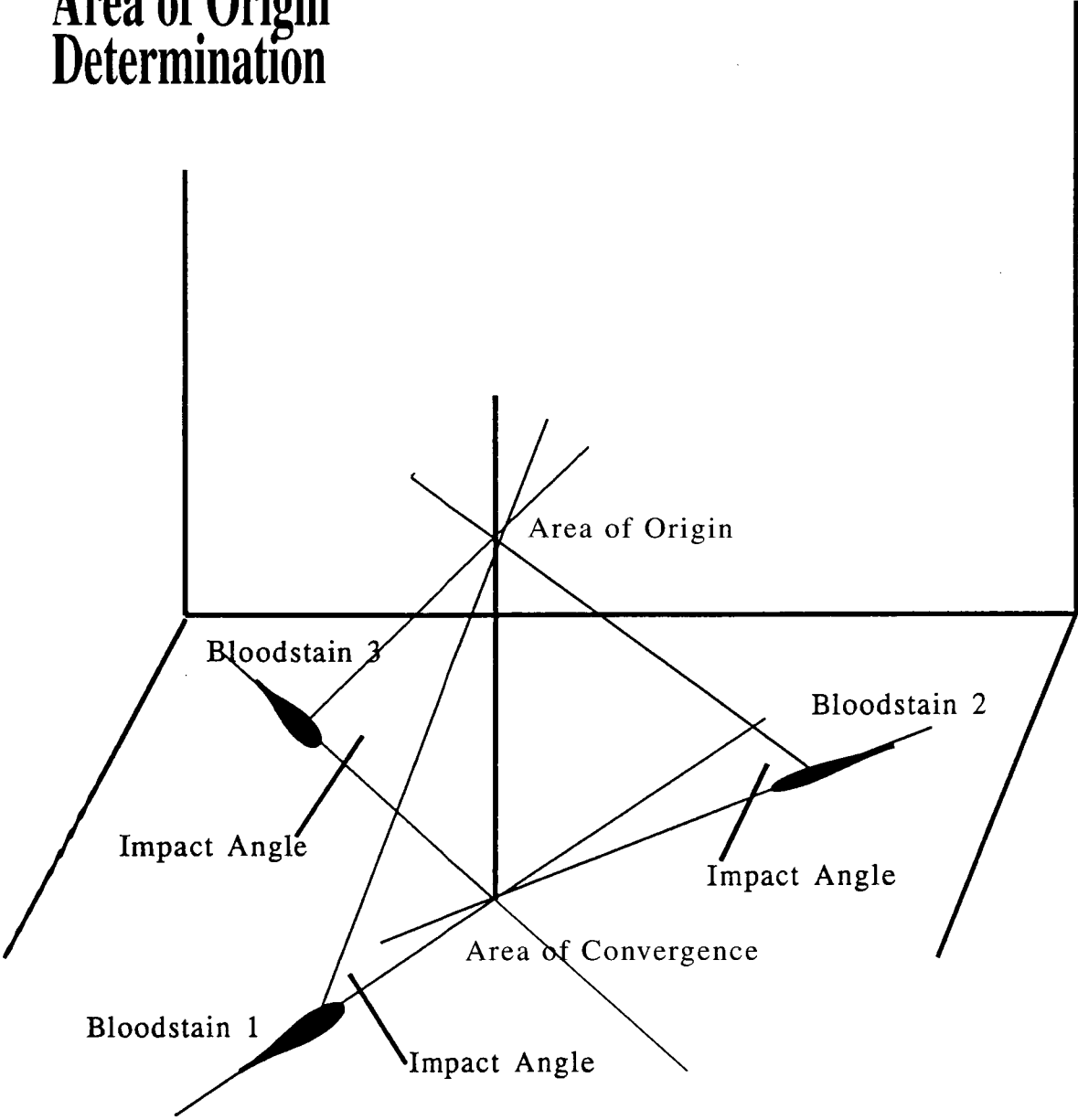
STAIN	WIDTH OF ELLIPSE	LENGTH OF ELLIPSE	W/L RATIO	ANGLE OF IMPACT
A				
B				
C				
D				
E				
F				
G				
H				

INTERNAL ANGLES OF IMPACT



Notes

Area of Origin Determination



HOMICIDE BY POISONING

Homicide By Poisoning

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Introduction

One of the most perplexing cases for a death investigator is a death by poison. Many times poison is not even considered when an elderly person dies or becomes violently ill. Also to be considered are hospital patients who die while under treatment for various illnesses.

If a medical examiner does not do toxicological testing for poison, it will not be found, as it does not cause any marked change in tissue in most cases.

The availability of poison is surprising. Most hardware stores carry a full line of insect sprays and ant/roach killers, most of which contain arsenic.

The cost of testing for poison is another factor to be considered when investigating a suspected poison death.

II. Statistics of Poisoning Cases

- A. The amounts and types of toxic substances ingested by or injected into individuals either by accident or on purpose is hard to believe. The 430 Poison Control Centers throughout the U.S. report 1.5 million calls yearly where potentially toxic substances were involved. Of the 1.5 million calls, 91% occurred in the home; 60% of these were children under 7 years of age.
- B. From 1979-1982, 21,600 children between birth and 9 years of age were hospitalized for poisoning.
- C. In 1980 there were 10,968 poisoning deaths reported in the U.S. Of these, 4,331 (39.5%) were accidental deaths and 5,453 (49.7%) were suicides.
- D. Poisoning patterns have changed dramatically as a result of the availability of new drugs and the passage of the Child-Resistant Packaging Law.
- E. Pharmaceuticals, both prescription and over-the-counter medications, account for about 40% of exposures in children under the age of 5, followed by cleaners, polishes, and plants. Vitamins are among the pharmaceutical products most often involved, accounting for 14.1% of exposures in one series.
- F. Type of drug depends on the area of the country. A hospital in Boston reported that in 1978, salicylates were the drugs involved in most cases, followed by diazepam, acetaminophen, and vitamins.

III. Historical Look at Homicides Involving Poison

- A. Prehistoric man
Observation led to knowledge
Knowledge led to power
Power led to mystery
- B. Greeks--toxicant poison (shot with an arrow)
- C. William Palmer, MD (The Rugeley Poisoner)
motive: money (was a gambler)
poison: antimony
time: 1855, Rugeley Staffordshire, England
outcome: hanged June 14, 1856
- D. Edward William Pritchard, MD
poison: antimony
victims: wife and mother-in-law
time: 1865, Glasgow, Scotland
outcome: hanged
- E. George Henry Lamson, MD
motive: money (morphine addiction)
poison: aconite (given in Dundee cake)
victim: brother-in-law
time: December 1881, England
outcome: hanged April 28, 1882
- F. Thomas Neil Cream, MD
motive: sadism (hated prostitutes)
poison: strychnine
time: 1891, London
outcome: hanged November 15, 1892
- G. Cordelia Botkin
motive: love and jealousy
poison: arsenic
victims: lover's wife and sister
time: August 9, 1898, Dover, Delaware
outcome: died in San Quentin, 1909, life imprisonment
- H. Johann Otto Huch
motive: money (an opportunist)
poison: arsenic
victims: 12-24 wives
outcome: hanged
- I. Hawley Harvey Crippen, MD
motive: mistress
poison: hyoscine

victim: wife (dismembered)
time: March 1910
outcome: executed November 23, 1910, England (born in Coldwater, Michigan)

- J. Frederick H. and Mary A. Seddon
motive: money
poison: arsenic (from fly papers)
victims: husband and wife
time: September 14, 1911, England
outcome: Fred was executed April 18, 1912; Mary was found not guilty
- K. Henri Girard (The First Scientific Murderer)
motive: a financial manipulator
time: 1912, Paris
outcome: committed suicide
- L. Henri Desire Landru
motive: money (an opportunist)
poison: cyanide
victims: 11 or more women
time: 1914, France
- M. Arthur Warren Waite (oral surgeon)
motive: money and mistress
poison: arsenic
victims: mother-in-law and father-in-law
time: January-March 1916, New York
outcome: electrocuted at Sing Sing May 24, 1917
- N. Kreisberg (grocer); Murphy (barman); Marino (bar owner);
Pasqua (undertaker); Green (taxi driver)
motive: life insurance money (\$800 - \$1,600)
poison: natural gas, antifreeze, tried to kill him several ways
victim: Mike Malloy
time: January 1933, New York City
outcome: all were electrocuted by Green (taxi driver)
- O. Sadamichi Hirasawa (artist and bank robber)
motive: money
poison: potassium cyanide
victims: 16 bank employees (12 died)
time: January 26 1948, Japan
outcome: died in prison serving life sentence
- P. Christa Lehman
poison: chocolate truffles laced with "E-605" (parathion)
victims: 3 neighbors

time: February 1954, Worms, Germany
outcome: life imprisonment

- Q. Graham Frederick Young (9 years in mental institution for prior poisoning attempts)
motive: poison obsession ego (felt he was above his peers & could fool everyone)
victims: boss and co-worker
time: 1971, England
outcome: life imprisonment July 1972; died at age 42 in 1989
- R. Ronald Clark O'Bryan (The Candy Man)
motive: insurance money (\$65,000)
poison: potassium cyanide in pixy stix candy straws
victim: son (8 years old)
time: October 31, 1974, Pasadena, Texas
outcome: executed March 31, 1984 by lethal injection
- S. James Warren Jones (leader of Peoples' Temple)
poison: cyanide (paranoid suicide/murder)
victim: mass suicide/murder
time: November 18, 1978, Guyana
outcome: death by self-infliction
- T. George Trepal
motive: bothered by neighbors
poison: thallium (bottles of Coke Classic)
victim: Peggy Carr and attempted on six other Carr family members
time: 1988, Bartow, Florida
outcome: guilty March 6, 1991; awaiting death in electric chair

IV. Types of Poisons: arsenic trioxide, potassium cyanide, strychnine sulfate, botulinus toxin, amanatin alpha, amanatin beta, cantharidin, thallium nitrate, sodium fluoroacetate

A. Thallium

1. Discovered in 1861, it was used as a medicinal agent for venereal disease, ringworm, gout, dysentery, and tuberculosis. Recent use: manufacture of imitation jewelry pigments, optical lenses, low-temp thermometers. Its use as a rodenticide was banned in 1965 because of accidental and suicidal exposures and its severe toxicity. Thallium is an acknowledged cumulative, homicidal poison. The average lethal adult dose is 1 g. of soluble thallium salt. The onset of thallium poisoning is insidious, reaching a maximum in 2 or 3 weeks, followed by gradual resolution or death.

2. Physical effects

a. immediate (3-4 hours)

Mostly gastrointestinal symptoms such as nausea, vomiting, and diarrhea. Hematemesis may occur.

b. intermediate (hours to days)

Central nervous system disorientation, lethargy, coma, convulsions, psychosis, thirst, insomnia, cerebral edema with central respiratory failure. Peripheral nervous system combined motor and sensory neuropathy, including severe hyperesthesia of palms and soles. Unlike Gullain-Barré Syndrome, stretch reflexes are preserved until late in the course of toxicity and prominent sensory changes precede motor weakness. Autonomic nervous system tachycardia, hypertension, fever, salivation, and sweating.

c. Late (24 weeks)

Dry scaly skin, white stripes across nails (Meer's lines), and scalp and facial hair loss.

d. Residual (months)

Central and peripheral nervous system abnormalities may persist, including ataxia, tremor, foot drop, and memory loss.

B. Arsenic

Arsenic has a long, nefarious history of use as a homicidal agent. It is an odorless, tasteless compound. Americans ingest an estimated 1 mg of arsenic daily in the water they drink. Arsenic is the most common cause of pesticide-induced deaths in children and is the most common cause of heavy-metal-related death, second only to lead. Ant pastes are a major source of exposure. (For effects, see Selenium)

C. Selenium

Selenium toxicity resembles arsenic toxicity.

1. Effects include: Hair loss, white horizontal streaking on fingernails, paronychia, fatigue, irritability, hyperreflexia, nausea, vomiting, garlic odor on breath, and metallic taste. Selenium poisoning also results in muscle tenderness, tremor, light-headedness, and facial flushing.
2. Acute ingestion of selenious acid is almost always fatal.
3. Stupor, respiratory depression, hypotension, and death can result several hours after ingestion.

D. Water Intoxication

Excessive water intake may result in severe neurologic symptoms and death. Hyponatremia--abnormally low sodium concentrations in blood. Causes of hyponatremia after excessive free-water intake:

1. Infants
 - a. feeding mismanagement
 - b. swimming lessons with water swallowing
 - c. vigorous hydration
 - d. use of dilute formulas
2. Adults
 - a. professional weight-loss programs (8-12 8 oz glasses per day)
 - b. Polydipsia associated with salt depletion or thiazide-induced decrease in urinary diluting capacity
 - c. Inappropriate secretion of antidiuretic hormone
 - d. Excessive water intake after accidental ingestion of caustics
 - e. Psychogenic polydipsia
 - f. Excessive beer drinking
 - g. Use of 5% dextrose in water as a vehicle for oxytocin for therapeutic abortions

E. Strychnine

1. Median lethal dosage

At one time strychnine was used as an appetite suppressant, aphrodisiac, and purgative. These uses have been discontinued. Strychnine is an alkaloid extracted from the dry seeds of the indian tree. The estimated lethal dose in humans is 5-8 mg/kg. Small children may develop symptoms with 15-20 mg; adults may develop

symptoms with 30-80 mg, and death occurs from 100 mg doses. Half of the absorbed dose is distributed to tissues within five minutes. Strychnine appears to excite all levels of the CNS, but stimulation at higher brain centers is much less than at the spinal cord. Symptoms begin rapidly (5 to 60 minutes), lasting 15-20 minutes.

2. Physical Effects

Affected persons will experience apprehension, fear, nausea, muscle twitching, feelings of depersonalization, and hyperreflexia within one hour. Severely affected persons progress to extensor spasm and opisthotonos, causing interference with breathing without loss of consciousness. Convulsions occur from 1-2 minutes at 5- to 10-minute intervals with extensor spasms. The patient usually remains conscious, but coma may follow repeated convulsions. The presence of symmetrical seizures, extensor spasms, trismus, opisthotonos, and risus sardonicus in awake patients strongly suggests strychnine poisoning. Respiratory depression secondary to spasms of the diaphragm is the major life-threatening emergency. There is no specific antidote available nor are there any effective elimination methods.

V. Medical Elements of Investigating Poisoning Cases¹

A. Medically, the basic approach to the poisoned patient is:

1. Stabilization
2. Complete patient evaluation (history, physical examination, laboratory tests)
3. Appropriate treatment to reduce absorption
4. Appropriate measures to improve elimination of the toxin
5. Consideration of the use of antidotes
6. Continuing care and disposition

B. However, the investigation of a poison case is extremely difficult because, in most cases, the crime scene is virtually nonexistent. The victim is usually diagnosed as being ill or dying from a disease.

Determining that a person has died as the result of homicidal poisoning is the most difficult type of investigation for law enforcement officers and medical experts. The general evidence of poisoning is obtained from a knowledge of the symptoms displayed by the decedent prior to death, the postmortem examination of the body by the pathologist, and the isolation and identification of the poison by the toxicologist. For successful prosecution of a suspect, law enforcement officers must establish a motive for the crime, access of the perpetrator to a supply of the poison, that he was aware of the lethal effects of the poison,

¹This section is by Dr. Alphonse Poklis, Director of Toxicology, Medical School of Virginia, Richmond, Virginia.

and had opportunities to administer the poison to the decedent. Each aspect of the investigation is dealt with below.

VI. Lack of Suspicion

- A. When the victim is attended prior to death by a physician, the doctor seldom, if ever, considers poisoning as a cause of the patient's illness. Only if the patient's occupation brings him into contact with toxic substances (works in a refinery, chemical or smelting plant; farmer who uses pesticides or herbicides) will the physician suspect a chemical intoxication.
- B. Self-poisoning (suicides or drug abuse) is common today; however, murder by poison is rare.
- C. Persons who resort to the use of poisons are usually very stupid or very clever. The stupid ones make obvious their crimes; the clever ones may never be unmasked.

VII. Signs and Symptoms Prior to Death

- A. There is rarely any symptom of poisoning that cannot equally well be caused by disease; however, there are conditions or symptoms that render a diagnosis of poisoning moderately certain. For example, the onset of symptoms immediately after eating or drinking, a progression of symptoms and rapid death indicate acute poisoning. (Bacterial food poisoning has a delayed onset of symptoms.)

Table 1. Symptoms That May Indicate Poisoning or a Pathological Condition

Symptom	Poison	Disease
Vomiting, Diarrhea, Rapid Collapse, Weak Pulse	Arsenic	Rupture of Gastric Ulcer, Inflammation of the Pancreas or Appendix
Convulsions	Strychnine	Tetanus
Contracted Pupils, Narcosis	Narcotics	Brain Lesions

- B. If medical assistance is called prior to death, the following should be noted:
1. Time medical personnel arrived
 2. The signs and symptoms of intoxication
 - a. condition of the pupils
 - b. pulse and respiratory rate
 - c. convulsions or paralysis
 - d. stomach pain
 3. Time the symptoms started and **their order**
 4. Smell and color of the subject's vomit, odor of breath
 5. Time of death
 6. All statements made by the victim

VIII. Evidence

- A. From the victim's residence and/or from witnesses obtain the following information:
1. All substances, food, and drink, that the deceased ingested 24 hours prior to the onset of the symptoms. **If still available, collect all such items.**
 2. Time of last meal or drink.
 3. The state of health of the victim prior to the onset of symptoms.
 4. Did others who shared the deceased's last meal become sick; if so, what were the symptoms.
 5. Had the subject ever attempted suicide (suicide defense)
 6. Where poisons and medicines were kept.
 7. Inquire of the victim's personal physician all pertinent medical information.

B. Collection of evidence at the scene

Remember that in all legal cases, it is essential that the proper chain of custody of evidence be maintained. Conduct a complete and thorough search of the premises where the deceased was found and collect the following:

1. All medicine bottles, hypodermic syringes, etc.
2. All empty, partially empty, or opened containers of poisons or medicines
3. All food the victim may have recently eaten. Place each item in a separate clean glass container (rinse the container with water prior to use and submit a sample of the rinse water to the laboratory with the samples), close and seal, and label.
4. All utensils, plates, cuts, etc., used for recent eating and drinking.
5. Garbage left from the victim's last meal.
6. Vomit, urine, excretion of the victim prior to death.
7. Soiled linen or clothes of the deceased.

IX. Postmortem Examination of the Body

- A. The pathologist can recognize the effects of certain poisons at autopsy. Strong acids and alkalis may cause extensive burns around mouth or on the surface of the body and severe destruction of the tissues. Metallic poisons may cause intensive damage to the gastrointestinal tract, liver, and kidneys. Phosphorous causes gross fatty degeneration of the liver.
- B. Most drugs and poisons do not produce characteristic pathological lesions and can only be demonstrated in the body by toxicologic analysis.
- C. In many instances of poisoning, the value of the pathologist's examination is the establishment that death was not due to natural causes or traumatic injury, that there is not evidence for death except from possible poisoning.

X. Toxicologic Examination

- A. Death due to poisoning cannot be established without contention unless the agent can be demonstrated in the body by chemical methods of isolation and identification.

- B. The stomach and the intestines are "legally" considered outside the body. The presence of the poison must be established in blood, liver, or other tissues in the body.
- C. The presence of a poison in urine only indicates that it was **at some time** present in the body; the significance of urine levels is subject to question.
- D. There are thousands of compounds that are lethal if ingested, and the toxicologist has only a limited amount of material on which to perform analysis; therefore, it is imperative that the investigators supply the toxicologist with as much information as possible concerning the facts of the case. The possible identity of the poison in question would greatly help.
- E. Embalming and putrefaction may greatly hinder the toxicologist's work.
- F. Many poisons are rapidly biotransformed or excreted by the body; in such cases only the biotransformation products (metabolites) or low levels of the poisons may be detected.
- G. Many poisons can be detected for many years after death (arsenic).

XI. Collection and Preservation of Specimens

- A. All specimens, whether food or garbage or tissues obtained at autopsy, should be placed in separate containers. Glass jars with screw tops (mason jars) or plastic bags are acceptable.
- B. Each container should be labeled and the identification should bear the date and time of collection, the name of the victim, the identity of the sample and the signature of the law enforcement person or pathologist.
- C. All containers should be sealed and initiated by the person collecting the sample.
- D. When exhibits are handled by several persons and when they are accepted by the analyst, a written receipt must be obtained, one that **can subsequently be produced in court**.

PROFILES OF COMMON HOMICIDAL POISONS

by

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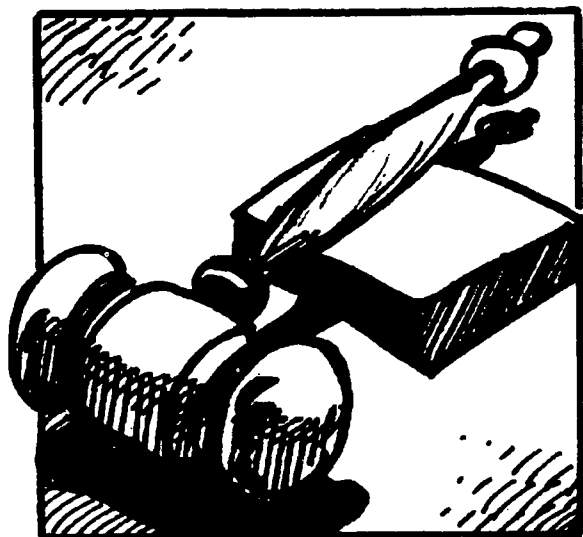


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INTRODUCTION

These **substance profiles** are designed for the use of law enforcement officers responding to scenes of potential poisoning homicides. This material describes the essential features of some of the more commonly utilized homicidal poisons.

Homicide should always be suspected in the case of a sudden death, and certainly poisoning must always be considered when there are no visible signs of trauma in a normally healthy individual now deceased! Poisoning fatalities can result from: accidents, or suicide, as well as from homicidal causes.

Always remember the essentials of crime scene investigation:

1. Until facts prove otherwise, a death **MUST** be considered a homicide.
2. All things **MUST** be considered as potential evidence.
3. After the crime scene has been secured, the appropriate homicide investigators **MUST** be notified immediately.
4. The proper chain-of-custody for evidence **MUST** be maintained!
5. To establish death from poisoning, the presence of the poison **MUST** be proven, by means of analytical methods.
6. The gut is like a garden hose (hollow and open at both ends). In order to cause death, the poison **MUST** be absorbed through the walls of the gut and enter the body's systemic circulation.
7. "When you have eliminated the impossible, whatever remains, however improbable, **MUST** be the truth" - (Sherlock Holmes, The Sign of Four).

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ARSENIC THE POISON

FORM: metallic Arsenic (As) is a steel-gray, brittle metal. Arsenic trichloride (AsCl_3) is an oily liquid. Arsenic trioxide (As_2O_3) is a crystalline solid. It can also exist as Arsine gas (AsH_3). Lewisite, a war gas, is a derivative of arsine.

COLOR: metal (steel-gray), salts (white powder).

ODOR: odorless, but Arsenic can produce a garlicky odor to the breath.

SOLUBILITY: Arsenical salts are water soluble.

TASTE: almost tasteless.

SOURCE: pesticides, rodent poison, ant poison, homeopathic medications, weed killers, marine (Copper arsenate) and other paints, ceramics, livestock feed.

LETHAL DOSE:

ACUTE	CHRONIC
200 mg (As_2O_3)	?

HOW IT KILLS: Arsenic is a general protoplasmic poison, it combines with sulfhydryl ($-\text{SH}$) groups on enzymes to inhibit their normal function. This results in disruption of normal metabolic pathways related to energy transfer.

POISON NOTES: the trivalent Arsenic (As^{+3}) is MORE toxic than the pentavalent (As^{+5}) form. Arsenic is one of the oldest poisons used by man.

THE VICTIM OF ARSENIC

ADMINISTERED: often administered to victim in food or drink.

SYMPTOM ONSET TIME INTERVAL: hours to days

SYMPTOMS - ACUTE: GI (30 minutes to 2 hours post exposure) = vomiting, bloody diarrhea, severe abdominal pain, burning esophageal pain, metallic taste in the mouth. Later symptoms include: jaundice, kidney failure, and peripheral neuropathies (destruction of the nervous system). Death from circulatory failure within 24 hours to 4 days.

SYMPTOMS - CHRONIC: GI (diarrhea, abdominal pain), skin (hyper pigmentation of palms and soles), nervous system (symmetrical sensory neuropathy with numbness and loss of vibratory or positional sense, burning pain on the soles of the feet), localized edema (face, ankles), sore

throat, stomatitis, pruritis, cough, tearing, salivation, garlic odor on breath, Aldrich-Mees lines (horizontal white lines which normally take 5 to 6 weeks to appear after the exposed nail bed area grows), hair loss.

DISEASE CONFUSION: gastroenteritis, neurological disease.

VICTIM NOTES: in homicides the amount of Arsenic administered could be a large *ACUTE* dose, or chronically in small *CHRONIC* doses to make the symptoms appear like a progressing natural illness. In suicides, the amount of Arsenic taken is usually large.

THE DETECTION OF ARSENIC

SPECIMENS: food, beverages, medications, blood, urine, gastric contents, hair, nails, autopsy organ specimens.

METHOD: colorimetric, atomic absorption (AA).

TOXIC LEVELS:

BLOOD	URINE	GASTRIC	OTHER
0.6-9.3 mg/Liter	3,300 mcg/Liter	?	3 ppm (hair/nails) >1 mcg/gm dry weight

ANALYSIS NOTES: Arsenic can be detected in hair and bones many years after the poisoning. Several hairs pulled out by the root should be sent for analysis, with a clear indication of which end of the hair is the root. Segmented hair analysis using neutron activation gives an indication of arsenic exposure over the last several months.

SELECTED ARSENIC HOMICIDE CASES

Mary Blandy - 1752	Mabel Greenwood Case - 1919
Madeline Smith - 1857	Herbert Armstrong - 1921
Florence Maybrick - 1889	Michael Swango - 1985
Johann Hoch - 1905	Marie Hilley - 1986
Henry Seddon - 1911	Blanche Moore - 1988

Revised: November 16, 1997

CYANIDE THE POISON

FORM: in liquid form, hydrogen cyanide (HCN) is also known as "Prussic Acid". Pure hydrogen cyanide is a gas which is usually made by mixing an acid with cyanide salts. It is more commonly

found in form of its Sodium, Potassium, or Calcium salts, which are crystalline materials. Industrial cyanide can take the form of large nuggets called cyanide eggs".

COLOR: the sodium and potassium salts of HCN are white.

ODOR: supposed to elicit the odor of almonds to some persons (**NOTE:** 40-60% of the population can *NOT* detect the odor due to a genetic difference - a form of "odor blindness").

SOLUBILITY: the salts of cyanide are easily dissolved in aqueous liquids. Acidic liquids would cause the release of some HCN gas.

TASTE: salts of cyanide have a bitter (alkaline) taste, and can have a mild corrosive action on tissues.

SOURCE: fumigants, insecticides, rodenticides, metal polishes (especially silver polish), electroplating solutions, metallurgy for the extraction of gold and silver from ore, photographic processing, jewelers, and chemical laboratories. Contained as cyanogenic glycosides inside the pits and seeds of certain plants of genus *Prunus* (i.e. cherry, peach, bitter almonds, cassava, Laetrile, etc.). Cyanide can also be produced by the action of flame on certain synthetic plastic materials polyurethane & polyacrylonitrile). Also in the intravenous antihypertensive drug Sodium nitroprusside (Nipride). Cyanide is also found used in the most commonly employed method of synthesizing Phencylidine (PCP).

LETHAL DOSE:

ACUTE	CHRONIC
270 ppm (air)	?
50 mg (HCN)	?
200-300 mg (NaCN or KCN)	?

HOW IT KILLS: Cyanide shuts down respirations at the cellular level by inactivating essential enzymes resulting in metabolic asphyxiation. Critical effects are on those organs most sensitive to oxygen deprivation (brain & heart).

POISON NOTES: extreme care must be taken in providing mouth-to-mouth respiration support to victim, to avoid contamination of the individual providing aid!

THE CYANIDE VICTIM

ADMINISTERED: often administered to victim in food or drink.

SYMPTOM ONSET TIME INTERVAL: immediate (as little as 30 seconds), few poisons are as rapidly lethal!

SYMPTOMS - ACUTE: headache, nausea, vomiting, difficult breathing, and confusion. These initial symptoms are rapidly followed by: seizures, coma, gasping respirations, and cardiovascular collapse.

SYMPTOMS - CHRONIC: *NOT* applicable.

DISEASE CONFUSION: heart attack, acute asthmatic attack.

VICTIM NOTES: an abrupt onset of profound symptoms after exposure is classic for cyanide exposure.

THE DETECTION OF CYANIDE

SPECIMENS: food, beverages, medications, blood, urine, gastric contents, and autopsy organ specimens.

METHOD: colorimetric techniques

TOXIC LEVELS:

BLOOD	URINE	GASTRIC	OTHER
12.4 mg/Liter	0.1 mg/Liter	?	?

ANALYSIS NOTES: toxic levels of cyanide in tissues may diminish significantly after death by mechanisms that include evaporation, thiocyanate formation, and reaction with tissue components. The formation of cyanide in postmortem tissues with accumulation to toxicologically significant levels apparently from the conversion of thiocyanate to cyanide, has been demonstrated, but can be prevented by the addition of Sodium fluoride (NaF). Blood specimens should be kept at temperatures from -20 to 4 degrees Centigrade to reduce losses.

SELECTED CYANIDE HOMICIDE CASES

Theodosius Boughton Case - 1781

Dr. Collidge - 1847

Mrs. MacFarland Case - 1911

Twigg/Elosser Case - 1911

Jessie Costello - 1933

Ronald O'Bryan - 1974

People's Temple Case - 1978

Tylenol tampering (Chicago)- 1982

Donald Harvey - 1987

Stella Nickel - 1988

Revised: November 16, 1997

STRYCHNINE THE POISON

FORM: Strychnine is an alkaloidal plant compound obtained from the tree *Strychnos nux-vomica*. The seeds are discs (1 inch diameter, 0.25 inch thick at the rim), with a central depression, gray-green in color, and a satin-like appearance. Pure Strychnine alkaloid is a white powder.

COLOR: white, crystalline powder.

ODOR: none that is characteristic.

SOLUBILITY: soluble in aqueous solutions.

TASTE: Strychnine is extremely bitter, with a taste that is detectable at a dilution of 1:100,000. Strychnine could be administered in alcohol, if the victim was used to bitter drinks (tonic water). Strychnine can also be introduced into foods that normally have a sour or bitter taste.

SOURCE: rodenticides (concentrations over 0.5% are currently distributed only to licensed exterminators), sometimes found as an adulterant in illicit drugs. At one time Strychnine was sold over-the-counter as an ingredient in a variety of stimulant tonics and laxatives.

LETHAL DOSE:

ACUTE	CHRONIC
5-8 mg/Kg	?
30-100 mg (oral)	?

HOW IT KILLS: respiratory arrest.

POISON NOTES:

THE VICTIM OF STRYCHNINE

ADMINISTERED: food, beverages, medications.

SYMPTOM ONSET TIME INTERVAL: 15-30 minutes (oral route), 5 minutes (IV or nasal route).

SYMPTOMS - ACUTE: muscle stiffness and painful cramps which precede generalized muscle contractions. The victim's body may take the form of an arch (with only head and heels touching the floor) -- this is called an "*opisthotonic*" convulsion. The face may be drawn into a forced smile or sardonic grin "*risus sardonicus*". The muscle contractions (spasms) are intermittent and can be easily triggered by emotional or physical stimuli (sound, touch, light). Death is usually due to respiratory arrest.

SYMPTOMS - CHRONIC: ?

DISEASE CONFUSION: grand mal seizures, tetanus.

VICTIM NOTES: Strychnine does *NOT* cause true seizures, and the patient is awake and painfully aware of the contractions.

THE DETECTION OF STRYCHNINE

SPECIMENS: food, beverages, medications, blood, urine, gastric contents, autopsy organ specimens.

METHOD: colorimetry, ultra-violet (UV) spectrophotometry, or gas chromatography (GC).

TOXIC LEVELS:

BLOOD	URINE	GASTRIC	OTHER
21 mcg/ml	9.1 mcg/ml	61 mcg/ml	?

ANALYSIS NOTES:

SELECTED STRYCHNINE HOMICIDE CASES

Christina Edmunds - 1871

Thomas Cream - 1892

Jean-Pierre Vacquier - 1924

Ethel Major - 1934

Floyd Horton - 1937

Patsy Wright Case - 1987

Revised: November 16, 1997

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Revised: November 16, 1997

POISONERS THROUGHOUT HISTORY

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QUOTES OF INTEREST POISONERS THROUGHOUT HISTORY

Glistening salts, and shimmering scales, and crystals of purest white, High on the shelves in their spotless rows, enclosed in their bottles bright...Here heavy syrups, thick and sweet, prepared with skill and toil. And there, distilled in precious drops, stands many a spiced oil...And high on the wall, beneath lock and key, the powers of the Quick and Dead! Little low bottles of blue and green, each with a legend red...From the Borgias' time to the present day, their power has ever been proved and tried! Monkshood blue, called Aconite, and deadly Cyanide! Here is sleep and solace and soothing, of pain - courage and vigour new! Here is menace and murder and sudden death! In these vials of green and blue...Beware of the Powers that never die though men may go their way, The Power of the Drug, for good or ill, shall it ever pass away? (*The Road of Dreams, "In a Dispensary"*, 1924, Agatha Christie) **NOTE:** Dame Agatha Christie, between 1920 and 1975, wrote 85 books (41 of which involved poisons) and 148 short stories (24 of which involved poisons). She held a certificate from the *Whorshipful Society of Apothecaries of London*, as a "dispenser" (assistant pharmacist).

That in the mortar - you call it a gum?
Ah, the brave tree whence such gold oozings come!
And yonder soft phial, the exquisite blue,
Sure to taste sweetly - is that poison too?
(*The Laboratory: Ancient Regime* - Robert Browning)

When the fatal cup was brought, he [Socrates] asked what it was necessary for him to do. "Nothing more", replied the servant of the judges, "then as soon as you have drunk of the draught, to walk about until you find your legs become weary and afterwards lie down upon your bed". - (on the death of Socrates, - Plato)

She had never forgotten that, if you drink much from a bottle marked poison", it is almost certain to disagree with you, sooner or later. - (*Alice in Wonderland*, Lewis Carroll)

I maintain that though you would often in the fifteenth century have heard the snobbish Roman say, in a would-be off-hand tone, "I am dining with the Borgias tonight", no Roman was ever able to say, "I dined last night with the Borgias". - (*And Even Now*, Sir Max Beerbohm)

Were you enamoured on his copper rings,
His saffron jewel, with the toadstone in't?
("Fox", Ben Johnson)

Pronounce not the name of I-A-O under the penalty of the peach.
(From an Egyptian papyrus - possibly relating to cyanogenic glycosides)

Credence and tastyng is used for drede of poysenyng to all officers ysworne and grete othe by

charyne. - (Book of Nature, Russell - dated 1480, it is the earliest allusion to assay cups of the horn of the rhinoceros and the "unicorn")

She drank prussic acid without any water. - (The Tragedy, Richard Harris Barham)

Bid the apothecary
Bring the strong poison that I bought of him.
(Henry VI, William Shakespeare)

Let me have
A dram of poison, such soon-speeding gear
As will disperse itself through all the veins
That the life-weary talker may fall dead,
And that the trunk may be discharg'd of breath
As violently as hasty powder fir'd
Doth hurry from the fatal cannon's womb.
(Romeo and Juliet, William Shakespeare)

Put this in any liquid think you will,
And drink it off; if you have the strength
Of twenty men, it would dispatch you straight.
(Romeo and Juliet, William Shakespeare)

Toad, that under cold stone,
Days and night went thirty-one
Swelter'd venom sleeping got.
(Macbeth, William Shakespeare)

There was a king reigned in the East:
There, when kings will sit to feast,
They get their fill before they think
With poisoned meat and poisoned drink.
He gathered all that springs to birth
From the many-venomed earth;
For a little, thence to more,
He sampled all her killing store;
And easy, smiling, seasoned sound,
State the king when healths went round.
They put arsenic in his meat
And stared aghast to watch him eat;
They poured strychnine in his cup
And shook to see him drink it up:
They shook, they stared as white's their shirt;

POISONERS THROUGHOUT HISTORY

I. POISONING IN ANCIENT TIMES

A. Prehistoric Man

1. The Medicine Man discovered that his knowledge of special substances conferred on him a position of privilege and authority in his tribe. This was reinforced by associating with certain magic rites and charms, which produced a halo of mystery around his actions.
2. Logical “post hoc ergo propter hoc” observations:

OBSERVATION ---> KNOWLEDGE ---> POWER ---> SECRECY ---> FEAR

3. From these early beginnings came the magician, sorcerer, poisoner, physician, pharmacist, and toxicologist.

B. The Sumerians (~4500 BC)

GULA - the earliest deity associated with poison was the “Mistress of Charms and Spells” & “Controller of noxious poisons”.

C. The Egyptians

1. King Menes (~3000 BC) - studied plant properties.
2. “*Pronounce not the name of I.A.O. under the penalty of the peach*”. From the Ebers Papyrus, this is thought to refer to cyanogenic glycosides.
3. The Egyptians believed even their gods were susceptible to poisoning:
 - a. RA (the Sun God) nearly died of a snakebite.
 - b. HORUS (son of ISIS) died from a scorpion sting.
4. Psammentius (525 BC), King of Egypt was forced to drink bull's blood which immediately occasioned his death.
5. Zopyrus - a physician of Alexandria, concocted an antidote of 30-50 ingredients.

D. The Hebrews - had words for some specific poisons:

1. Words for poisons:

“Sam” = arsenic

“Boschka” = aconite

“Son” = ergot

2. The witches of the Old Testament were probably sorcerers and poison vendors.

E. The Asian Indians

1. Famous writings on poisons are the Charaka Sambita and the Susruta Sambita, written about 600-100 BC.

2. It has been suggested that the practice of "suttee" or burning of the widow on the death of the husband may have had its origin as a discouragement to conjugal homicide.

3. The Veda, gives the physician specific directions in the detection of poisoners:

"He does not answer questions, or the answers are evasive. He speaks nonsense, rubs the great toe along the ground and shivers. His face is discolored. He rubs the roots of the hair with his fingers and he tries by every means to leave the house. The food which is suspected should be given to animals. It is necessary for the practitioner to have knowledge of the symptoms of the different poisons and their antidotes, as the enemies of the Raja, bad women and ungrateful servants sometimes mix poison with food."

F. Nicander of Colophon (204-135 BC):

1. Compiled the first poison pharmacopoeia.

2. Physician to Attalus III, King of Pergamum.

3. His favorite antidote: viper parts seasoned with aromatic roots and fruits (ginger, cinnamon, myrrh, iris, & gentian).

4. Wrote two poems on poisons:

“*Theriaca*” - 1,000 lines dealing with poisonous animals.

“*Alexipharmaca*” - 600 lines dealing with antidotes.

G. Philon of Tarsus

1. Physician who came up with one of the most celebrated and long-lived potions.
2. *Philonium Romanorum* - contained herbs (spikenard, henbane, pyrethrum, euphorbia, and saffron).

H. Mithridates (~100 BC) - King of Pontus

1. Had the reputation of knowing more about poisons and their antidotes than any other man of his time.
2. Invented *Mithridatum*, a "universal" antidote against poisons.

I. The Greeks

1. The Greek word "*toxicon*" was used to denote poison, from a word signifying a bow (a poison-tipped arrow).
2. Hecate's Garden - the Greek goddess of witchcraft, and the first to discover the existence of poisonous plants. The first to use aconite.
3. Medea - supposed to have discovered the use of colchicum as a poison.
4. Circe - one of the first Great Sorceresses (Homer's *Odyssey*).
5. The Athenian State Poison - "Poison Hemlock" (*Conium maculatum*), supposedly claimed the following victims:

Theramener	404 BC	Theramenes	362 BC
Socrates	402 BC	Phocion	317 BC

6. Hippocrates' genuine works contain NO information on criminal poisoning.
7. Aristotle - described the preparation and use of arrow poisons by the Scythians: "snakes are left until they decay and the liquid which oozes from them is added to the clear fluid exuded from decomposing blood, and the resulting mixture is smeared on arrows".
8. Galen (born ~129 AD)
 - a. Compounded the "*Nut Theriac*" as a remedy against bites/stings and poisons.

- b. Nut Theriac - consisted of: 4 figs + salt + nut and *Ruta graveolens*. [Of the Ruta 20 parts, the inner part of the nut (2 nuts), salt 5 parts, dried fig 2 parts, mixed into a porridge].

J. The Romans

1. As early as 331 BC, according to Livy, there was an outbreak of poisoning in Rome in high circles.
2. **Locusta** - poisoner to the Emperor Nero. Nero poisoned his stepbrother Britannicus with cyanide, and also killed his mother and wives likewise.
3. **Livia** - wife of the Emperor Augustus. Used belladonna.
4. **Agrippina** - wife of Claudius. Injected poisons into his personal figs.
5. The Emperor Trajan (98-117 AD), decreed that no *Wolfsbane* was to be grown in domestic gardens.
6. Ovid - refers to Aconite as the "step-mother's poison".
7. Sulla in 82 BC issued an edict, the "*Lex Cornelia*", against assassination by poison. This was the first legislative enactment against poisoning.
8. Other poison-minded Roman emperors included: Vitellius, Domitian, Commodus, Caracalla, Elagabalus, & Caligula.

K. The "*Italian School*" of Poisoners

1. The Venetian "Council of Ten" - (1419)
 - a. Members carried out murder by poison, for a fee.
 - b. Three recipes for poison are preserved as *secreta secretissima* in the archives under dates of 1540-44 AD.

Chief ingredients included: corrosive sublimate (HgCl_2), White Arsenic (As_2O_3), Arsenic trisulphide (As_2S_3), & Arsenic trichloride (AsCl_3).

2. Venice and Rome had schools for poisoners from the 15th to the 17th Centuries.
3. The Borgias (~1455)

- a. **Rodrigo Borgia** (born 1431), became **Pope Alexander VI**, he had 5 children including Cesare and Lucrezia.

(1) **Lucrezia** died at 39 years, and probably never killed anyone.

(2) **Cesare** - died at 32 years of age, being responsible for dozens of murders.

- b. The "Gift of the Borgia"

They used a poison called "*La Cantarella*" - a mixture of arsenic + phosphorus. Believed to have been made as follows: "A hog was killed with arsenic. Its abdomen was opened and sprinkled with more of the same drug. The animal was then allowed to putrefy. The liquor which trickled from the decaying carcass was collected and evaporated to a powder."

- c. Most famous victim was Zizin, the son of Sultan Mahomet II, for a price of 300,000 ducats.

4. **John of Ragusa** (1543), had a price list for doing away with specific officials.
5. The poison "Venenum Lupinum" consisted of: aconite + *Taxus baccata* + caustic lime + arsenic + bitter almonds + powdered glass. Mixed with honey and rolled into pills.
6. **Madame Giulia Toffana** (1650) - made the famous "*Aqua Toffana*", thought to have been a solution of Arsenic trioxide (As_2O_3). She is credited with over 600 successful poisonings.
7. **Hieronyma Spara** (1659) - taught women through her "Society" how to murder their husbands with poison. Dispensed her poison in small vials labeled "*Manna of St. Nicholas of Bari*".
8. **Catherine de Medici**, the Italian bride of Henry II - introduced the methods of the "*Italian School of Poisoners*" into France.
- a. Her accomplices were the Florentines, **Rene Bianco** and **Cosme Ruggieri**
- b. She is usually credited with the poisonings of: Jeanne d' Albret (Queen of Navarre), the Cardinal of Lorraine, Coffe (a marshal of France), and the Duc d'Anjou.
9. **Antonio Exili** (aka **Eggidi**) - most notorious maker of poisons in the 17th Century.

L. The "*French School*" of Poisoners

1. **Marie Madeleine, the Marchioness de Brinvilliers** (1670).

- a. Became acquainted with poisons through her lover, **Gaudin de Sainte-Croix**, and used: arsenic, sugar of lead, corrosive sublimate, tartar emetic, copper sulfate, and other poisons.
- b. She experimented on hospitalized patients to test her recipes for effectiveness.
- c. To gain property she supposedly poisoned her father, two brothers, and a sister.
- d. She was executed in 1676.

2. **Catherine Deshayes ("La Voisin")** - an arch poisoner, abortionist, and sorceress.

- a. She was the last of the "poisoners for hire". She accepted a commission of 100,000 crowns to poison Louis XIV. She was tried and condemned by the *Chambre Ardente*, and after torture, was burned at the stake.
 - b. Provided poisons to women in order to get rid of their husbands. One of the poisons was known as "*La Poudre de Succession*", to hasten the succession of rich estates. The powder was supposed to have a base of arsenic but was mixed with aconite, belladonna, and opium.
3. In the 17th Century a popular method was for a wife to soak her husband's shirt tail in arsenic, corrosive sublimate, or cantharides, which would produce a violent dermatitis around the perineum and neighboring parts. When a doctor made the diagnosis of syphilis, mercury was ordered; and the wife then gave excessive doses of mercury to poison her husband.
4. Formation of the "*Chambre Ardente*" (1679-1682), to deal with poisoners. Investigated 442 persons, ordered 367 arrests; 36 individuals were executed, 23 banished, and 218 imprisoned.

M. Others

1. **Edward Squires** - hired by Spain to poison Queen Elizabeth I, in 1596, by smearing opium-based poison on the pommel of her saddle.
2. **Thomas Hickey** - in 1776, attempted to assassinate George Washington, by poisoning a dish of green peas. Foiled, he was hanged, becoming the first American traitor executed.

II. ANALYSES OF CRIMINAL POISONING CASES - (a review of 679 cases)**A. TIME period:**

YEAR A.D.	# CASES	%
B.C.	3	0.4%
0000-1000	13	2%
1000-1499	11	2%
1500-1599	15	2%
1600-1699	25	4%
1700-1799	18	3%
1800-1849	63	9%
1850-1899	122	18%
1900-1949	178	26%
1950-1999	207	30%
?	24	4%
TOTAL	679	100%

B. POISON used:

POISON	# CASES	%
Acid	2	0.3%
Acid: Boric	1	0.1%
Acid: Hydrochloric	1	0.1%
Acid: Nitric	1	0.1%
Acid: Oxalic	2	0.3%
Acid: Sulfuric	3	0.4%
Aconite	5	0.7%

POISON	# CASES	%
Ammonia	1	0.1%
Ammonium chloride	2	0.3%
Ammonium hydroxide	1	0.1%
Anesthetics	1	0.1%
Antifreeze	1	0.1%
Antimony	9	1.3%
Arsenic	209	30.8%
Atropine	3	0.4%
Bacteria	7	1.0%
Barium acetate	1	0.1%
Belladonna	3	0.4%
Cantherides	1	0.1%
Carburetor cleaner	1	0.1%
Carbon monoxide	7	1.0%
Carcinogen	4	0.4%
Chemicals	1	0.1%
Chloral hydrate	3	0.4%
Chloroform	12	1.8%
Cleaning fluid	1	0.1%
Cocaine	1	0.1%
Copper sulfate	2	0.3%
Corrosives	1	0.1%
Cyanide	61	9.0%
Diazinon	1	0.1%
Drain cleaner	1	0.1%

POISON	# CASES	%
Drano ^R	4	0.6%
Drug: Antineoplastic	1	0.1%
Drug: Antipyrine	1	0.1%
Drug: Aspirin	1	0.1%
Drug: Barbiturate	4	0.6%
Drug: Chlorodyne	2	0.3%
Drug: Codeine	1	0.1%
Drug: Colchicine	1	0.1%
Drug: Curacit	1	0.1%
Drug: Curare	2	0.3%
Drug: Demerol	2	0.3%
Drug: Digitalis	4	0.6%
Drug: Digoxin	2	0.3%
Drug: Innovar	1	0.1%
Drug: Insulin	11	1.6%
Drug: Laudenum	5	0.7%
Drug: Lidocaine	4	0.6%
Drug: Morphine	21	3.1%
Drug: Navane	1	0.1%
Drug: Opiates	3	0.4%
Drug: Opium	1	0.1%
Drug: Pancuronium	3	0.4%
Drug: Paraldehyde	1	0.1%
Drug: Pavulon	2	0.3%
Drug: Pentothol	1	0.1%

POISON	# CASES	%
Drug: Potassium	3	0.4%
Drug: Scopolamine	2	0.3%
Drug: Sedatives	1	0.1%
Drug: Succinylcholine	3	0.4%
Drug: Sucostrin	1	0.1%
Drug: Veronal	1	0.1%
Drug: unknown	9	1.3%
Ethanol	1	0.1%
Ether	2	0.3%
Ethylene glycol	1	0.1%
Etorphine	1	0.1%
Fumes/Gas	5	0.7%
Glass	2	0.3%
Hemlock	2	0.3%
Herbicide	1	0.1%
Herbicide: Paraquat	7	1.0%
Herbicide: Pyrilon	1	0.1%
Heroin	2	0.3%
Hyoscine	1	0.1%
Insecticide	1	0.1%
Lead acetate	1	0.1%
Magnesium sulfate	1	0.1%
Mercuric chloride	11	1.6%
Mercury	5	0.7%
Methanol	1	0.1%

POISON	# CASES	%
Multiple poisons	14	2.1%
Mushrooms	1	0.1%
Nerve gas: Sarin	1	0.1%
Nicotine	1	0.1%
Parathion	1	0.1%
Phencyclidine (PCP)	1	0.1%
Phenol	1	0.1%
Phosphorus	4	0.6%
Plant	1	0.1%
Poison Hemlock	1	0.1%
Ratsbane	1	0.1%
Ricin	2	0.3%
Rodenticide	9	1.3%
Selenious acid	1	0.1%
Selenium	1	0.1%
Strychnine	40	5.9%
Thallium	10	1.5%
Unknown: whisky	1	0.1%
Venom	2	0.3%
Warfarin	1	0.1%
Unknown	89	13.1%
TOTAL	679	100.0%

C. LOCATION of poisoning:

COUNTRY/LOCATION	# CASES	%
Africa	1	0.1%

COUNTRY/LOCATION	# CASES	%
Africa, South	13	1.9%
Algeria	1	0.1%
Arctic	1	0.1%
Australia	10	1.5%
Austria	4	0.6%
Belgium	4	0.6%
Canada	6	0.9%
Chile	1	0.1%
China	3	0.4%
Denmark	2	0.3%
France	42	6.2%
Great Britain: England	158	23.3%
Great Britain: N. Ireland	1	0.1%
Great Britain: Scotland	18	2.7%
Great Britain: Wales	2	0.3%
Germany	19	2.8%
Greece	2	0.3%
Guyana	1	0.1%
Hungary	12	1.8%
India	6	0.9%
Ireland	4	0.6%
Israel	1	0.1%
Italy	30	4.4%
Jamaica	1	0.1%
Japan	3	0.4%

COUNTRY/LOCATION	# CASES	%
Kuwait	1	0.1%
Macedonia	1	0.1%
Mexico	1	0.1%
Netherlands	5	0.7%
New Zealand	2	0.3%
Norway	2	0.3%
Puerto Rico	1	0.1%
Poland	1	0.1%
Rumania	1	0.1%
Russia	5	0.7%
Singapore	1	0.1%
Spain	3	0.4%
St. Helena	1	0.1%
Sweden	1	0.1%
Switzerland	2	0.3%
United States	297	43.7%
Yugoslavia	1	0.1%
?	7	1.0%
TOTAL	679	100.0%

D. Example Cases

1. **William Palmer, MD - "The Rugeley Poisoner"**
 - a. TIME - 1855, Rugeley, Staffordshire, England
 - b. POISONER - physician with a gambling problem
 - c. VICTIMS: John Parsons Cook (possibly 14 others)
 - d. POISON: antimony
 - e. MOTIVE: money
 - f. OUTCOME: hanged, June 14, 1856

2. Edward William Pritchard, MD

- a. TIME: 1865, Glasgow, Scotland
- b. POISONER: physician with a mistress
- c. VICTIMS: Mary Jane Palmer (wife), Mrs. Taylor (his mother-in-law)
- d. POISON: antimony (as Tartar Emetic)
- e. MOTIVE: mistress
- f. OUTCOME: hanged, July 28, 1865

3. George Henry Lamson, MD

- a. TIME: December, 1881, England
- b. POISONER: physician with morphine addiction
- c. VICTIM: Percy Malcolm John (his 18 year old brother-in-law)
- d. POISON: aconite (given in Dundee cake)
- e. MOTIVE: money
- f. OUTCOME: hanged, April 28, 1882

4. Thomas Neill Cream, MD - "The Lambeth Poisoner"

- a. TIME: 1891, London, England
- b. POISONER: a moral degenerate who hated prostitutes
- c. VICTIMS: 4 prostitutes
- d. POISON: strychnine (given in capsules as a Rx)
- e. MOTIVE: sadism
- f. OUTCOME: hanged, November 15, 1892

5. Cordelia Botkin

- a. TIME: August 9, 1898, Dover, Delaware
- b. POISONER: a "femme-fatale"
- c. VICTIMS: Mrs. John P. Dunning (her lover's wife), Mrs. Deane
- d. POISON: arsenic (placed in candy)
- e. MOTIVE: love/jealousy
- f. OUTCOME: life imprisonment (died San Quentin, 1909)

6. Johann Otto Hoch - "The Stockyards Bluebeard"

- a. TIME: 1892-1905, United States of America
- b. POISONER: an opportunist
- c. VICTIMS: (possibly 12 of 24 wives) - Julia Walker, Amelia Walker, & many others
- d. POISON: arsenic (carried in a hollow fountain pen)
- e. MOTIVE: money
- f. OUTCOME: hanged, February 23, 1906, Chicago, Illinois

7. Hawley Harvey Crippen, MD

- a. TIME: March, 1910, England
- b. POISONER: physician with a mistress
- c. VICTIM: Cora (Turner) Crippen (his wife)
- d. POISON: hyoscine (dismembered and buried body)
- e. MOTIVE: mistress (Miss Ethel le Neve)
- f. OUTCOME: hanged, November 23, 1910

8. Frederick & Mary Seddon

- a. TIME: September 14, 1911, England
- b. POISONERS: husband and wife
- c. VICTIM: Elizabeth Barrow
- d. POISON: arsenic (from fly papers)
- e. MOTIVE: money
- f. OUTCOME: Frederick (executed April 18, 1912), Mary (found "not guilty")

9. Henri Girard - "The First Scientific Murderer"

- a. TIME: 1912, Paris, France
- b. POISONER: a financial manipulator
- c. VICTIMS: Louis Pernotte, & Mme. Monin
- d. POISON: typhoid organisms, mushrooms
- e. MOTIVE: insurance premiums
- f. OUTCOME: committed suicide with a "germ culture", while in custody

10. Arthur Warren Waite, DDS

- a. TIME: January-March 1916, New York City, NY
- b. POISONER: an oral surgeon(?)
- c. VICTIMS: Hannah Peck (mother-in-law), & John E. Peck (father-in-law)
- d. POISON: arsenic (also tried pneumonia, diphtheria, & typhoid organisms)
- e. MOTIVE: money & mistress
- f. OUTCOME: electrocuted, Sing Sing, May 24, 1917

11. Murderers of Mike Malloy

- a. TIME: January 1933
- b. POISONERS: opportunistic New York City residents (Dan Kreigsberg - local grocer, David "Red" Murphy - barman, Anthony "Tony" Marino - bar owner, Frank Pasqua - undertaker, Hersey Green - taxi driver).
- c. VICTIM: Michael Malloy (alcoholic, "skid-row" resident)
- d. POISONS: coal gas, antifreeze, horse liniment
- e. MOTIVE: money - life insurance policy, \$1,600
- f. OUTCOME: electrocuted (4 of 5 men), June 8, 1934

12. **Rev. Frank Elias Sipple**

- a. TIME: 1939, Grand Rapids, Michigan
- b. POISONER: minister, Southlawn Church of God
- c. VICTIM: Dorothy Ann Sipple (daughter)
- d. POISON: Cyanide + Arsenic?
- e. MOTIVE: Euthanasia, or to cover an earlier crime?
- f. OUTCOME: discovered in 1948, life in prison

13. **Sadamichi Hirasawa**

- a. TIME: January 26, 1948, Japan
- b. POISONER: artist, bank robber

Sadamichi Hirasawa, pretending to be a Dr. Jiro Yamaguchi, enters the suburban Shiinamaki branch of the Teikoku Imperial Bank in Tokyo, Japan, just as the bank closes, telling 14 employees that they must drink some medicine to prevent an outbreak of amebic dysentery then rampant in the district; the employees swallow teacups full of liquid heavily laced with potassium cyanide, a deadly poison; 13 die on the spot, while Hirasawa loots the bank of more than 180,000 yen (about \$600) and vanishes; Japanese police laboriously interview thousands of people who have received cards from a man pretending to be a physician and finally pinpoint Hirasawa, an artist, who later is identified by the lone surviving bank employee; Hirasawa admits his guilt and is imprisoned for life.

- c. VICTIMS: 16 bank employees (12 died)
- d. POISON: Potassium cyanide
- e. MOTIVE: money (equal to \$720)
- f. OUTCOME: life imprisonment

14. **Martha Beck & Raymond Fernandez - "The Lonely Hearts Killers"**

- a. TIME: Jan. 1949, Grand Rapids, Michigan
- b. POISONERS: nurse & con-man
- c. VICTIMS: Delphine Dowling & daughter Rainelle, + 17 other victims in other states.
- d. POISON: digitalis, sleeping medications
- e. MOTIVE: swindling elderly women
- f. OUTCOME: Executed at Sing Sing, Aug. 22, 1949

15. **Christa Lehman**

- a. TIME: February 1954, Worms, Germany
- b. POISONER: resident of the town
- c. VICTIMS: 3 neighbors
- d. POISON: chocolate truffles laced with "E-605" (parathion)
- e. MOTIVE: upset with neighbor
- f. OUTCOME: life imprisonment

16. Nanny "Arsenic Annie" Doss

- a. TIME: 1954, Tulsa, Oklahoma
- b. POISONER: housewife
- c. VICTIMS: total of 11 (5 husbands, 2 children, mother, 2 sisters, nephew)
- d. POISON: Arsenic
- e. MOTIVE: "I was searching for the perfect mate, the real romance of life."
- f. OUTCOME: life imprisonment, died of leukemia in 1965

17. Geza de Kaplany, MD - "The Acid Doctor"

- a. TIME: 1962, San Jose, California
- b. POISONER: Hungarian, anesthesiologist
- c. VICTIM: Hanja (newly married wife)
- d. POISON: corrosive acids, died of 3rd degree burns, 21 days later.
- e. MOTIVE: paranoid jealousy, destroy her beauty
- f. OUTCOME: imprisoned for life, paroled 1975, went to Taiwan

18. Graham Frederick Young

- a. TIME: 1971, England
- b. POISONER: student of poisons, mentally unbalanced
- c. VICTIMS: Bob Egle (his boss), & Fred Biggs (a co-worker)
- d. POISON: thallium (given in tea)
- e. MOTIVE: poison obsession, ego
- f. OUTCOME: sentenced to life imprisonment, July 1972. Died in prison at age 42 years (1989).

19. Ronald Clark O'Bryan - "The Candy Man"

- a. TIME: October 31, 1974, Pasadena, Texas
- b. POISONER: a father (30 years old)
- c. VICTIM: Timothy Marc O'Bryan (8 year old son)
- d. POISON: Potassium cyanide (in "Pixy Stix" candy)
- e. MOTIVE: insurance premium (\$65,000)
- f. OUTCOME: Execution by lethal injection, March 31, 1984

20. Audrie Marie Hilley

- a. TIME: 1975 & 1979, Anniston, Alabama
- b. POISONER: housewife
- c. VICTIMS: Frank Hilley (husband), Carol Hilley (daughter)
- d. POISON: arsenic
- e. MOTIVE: insurance policy
- f. OUTCOME: found guilty of murder & attempted murder. Died from exposure on a weekend furlough.

21. **Rev. James Warren Jones**
 - a. TIME: November 18, 1978, Jonestown, Guyana
 - b. POISONER: leader of the People's Temple cult
 - c. VICTIMS: 913 commune members
 - d. POISON: cyanide
 - f. OUTCOME: death by self-inflicted(?) gunshot

22. **Murder of Georgi Markov**
 - a. TIME: September 7, 1978, London, England
 - b. POISONER: unknown, never identified
 - c. VICTIM: Georgi Markov, Bulgarian defector
 - d. POISON: ricin?
 - e. MOTIVE: political?
 - f. OUTCOME: victim died September 11, 1978

23. **Stella M. Nickell**
 - a. TIME: 1986, Auburn, Washington
 - b. POISONER: housewife
 - c. VICTIMS: Bruce (husband), Susan Snow (random victim)
 - d. POISON: Cyanide
 - e. MOTIVE: insurance (\$135,000 on husband)
 - f. OUTCOME: guilty (two 90 year sentences)

24. **Donald Harvey - "The Angel of Death"**
 - a. TIME: 1983-1987, Cincinnati, Ohio
 - b. POISONER: a nurse's aide
 - c. VICTIMS: 24 patients (maybe 50)
 - d. POISONS: arsenic, cyanide
 - e. MOTIVE: personality disorder (compulsion to kill)
 - f. OUTCOME: imprisoned (3 consecutive life terms)

25. **George Trepal**
 - a. TIME: 1988, Bartow, Florida
 - b. POISONER: computer programmer, "Mensa" member
 - c. VICTIM: Peggy Carr (a neighbor)
 - d. POISON: thallium (in bottles of cola)
 - e. MOTIVE: bothered by his neighbors
 - f. OUTCOME: found guilty, March 6, 1991 - awaiting death in the electric chair.

III. ANALYSES OF POISONS USED IN FICTION

A. Poison used in literature (a review of 187 works):

POISON	# CASES	%
Acid	1	0.5%
Aconite	2	1.1%
Air (by injection)	1	0.5%
Akee	1	0.5%
Antimony	1	0.5%
Arrow poison	1	0.5%
Arsenic	13	7.0%
Atropine	5	2.7%
Barbitone	3	1.3%
Bowl cleaner	1	0.5%
Carbon monoxide	3	1.6%
Chloral	1	0.5%
Chloral hydrate	2	1.1%
Coal gas	2	1.1%
Cocaine	2	1.1%
Coniine	1	0.5%
Curare	4	2.1%
<i>Cyanea capillata</i>	1	0.5%
Cyanide	25	13.4%
“Devil’s Foot Root”	1	0.5%
Digitalin	3	1.6%
Digitalis	3	1.6%

POISON	# CASES	%
Digitoxin	1	0.5%
Drugs	1	0.5%
Fear: of poison death	2	1.1%
Food poisoning	1	0.5%
Formic acid	1	0.5%
Fungus	1	0.5%
Gelsemium	1	0.5%
Hemlock	1	0.5%
Henbane	1	0.5%
Hexabarbital	1	0.5%
Hyoscine	3	1.6%
Indian Hemp + <i>Datura</i>	1	0.5%
Jimson Weed	2	1.1%
L-thyroxine	1	0.5%
Microorganisms: Cholera	1	0.5%
Morphine	6	3.2%
Multiple poisons	1	0.5%
Muscarine	1	0.5%
Mushrooms	15	8.0%
Narcotic	1	0.5%
Nicotine	6	3.2%
Nitrobenzene	2	1.1%
Oleander	2	1.1%
Paint thinner	1	0.5%
Phenylbutazone allergy	1	0.5%

POISON	# CASES	%
Phosphorus	1	0.5%
Photographic developer	1	0.5%
Physostigmine	2	1.1%
Poison gas	1	0.5%
Poisoned darts	1	0.5%
Procaine	1	0.5%
Purvisine (an alkaloid)	1	0.5%
Ricin	2	1.1%
Serenite (an invented poison)	1	0.5%
Solanine	1	0.5%
Strptomycin allergy	1	0.5%
Strophanthin	5	2.7%
Strychnine	6	3.2%
Taxine	1	0.5%
Tetra-ethyl-pyrophosphate	1	0.5%
Tetrodotoxin	1	0.5%
Thallium	2	1.1%
Toxin	1	0.5%
Trinitrin	1	0.5%
Tuberculin	1	0.5%
Unidentified native poison	2	1.1%
Unknown poison	13	7.0%
Venom: bee	2	1.1%
Venom: snake	4	2.1%
Virus	1	0.5%

POISON	# CASES	%
Warfarin	1	0.5%
TOTAL	187	100.0%

B. Poisons used in motion pictures (a review of 15 works):

FILM TITLE	DATE	POISON USED
Attack of the Mushroom People	1964	Mushrooms
Beguiled, The	1971	Mushrooms
Black Widow	1987	Penicillin allergy + unknowns
Court Jester, The	1956	Unknown
Dead Pool, The	1988	Street drug
D.O.A.	1949	Iridium
D.O.A.	1988	Radium chloride
Fer-de-Lance	1974	Venom: snake
Flesh and Fantasy	1943	Aconite
Goliath Awaits	1981	Algae extract ("Palmer's Disease")
Pope of Greenwich Village, The	1984	Lye (Sodium hydroxide)
Serpent and the Rainbow, The	1988	Tetrodotoxin
Throw Mama from the Train	1987	Lye (Sodium hydroxide)
Venom	1982	Venom: snake
Young Sherlock Holmes	1985	Dart poison

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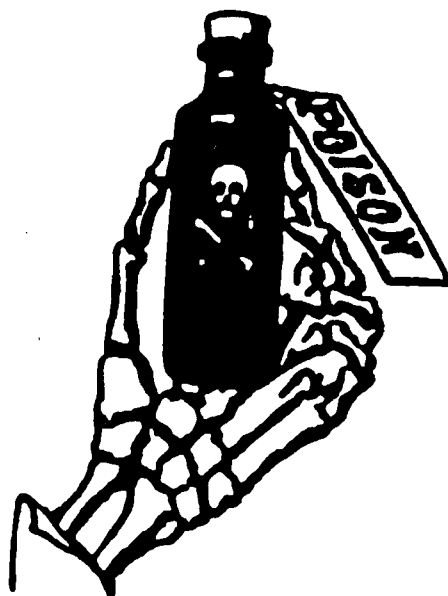
- CONFIDENTIAL MATERIAL -

CRIMINAL POISONING MURDER BY POISON!

**for
Law Enforcement, Toxicologists, &
Forensic Scientists**

by

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Grand Rapids, Michigan, USA**



WARNING!

The material in this document is to be considered **CONFIDENTIAL**, and is intended solely for the use of forensic scientists and law enforcement personnel! There are poisoners loose in the general population - they just have *NOT* been detected yet! We should **NEVER** be satisfied with the number of poisoners that have been caught and prosecuted, but rather frustrated by the majority of poisoners that still walk free believing that they have carried out the perfect crime"!

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QUOTES OF INTEREST CRIMINAL POISONING

There is no den in the whole world to hide a rogue. Commit a crime and the whole world is made of glass. - (Ralph Waldo Emmerson)

Poisons and medicine are oftentimes the same substance given with different intents. - (Peter Mere Latham)

The coward's weapon, poyson. - (Sicelides, Phineas Fletcher)

Difficult as it may be to cure, it is always easy to poison and kill. - (Philosophy of Medical Science, Elisha Bartlett)

He feasts secure on mushrooms fine as those
Which Claudius for his special eating chose
Till one more fine provided by his wife
Finished at once his feasting and his life.
(Gifford)

Through this rose which the spell-breather had given him
Fear overmastered the foe and he gave up the ghost.
That one by treatment expelled the poison from his body,
While this one died of a rose from fear.
(Treasury of Secrets, Nizami)

Take then the antidote the Gods provide
The plant I give through all the direful power
Shall guard thee and avert the evil hour.
(Odyssey, Homer)

Passion often makes fools of clever men; sometimes even makes clever men of fools. - (La Rochefoucauld)

"POISON" - any substance in relatively small quantities can cause death or illness in living organisms by chemical action. The qualification "by chemical action", is necessary because it rules out such...effects as those produced by a small quantity of lead entering the body at high velocity. - (Scientific American)

"TOXICOLOGY" - a noun, (from the Greek for "I never liked dogs"). Animal testing based on the premise that if something makes a dog sick, it isn't good for humans. It ignores the obvious corollary that humans should therefore thrive by drinking from rain puddles and eating dead possum at the roadside. - (Journal of Irreproducible Results)

What is there that is not poison, all things are poison and nothing [is] without poison. Solely the dose determines that a thing is *NOT* a poison. - ("*Third Defense*", Paracelsus, 1564)

When you consider what a chance women have to poison their husbands, it's a wonder there isn't more of it done. - (Kim Hubbard)

One man's mate is another man's poison.

There's one thing in favor of drinking poison: it never becomes a habit.

Justice, while she winks at crimes,
Stumbles on innocence sometimes.
(Hudibras, Samuel Butler)

Murder, like talent, seems occasionally to run in families.
(The Psychology of Common Life, George Henry Lewes)

Sleeping within mine orchard,
My custom always in the afternoon,
Upon my secure hour they uncle stole,
With juice of cursed hebenon in a vial,
And in the porches of mine ears did pour
The leperous distilment; whose effect
Holds such an enmity with blood of man
That swift as quicksilver it courses through
The natural gates and alleys of the body;
And with a sudden vigour it doth posset
And curd, like eager droppings into milk,
The thin and wholesome blood: so did it mine;
And a most instant tetter bark'd about,
Most lazar-like, with vile and loathsome crust
All my smooth body.
(Hamlet, Act I, Scene 5, lines 59-73, William Shakespeare)

Some poison'd by their wives, some sleeping kill'd; all murder'd. -
(King Richard II, William Shakespeare)

Revolted by the odious crime of homicide, the chemist's aim is to perfect the means of establishing proof of poisoning so that the heinous crime will be brought to light and proved to the magistrate who must punish the criminal. - (Matthew J.B. Orfila, Traite de toxicologie, 1814)

MARTHA: Well, dear, for a gallon of elderberry wine, I take one teaspoonful of arsenic, and add a half a teaspoonful of strychnine, and then just a pinch of cyanide. - (*Arsenic and Old Lace*, Joseph Kesselring)

Mr Pugh
Here is your arsenic dear,
And your weedkiller biscuit,
I've throttled your parakeet,
I've spat in the vases,
I've put cheese in the mouseholes.
Here's your...[door creaks open]
tea, dear.
(*Under Milkwood*, Dylan Thomas)

Of all forms by which human nature may be overcome the most detestable is that of poison, because it can of all others be the least prevented either by manhood or forethought. - (Mr. Justice Avory, at the trial of Jean Pierre Vaquier, 1924)

Every murderer is probably somebody's old friend. - (Agatha Christie)

Then the defenceless state of the victim, who unconsciously receives from professedly friendly hands the deadly draught or poisoned food, or is unknowingly made the instrument of his own destruction, makes us furious against this violation of every principle of manliness and fair play, deprives the poisoner of every speck of sympathy, and makes us consider him an enemy of the human race, at whose detection and punishment every one rejoices. - (Davies. Liverpool Lit. & Philosophical Society, 1876-77)

Poison has a certain appeal...It has not the crudeness of the revolver bullet or the blunt instrument. - (Murder With Mirrors, Agatha Christie)

Poison is a woman's weapon...There must be many secret woman poisoners -- never found out. (Cards on the Table, Agatha Christie)

If all those buried in our cemeteries who were poisoned, could raise their hand, we would probably be shocked by the numbers! - (John Trestrail)

Murder is first conceived in the heart. But if it remains there -- as it often does -- it is no crime, though it may well be a sin. Is the acceptance of the idea of murder as a possible means of getting what one wants that is the decisive step. For most normal and sane people the idea is still-born. They smile to themselves and say "What am I thinking of?" The thought passes, and is lost in the limbo of forgotten fantasy. But if the thought is not forgotten? If it recurs? If it is first half-accepted and then embraced? From this point we have a woman who intends to murder and

we pass to the field of strategy and tactics. (Gerald Sparrow).

Alone in the hissing laboratory of his wishes, Mr. Pugh minces among bad vats and jeroboams, tiptoes through spinneys of murdering herbs, agony dancing in his crucibles, and mixes especially for Mrs. Pugh a venomous porridge unknown to toxicologists which will scald and viper through her. (Under Milk Wood, Dylan Thomas)

THE TOXIC AVENGER

by
John H. Trestrail, III, RPh, ABAT



From the grave, if lips could speak
the person who was, pleads -- you must seek
the individual who had my trust,
and thru deceit and cunning into grave did thrust
this body once alive and well,
now silenced by death, who cannot tell
my death was NOT what all thought then,
for a poison brought my life to end!

Avenge me now, for you alone
can find the truth beneath this stone.
Look close and the clues you'll see
that tell the tale of what killed me.

For you must tell all others now,
that this was **MURDER** -- and tell them how!
For if no one looks to find what's here,
an injustice was done to a life so dear.

If now only you could hear,
my muted pleading to make wants clear.
I'd speak as plain as it could be.
Since I can't -- **YOU must AVENGE ME!**



THE POISONER

by

John H. Trestrail, III, RPh, ABAT



The Borgias, DeMedicis, and all those past --
you may have thought you had seen the last.
But, we poisoners are still around today,
and if you miss my crime, I'll get away.

The body lies there neat and clean,
as the cause of death is seldom seen.
And the Coroner may take time to pause --
"is this death due to a natural cause?"

An autopsy or tox screen may reveal death's why,
but I hope the case will just slip by.
My crime is quiet and well thought through.
For you're used to violence -- can I fool you?

The event's rarity is on my side,
for I count on you burying my homicide.
And though I roam free 'round the nation,
I live in fear of an exhumation.

The clues I leave may be hard to find,
you see, to me, I have a superior mind.
My weapons are there before your eyes,
but they are so very small -- of molecular size.

I don't think you'll have a notion,
for mine is murder in slow motion.
It gives me time to just slip by,
and create my perfect alibi.

Where to look for me isn't clear.
I may be far, or I may be near.
I could be a stranger, though it is quite rare,
for I'm probably related to the victim there.

I chose the place, the means, and time,
for poisoning is usually a household crime.
The knowledge gained by my living close,
made it so very easy to deliver the dose.

Seeing it as poisoning would be profound,
but I think you'll miss it as you look around.
I'm a different kind of killer as you can see.
I am a POISONER -- can you catch me?





No matter how hard we
try to solve a poisoning
homicide – sometimes
the Dragon wins!

CRIMINAL POISONING
- Forensic Toxicology -

I. INTRODUCTION

Homicide by poisoning is one of the most difficult types of cases to prove for the death investigator and medical expert.

- A. Rarely encountered? = ~3-6% of known homicides
- B. Often, no visible signs of trauma.
 - 1. Bullets leave holes, knives leave cuts, clubs leave bruises, but the poisoner covers the murder with a blanket of invisibility!
 - 2. Important clues are usually buried with the victim.
- C. Poisons are **OFFENSIVE** weapons *NOT DEFENSIVE* weapons.
- D. Crime scene may seem nonexistent.

II. THE POISON

- A. Definitions - a legal definition is difficult.
 - 1. POISON [Paracelsus, 1564] - "What is there that is not poison, all things are poison and nothing (is) without poison. Solely the **DOSE** determines that a thing is *NOT* a poison."
 - 2. POISON - "a substance which exerts a deleterious (and ultimately fatal) effect by virtue of its chemical action, even when it is administered in relatively small quantities, usually <one ounce (30 grams)."
 - 3. POISON [Blakiston, 1979] - "a substance that in relatively small doses, has an action, when it is ingested by, injected into, inhaled or absorbed by, or applied to a living organism, that either destroys life or impairs seriously the functions of one or more organs or tissues."
 - 4. POISON [WA Dorland, 1985] - "any substance which when injected, inhaled or absorbed, or when applied to, injected into, or developed within the body, in relatively small amounts, by its chemical action may cause damage to structure or disturbance of function."

B. Characteristics of the ideal poison:

1. Tasteless - easier to administer
2. Odorless - easier to administer
3. Colorless - easier to administer
4. Readily soluble (in water, etc.) - easier to administer
5. Delayed onset of action - allows for alibi
6. Undetectable - less likely to be caught
7. Exotic - less likely to be looked for
8. Low-dose lethality - easier to administer
9. Easily obtained (not traceable) - allows for alibi
10. Chemically stable - easier to store
11. Mimics a natural disease - less likely to be suspected

C. Poison's advantages over more traditional weapons

1. Invisible ("stealth") weapon.
2. Chemical "bomb" - thus, a bomber's profile could show some similarities with the homicidal poisoner:
 - a. white, male
 - b. average to above intelligence
 - c. underachiever
 - d. inadequate personality
 - e. non-athletic
 - f. cowardly
 - g. neat & orderly
 - h. meticulous
 - i. loner
 - j. careful planner
 - k. non-confrontational (physically or psychologically)
3. No trauma or visible signs - body kills itself physiologically by a chemical short circuit. Allows the design of the symptoms exhibited by the chemical and toxicological nature of the poison.
4. Victim has no protection: must eat, drink, & breath!
5. No noise like a gun - a supreme silencer.
6. Precise victim targeting - innocent bystanders won't get hurt.

7. Easy to overcome a physically, or mentally, stronger person by invading their defense zone.
 8. Physically or psychologically non-confrontational.
 9. If the attempt is unsuccessful - a chance to try again. The Victim is NOT even aware that a first attempt was made.
 10. Unlikely to be disarmed and used against the Offender.
 11. Weapon most likely overlooked at the crime scene.
 12. Makes murder look like suicide, or suicide look like murder!
 13. No gore for the squeamish.
 14. Depersonalizes the murder. In their mind, the *POISONER* sets the trap, but the *VICTIM* actually springs it.
- D. **“Chemical monkey wrenches”** - like a wrench in the engine of a car disrupts the proper running, the chemical molecule disrupts the proper running of the body's biochemical processes. The molecule can be carefully selected to disrupt a specific process:
1. Inflammation - irritant chemicals (acids)
 2. Enzyme inhibition - heavy metals (As, Sb, Pb, Tl)
 3. Receptor site interference in the ANS, CNS, & other sites (atropine, botulism, hyoscyamine, strychnine)
 4. Lethal synthesis - chemicals (Monofluoroacetate "1080")
 5. Essential organ necrosis - chemicals (Mushroom amatoxins)
 6. Lipid peroxidation - chemicals (Carbon tetrachloride)
 7. Neoplasia - carcinogenic chemicals (Benzene)
 8. Pharmacological effects - multiple chemical substances
- E. How do poisons kill?

1. Central Nervous System (CNS) effects:
 - a. Depression causes coma.
 - b. Loss of the respiratory drive (respiratory arrest).
 - c. Loss of reflexes protecting the airway
 - (1) Flaccid tongue obstructs the airway.
 - (2) Aspiration of gastric contents into the bronchial tree.
2. Cardiovascular (circulatory) effects:
 - a. Hypotension (low blood pressure) from decreased cardiac contractions.
 - b. Hypovolemia from loss of fluids.
 - c. Peripheral vascular collapse.
 - d. Cardiac arrhythmias.
3. Cellular hypoxia (lack of Oxygen) - due to a breakdown in the normal transport of Oxygen.
4. Seizures:
 - a. Muscle hyperactivity
 - (1) Hyperpyrexia (increase in body temperature)
 - (2) Kidney failure resulting from destruction of muscle tissue (deposition of myoglobin in the kidneys).
 - b. Pulmonary aspiration
 - c. Brain damage from lack of Oxygen
5. Other (e.g. destruction of vital organs):
 - a. Lung destruction - Paraquat (herbicide)
 - b. Liver destruction - Acetaminophen (APAP), Amatoxins (mushrooms)

F. Poison profiles:

NOTE: for the common homicidal poisons, see supplemental handout, Profiles of Common Homicidal Poisons, by JH Trestrail.

1. Form
2. Color
3. Odor
4. Solubility
5. Taste
6. Source
7. Lethal dose
8. How it kills
9. How it is administered
10. Symptom onset time interval
11. Symptoms - acute exposure
12. Symptoms - chronic exposure
13. Disease state confused with
14. Victim notes
15. Specimens
16. Detection method
17. Toxic levels
18. Analysis notes
19. Selected homicide cases

G. Poison equivalents to the weight of a "dime" =2,600 mg:

POISON	LETHAL DOSE (LD)	#LDs
Thallium	1,000 milligrams	2
Compound "1080"	700 milligrams	3
Cyanide	200 milligrams	13
Arsenic	200 milligrams	13
Strychnine	100 milligrams	26
Botulinus toxin	50 nanograms	52,000,000

H. Number of "KILLER MOLECULES" in a lethal dose. Based on "Avogadro's Number" of 6.02×10^{23} molecules per gram molecular weight (GMW) of a substance:

POISON	GRAM MOLECULAR WEIGHT	# MOLECULES
Amatoxin (mushroom)	900.00	10×10^{18}
Arsenic	74.92	$1,607 \times 10^{18}$
Botulinus toxin	150,000	2×10^{11}
Compound "1080"	100.03	$4,213 \times 10^{18}$
Cyanide	26.02	$4,627 \times 10^{18}$
Strychnine	334.45	180×10^{18}
Thallium	204.37	$2,946 \times 10^{18}$

NOTE: 10^{18} = one billion billions! Thus, Cyanide has 4,627 billion billions atoms in a LETHAL DOSE of 200 milligrams. This represents a lot of "chemical firepower" for a few cents worth of a substance: at a cost of \$14/pound, this pound of chemical represents 2,270 LETHAL DOSES, or 0.6 cents per LETHAL DOSE, or 1.7 LETHAL DOSES for a cost of one penny. Cheaper than bullets (a 9mm round costs ~\$0.40 -- thus, for the same price one can purchase ~68 lethal doses of Cyanide)!

I. Poisoner's access to knowledge/poison (which comes first?):

1. Access to **KNOWLEDGE** about the poison

- a. Educational background: chemistry, pharmacology
- b. Printed media: books, manuals, magazines, newspapers
- c. Workplace: labels, manuals, MSDSs
- d. Visual media (movies, TV) - life imitating art
- e. Computers - Internet, World Wide Web
- f. Word of mouth

2. Access to the **POISON**

- a. Laboratories
 - (1) Industry

- (2) Medical
- (3) Educational facilities
- b. Hobby chemicals: photography, jewelers
- c. Antique drug/chemical bottles: flea markets
- d. "Underground" catalogues

III. THE POISONER

A. Poisoner types - based on victim specificity and degree of planning involved (classification method by Trestrail):

1. "Type S" - *specific* victim

- a. **Group "S"** - slowly planned crime, with a carefully selected poison.

Example - a woman mad at her husband, goes to the library, reads about a particular poison, procures the chemical, and decides the best manner of administration to the victim. (*Type S/S*)

- b. **Group "Q"** - quickly made decision, with a poison selected as a weapon of opportunity.

Example - a woman mad at her husband, while preparing dinner, quickly takes a can of herbicide from storage and adds it to his food. (*Type S/Q*)

2. "Type R" - *random* victim

- a. **Group "S"** - slowly planned crime, with a carefully selected poison.

Example - a tamperer intent on industrial blackmail, adulterates a food/drug with a carefully selected poisonous substance. Also includes terrorists. (*Type R/S*)

- b. **Group "Q"** - quickly made decision, with a poison selected as a weapon of opportunity.

Example - an employee upset with his employer picks up a toxic substance and adulterates the batch of food/drug with which he has access. (*Type R/Q*)

3. Watch out for the “Camouflaged” poisoner! (“*Type S*” as “*Type R*”)

Example - an offender poisons his spouse by tempering with her medication, then places similar tampered containers into a retail store, to make the death of the victim appear to be a random act, due to the work of a product tamperer.

RECORDED “CAMOUFLAGED” CASES (listed chronologically):

Christiana Edmunds, Brighton, U.K., 1871: Strychnine tampered chocolates in confectioner's shop - 1 child victim. Specific target = wife of the man who thwarted her affection.

Ronald Clark O'Bryan, Pasadena, Texas, 1974: Cyanide tampered Halloween candy - 1 victim, 3 attempts. Specific target = son.

Stella Nickell, Auburn, Washington, 1986: Cyanide tampered Excedrin capsules - 2 victims. Specific target = wife.

Joseph Meling, Tumwater, Washington, 1991: Cyanide tampered Sudafed 12-hour capsules - 2 victims. Specific target = wife.

Paul Agutter, Athelstaneford, Scotland, 1994: Atropine tampered tonic water - 8 attempts (no deaths). Specific target = wife.

B. Poisoner myths:

1. Most poisoners are female.

- a. In actuality the majority of poisoners that have been detected have been male.
- b. Are females more successful are getting away with the crime?
- c. It could be the favorite weapon of the female murderer!

An analysis of the 49 women executed for murder in Great Britain from 1843-1890, shows:

- (1) Motive - 22 (45%) were motivated by money, 10 (20%) were motivated by sexual triangles, 17 (35%) the motive was unclear.
- (2) Weapon - 29 (59%) of the women used poison. Arsenic was used by 23 (79%) of the poisoners.

2. For every poison there is an **emergency antidote!**

There are only about five *FDA* approved drugs which make a life and death difference in the poisoning emergency:

ANTIDOTE	POISON
Atropine	Organophosphates: nerve gases, insecticides
Cyanide Antidote Package (Lilly)	Cyanide
Epinephrine	Allergic shock
Naloxone	Opiates, narcotics
Oxygen	Carbon monoxide

3. There is a **perfect undetectable poison!**

- a. If there was such an undetectable substance how would we ever know it existed?
If it has a name someone must have detected it at least once!
- b. If poisoning is suspected, and the analytical experts are given proper guidelines, almost every toxic chemical can be identified.
- c. The problem is *NOT* the perfection of the poison, but the imperfection of the analytical process.

C. **Poisoner schematic**

1. Why does the murderer select poison as the means of getting to the goal?
 - a. An invisible weapon.
 - b. A sort of chemical bomb.
 - c. Allows completion of the assault without physical confrontation with the victim.
2. An intelligent-coward.

D. **Poisoner thought processes:**

All behavior is caused: **MOTIVE --> INTENT --> MEANS --> OPPORTUNITY --> DETECTION**

E. **Poisoner's profile - the psychology of the poisoner:**

1. Has an absolute defiance of legal authority.

2. Refuses to accept any moral basis for life.

Kills in order to gain: emotionally or materially.

3. Has/had an unfortunate married life.

4. Childhood has usually been one of two classes:

a. Spoiled by parents

(1) Poisoning is the most *childish* of all the criminal acts.

(2) Turns the victim into an object with no feelings.

b. Reared in unhappy homes

5. Has/had an abnormal life with: wife, children, and home.

6. Most have failed to make any kind of impression on life.

a. High proportion are daydreamers and fantasists.

b. Usually have a touch of the artistic temperament.

Able to design and set up the murder scene like a theatrical production.

7. High proportion have connections with the medical world:

a. Physicians

b. Nurses

c. Pharmacists

d. Dentists

e. Other health care workers

f. Laboratory workers - familiar with chemicals

8. Possesses vanity, and thinks he/she cannot be discovered.

Carefully calculates the odds and believes can get away with the crime.

9. Possesses limited mind: without sympathy.

- a. Childish personality: immature desire for own way, dreamy, romantic disposition.
- b. Something in the poisoners that keeps them permanently immature. They never seem to grow up.
- c. They try and make the world obey their will by cheating it in minor ways, and thereby stealing what it refuses to give them.
- d. They are: weak, cowardly, and avaricious.

F. Motives for murder - *NOT* much different from other homicides:

1. Money - insurance, tampering
2. Elimination - goal-blocker, political, etc. = "A 1,000 Ways to Kill Your Lover"
3. Jealousy - "lover's triangle"
4. Revenge - make them pay
5. Sadism - make them suffer
6. Conviction - political motives (assassination, terrorism)
7. Boredom - wants to have fun, challenge of wits
8. Ego - belief in mental superiority

G. Public perception of the poisoner:

1. Public have a special hatred for his/her sinister nature.
2. Poison is considered the "**coward's weapon**", because it is administered unemotionally and by stealth, often little by little over a long period of time, and in full recognition of the victim's often prolonged suffering.
3. Reviled for his/her lack of pity.

H. The "Toxicomaniac" (lover/collector of poisons)

1. Like gun or knife collector.

2. Gives a sense of power.
3. Prime example - England's Graham Frederick Young

I. MO vs. SIGNATURE

1. **MO** - learned behavior that may change through trial-and-error method.
2. **SIGNATURE** - should NOT be found with poisoners. It reflects the offender's personality (calling card). Repetitive behavior, with little changes. *Not* necessary to complete the crime.

J. An analysis of actual homicidal poisoning cases:

1. **Most common poison used (n = 679):**

POISON	#	%
Arsenic	209	31%
Cyanide	61	9%
Strychnine	40	6%
Morphine	21	3%
Chloroform	12	2%
TOTAL	343	50%

2. **Poisoner's background (n = 679):**

GROUP	#	%
Public	479	71%
Physician	52	8%
Political	29	4%
Nurse	24	4%
Other	33	5%
Unknown	62	9%
TOTAL	679	100%

3. Poisoner's gender (n = 679):

GENDER	#	%
Male	311	46%
Female	260	39%
Unknown	108	16%
TOTAL	679	100%

4. Number of victims (n = 679):

KNOWN VICTIMS	#	%
Single	443	66%
Multiple	236	35%
Unknown	0	0%
TOTAL	679	100%

5. Poisoner's motive (n = 679):

MOTIVE	#	%
Insurance - individual	176	26%
Domestic	58	9%
Political extremism	47	7%
Personal cause	76	11%
Other	129	19%
Unknown	193	29%
TOTAL	679	100%

6. Offender's conviction status (n = 679):

STATUS	#	%
Convicted	647	96%
Acquitted	32	5%
Unknown	0	0%
TOTAL	679	100%

7. Multiple offenders on victim(s) (n = 679):

OFFENDERS	#	%
Single	606	90%
Multiple	73	11%
Unknown	0	0%
TOTAL	679	100%

IV. THE VICTIM - "poisoning is murder in slow motion"

A. Classes of poisoning murders:

1. Suicidally motivated parent

Wants to take the children with them (example: use of Cyanide on the Goebbels' children, Berlin, 1945).

2. Unintentional homicidal poisoning = manslaughter

a. Drug abuse overdose (example: John Belushi)

b. Sexual arousal (example: use of cantharides by Arthur Ford, England, 1954).

c. Behavior modification - black pepper deaths in children.

d. **"Munchausen Syndrome by Proxy"** - mentally ill parent administers poison to child to draw attention to themselves. The offender gets some psychological reward from having doctors listen and begins to exaggerate symptoms.

- (1) Offender usually a mother.
 - (a) Usually come from a background where they were ignored & unrecognized.
 - (b) Some have histories of being abused themselves.
 - (c) Many consider the relationship they had with their obstetrician the most intense, personal, and rewarding they ever had. They then transfer the role to the pediatrician.
 - (d) Many have some nursing training, or a history of weaving false tales of medical tribulations.
- (2) Must be considered child abuse.
- (3) Father is usually oblivious or in subconscious collusion.

3. Euthanasia of the elderly and terminally ill.

- a. Nursing homes
- b. Terminally ill patients - at home
 - (1) Dr. Jack Kevorkian's process
 - (2) Final Exit - the guidebook
 - (3) The "Hemlock Society"

4. Intentional homicidal poisoning - the emphasis of this discussion = murder in the 1st degree.

B. Indices of poisoning:

1. Suspicious friends/relatives.
2. Suspicious circumstances.
 - a. Sudden death after eating, drinking, or going into the bathroom.
 - b. Poison containers found near the deceased.

3. Antemortem clinical course - confusion is very easy!

"Most signs and symptoms associated with natural disease can be produced by some poison, and practically every sign and symptom observed in poisoning can be mimicked by those associated with natural diseases." [L. Adelson]

4. Research conducted in 1958, indicated that 10% of homicides go unsuspected!

5. When autopsy results were compared to death certificates, there was found to be an error rate of ~50% in the cause of death as indicated on the certificates.

C. Poison lesions and their pathogenesis:

1. No morphological changes are present which can be attributed to direct chemical action by the toxic agent.

- a. Acute CNS depressants (alcohols, ethers, sedatives, Chloroform, hypnotics, etc.)
- b. Chemical asphyxiants (CO, HCN)
- c. Organo-phosphate insecticides (OPI)
- d. Alkaloids (Strychnine, Opiates)

2. Systemic lesions are produced without creating injury at the portal of entry.

- a. Arsine
- b. Nitrobenzene

3. Injury is present at portal of entry without remote or systemic evidence of direct cell damage.

- a. Immediate cellular necrosis (corrosives)
- b. Gaseous irritants (Chlorine, Sulfur dioxide)

4. Local and systemic injuries are present.

Heavy metals (Mercuric chloride, Arsenic)

D. Classic clues to poisoning:

- 1. **Hair loss** - heavy metals (Arsenic, Antimony, Thallium)
- 2. **Fever** - body defenses are active

3. **Constricted pupils ("miosis")** - opiates, Organophosphate Insecticides (OPI), etc.
4. **Dilated pupils ("mydriasis")** - atropine, hyoscyamine, insulin, cocaine, nicotine, etc.
5. **Odor** - some poisons have characteristic odors
6. **Oral burns** - caustics and corrosives (acids and alkalies (e.g. Sodium hydroxide = Lye)
7. **Gastrointestinal effects (diarrhea)** - many poisons, especially the heavy metals
8. **Skin color** - cherry-red color of Carbon monoxide, blue color (cyanosis) from Nitrites (methemoglobinemia)
9. **Vomiting** - due to stomach irritation (Arsenic, Antimony, aconite, acids, alkalies, colchicine, cantherides, Phosphorus, Mercury, Iodine, etc.)
10. **Injection tracks** - from multiple administrations of poisons by parenteral route
11. **Skin speckling** - caused by repeated doses of Arsenic (look like raindrops)
12. **Stomach cramps** - a classic sign of chronic poisoning
13. **Brittle nails** - heavy metals can change the nail structure. Also look for Mees' lines
14. **Convulsions** - strychnine, OPI, camphor, cyanide, etc.
15. **Coma** - opiates, hypnotics, sedatives, CO, CO₂, ethanol, phenols, etc.
16. **Paralysis (general or partial)** - botulism, cyanide, Thallium, Arsenic, etc.

V. THE CRIME SCENE - Never forget "chain of custody"!

A. Crime scene investigation:

1. Victimology
 - a. Why was the person targeted?
 - b. Get a complete history of the victim.
2. Crime scene indicators - the *VICTIM* itself is the most prominent crime scene!

- a. How many crime scenes? Usually more than one!
 - (1) Where the victim is **FOUND** = vomitus, clothes
 - (2) Where the poison is **ADMINISTERED** = medicine bottles, food/beverages
 - (3) Where the poison is **DISPOSED** = storage areas, trash
 - (4) Where the poison is **PREPARED** = tools, utensils, clothes, containers
 - (5) Where the poison is **PROCURED** = stolen, receipts, purchased, poison register
 - b. Environment/place/time?
 - c. How many offenders? Majority = single offender on a single victim.
 - d. Organized/disorganized/physical evidence?
 - (1) Organized characteristics
 - (a) Planned offense
 - (b) Weapon/evidence absent
 - (2) Disorganized characteristics
 - (a) Victim/location known
 - (b) Body left in view
 - (c) Weapon/evidence often present
 - (d) Body left at death scene
 - e. Body disposition?
 - f. Items left/missing?
 - g. Other indicators?
 - h. Watch out for the masking effect of tobacco smoke on unusual odors associated with some poisons. **NO SMOKING AT THE CRIME SCENE!**
3. Staging = purposeful alteration of the crime scene
- a. Mostly left in a natural state, except the vehicle for administering the poison may

have been removed or cleaned.

- b. Women are the best at cleaning up the evidence, as they are more familiar with how it should be done properly (domestic abilities): cleaning dishes thoroughly, cleaning up spills and stains, etc. She probably does this cleaning much more efficiently and completely than a male.

4. Forensic findings

5. Investigative considerations

- a. Interview the first aid responder, as to what the victim looked like before therapy was attempted.
- b. Was the victim cleaned up?

6. Search warrant considerations

- a. If the poisoner doesn't think he/she will be suspected, the area of preparation may *NOT* be cleaned up, as it is the "den of security". Why hide something you don't think they will ever look for?
- b. Must stay within the "four corners" of the warrant! Specify specific location, place, & items.
- c. Must have "probable cause" - see Constitution's 4th Amendment.
- d. Could be found anywhere! = wastebaskets, sink traps, garbage, work areas
- e. Most likely will be in small quantity (<200 grams)
- f. Related items to search for (*NOT* all inclusive):

- publications on poisons
- receipts
- medical publications
- recipe cards
- chemical catalogues
- diaries/journals

g. Other points

- (1) Read search warrant and affidavit prior to execution of the warrant.

Become very familiar with all details of the proposed search.

- (2) Leave a copy of the search warrant at each location.
- (3) Leave a receipt, and note date/time of execution and securing of evidence.
- (4) Maintain a complete and detailed inventory of seized properties.
- (5) Do *NOT* consume any edible materials at the site.

B. Poisoning as contrasted with other types of violent deaths:

1. Usually secret, quiet and covert.
2. Usually no visible external signs of violence.
3. Almost always involves careful planning and cool deliberation (the murderer engineers the well conceived opportunity).
4. Murderer is most thoughtfully and seriously concerned with discovery of the crime.
5. Most cunning of the murderers.
6. Murderer possesses a high degree of skill and knowledge of the victim's routine/personal habits.
7. Murderer usually acts alone - thus, no witnesses.
8. Offender kills because he/she really believes can kill and "get away with it".
9. Usually an intimate or "household" crime. Principles are usually united by close emotional ties (the marital bond being the most common).
10. The victim is defenseless, with no protection.
11. Murderer has a high degree of knowledge of the lethal potentialities of the poison to be used.
12. Least used method of homicide (accounts for 3-6% of *known* homicide cases).
13. Most difficult homicide to prove.
14. Homicidal poisoning is **almost** always murder and never manslaughter (unless legally

insane), because of premeditation, deliberation, and intent to kill.

C. Investigating a criminal poisoning

NOTE: all death investigations should be handled as homicide cases until the facts prove otherwise. Is the poisoning death: accidental, suicidal or homicidal?

1. Questioning the victim - if still alive
2. Questioning the witnesses
3. Essential information
 - a. Location of victim when symptoms first appeared?
 - b. What were the symptoms?
 - c. Did someone give the poison intentionally?
 - (1) Who?
 - (2) What was the motive?
 - d. Did the victim administer the poison him/herself?
 - (1) Accidental?
 - (2) Intentional?
 - (3) What was the reason?
 - e. Who summoned assistance? When? How?
 - f. What did the victim do prior to appearance of symptoms?
 - g. What did the victim eat or drink prior to symptoms? Did the victim abuse any drugs, especially controlled substances (which could have been easily adulterated!)?
 - (1) Where?
 - (2) Food/medication - requested or offered?
 - (3) Who prepared it?
 - (4) Who served it?
 - h. Did any other person consume the same items?

- (1) What is their condition?
- (2) Did they notice anything peculiar?

- i. Did the victim notice anything peculiar?
- j. Was the victim in the habit of consuming the substance in question?
- k. Was the victim in the habit of consuming any form of alcohol *NOT* intended for drinking purposes?

Ethylene glycol (antifreeze)
Methanol (antifreeze, Sterno)

- l. Did the victim eat or drink anything after the symptoms first appeared?
- m. Did the victim take any medicine before the appearance of the symptoms?
- n. What was the victim's general health condition?
- o. Was the victim recently unhappy, depressed, jealous, or angry?
- p. Did the victim have money on his/her person prior to the symptoms, what was the condition of his estate, and did he/she owe large sums of money?
- q. Who would inherit the victim's estate?
 - (1) Did that person lose money recently?
 - (2) Does he/she gamble?
 - (3) Does he/she handle money in their occupation?
- r. Did the victim have any recent difficulties with regard to his/her employment?
- s. Was anyone jealous of the victim because of his/her position?

Who will be promoted to the open position?

- t. Did the victim receive any threatening letters or other communications?
 - (1) Examples:
 - (a) Unsolicited gifts received by mail for birthday or special holidays?
 - (b) Unsolicited sample of new product received in the mail?

(2) Source?

- (a) Where are they?
- (b) Who sent them?

u. Did the victim write any letter recently?

4. Investigating the activities of the victim prior to the poisoning event.

5. Ascertain the source of the poison.

- a. Pure poison? - see "Poison Register" at pharmacies
- b. Commercial products?
- c. Stolen from place of employment?
- d. Ordered from chemical supply houses?

6. Collecting the physical evidence (remember "chain of evidence"!)

- a. Remains of food and drink
- b. Drugs, medicines, chemicals in the home
- c. Glasses, bottles, spoons, syringes
- d. Soiled linen, or clothing

7. Product tampering

a. **Federal Anti-Tampering Act:** it is a felony to tamper foods, drugs, devices, cosmetics, and other consumer products.

b. Investigational agencies:

(1) Prior to 1989, the FDA maintained the "Elemental Analysis Research Center", Cincinnati, Ohio.

(2) In 1989, the FDA began the "Forensic Chemistry Center", Cincinnati, Ohio.

c. Points of entry for contamination:

(1) During manufacturing -- employee sabotage.

(2) During distribution -- product is tampered with and returned to the shelf looking untouched. Frequently the offender has a specific victim in mind, and tries to make the crime look like a random death.

- (3) After purchase -- usually false report cases seeking settlement from the manufacturer.

D. Analytical toxicological analyses:

1. Tests do *NOT* detect all chemical substances!
 - a. Drug screen: Arsenic, Antimony, Thallium, Lead
 - b. Volatile screen: solvents (Chloroform, Ether)
 - c. General Unknown screen: Cyanide, Volatiles, Strychnine, Heavy metals, Drugs
2. Analysis is aided by indication of suspected substances. One can *NOT* find what one is *NOT* looking for!
3. Can only indicate the presence & quantity, but *NOT* the reason for the exposure.
4. Differences in quantitative amount:
 - a. Homicide - usually just the right amount for a lethal dose is given.
 - b. Suicide - usually a massive amount is taken.

E. Avoiding detection:

1. Witnesses
2. Evidence
3. Medical - (autopsy)

Cremated remains can *NOT* be analyzed to produce utilizable information.

- a. Most chemical substances will be burned off at the high temperatures required for incineration.
- b. Can *NOT* prove that sample is pure. Could be contaminated with other cremains.
- c. Would *NOT* be able to prove that the poison was in systemic circulation.
- d. Would *NOT* be able to prove what organ the poison originated in. There would be no basis for comparison (e.g. milligrams of Arsenic per gram of liver).

e. Chain of evidence is difficult to maintain.

F. Things that **should arouse an investigator's suspicions!**

1. Sudden death in a normally healthy individual.
2. An individual interfered with the victim receiving proper medical attention.
3. No signs of violence to the body.
4. Illness reoccurred in **cycles**: chronic exposure?
5. Mysterious symptoms in a **common group** of people.
6. An individual is anxious to dispose of food, drink, or medicine, of which the victim partook.
7. An individual prevented friends or relations being sent for during the illness.
8. Insistence on **NO autopsy**.
9. Insistence on a **rapid cremation**.
10. Explanation offered by family member for cause of death.
11. Attempts by family member to guide the investigation.
12. An individual shows a familiarity with poisons.

G. Forensic autopsy

1. Irritated tissues
2. Odors
3. Mees' lines - heavy metals
4. Toxicological screens
 - a. heavy metals
 - b. volatiles
 - c. common drugs

5. Specimens for testing (be certain all specimen containers are clean and *NOT* contaminated!):
 - a. Urine (all available)
 - b. Gastric contents (all available)
 - c. Blood (heart = 25 ml, peripheral = 10 ml)
 - d. Brain (100 grams)
 - e. Liver (100 grams)
 - f. Kidney (50 grams)
 - g. Bile (all available)
 - h. Vitreous humor (all available)
 - i. Hair/nails

VI. PROVING THE POISONING CRIME

A. **Detection** - the role of Analytical Toxicology.

1. The "shot gun" approach to detection will most likely *NOT* be successful.
2. The analysts need some guidelines to what compounds are suspected.
 - a. Crime scene
 - b. Autopsy - pathological findings
3. Cardiac blood may differ from peripheral blood in the quantitative analyses.
4. Get qualified Medical Examiner on the case immediately!

B. **Discovery** - proving legally that a crime was committed, and demonstrating beyond reasonable doubt that death was caused by poison, administered with malicious/evil intent to the deceased.

C. **Motive** - the instigating force responsible for carrying out the action.

D. **Intent** - the purpose or aim behind the commission of the act (the hoped for or desired outcome).

E. **Proof** - that the accused had access to the poison responsible for the death.

1. Proof of sale - (receipts, poison registers)
2. Proof of access at work place, occupation, or hobby

F. **Proof** - that the accused had access to the victim.

1. To administer the poison directly or indirectly
2. Original packings or wrappers, associated to suspect

G. **Proof** - that the death was caused by poison - sufficient *sound* evidence as would induce a reasonable person to come to this conclusion.

1. In order to prove death by poison, the presence of the poison in the **systemic** circulation and/or body organs must be made!
2. The presence of the poison only in the gastrointestinal (GI) tract does *NOT* prove death by poisoning. The GI from mouth to anus is like a garden hose - hollow, and open at both ends, and "outside" the topological frame of the body.
3. The poison must be absorbed through the walls of the gut and enter the body's systemic circulation.
4. Chain of evidence **MUST** be maintained!

H. **Proof** - that the death was homicidal. This can *NOT* be done analytically or by autopsy, but depends on the work of the criminal investigator at the crime scene and examination of witnesses! Must exclude categorically:

1. Accident
2. Intentional abuse
3. Suicide
4. Homicide

I. **Proofs** necessary for a conviction!

1. The death was caused by poison:
 - a. Chemical analyses
 - b. Pathological exam
2. The accused administered the poison to the deceased
 - a. Opportunity

- b. Possession
 - c. No other person was possible or probable
3. The accused was aware of the poison's lethality

VII. THE POISONER ON TRIAL

A. The poisoner defense

1. The best defense? The simplest answer that explains the facts!

2. Defenses

- a. Death was by another cause.
- b. Death was *NOT* homicidal.
- c. Death was *NOT* the intended outcome.
- d. Definition = substance is *NOT* a poison.
- e. Reasons for possession of poison:

- (1) Job/hobby related
- (2) Pesticide (domestic)

B. Poison conviction problems:

- 1. Evidence is circumstantial (indirect).
- 2. No witnesses.
- 3. Scientific evidence in dispute, and rebutted by other technical experts.
- 4. The "legal definition" of the poison can be a problem.
- 5. The "**CONVICTION PYRAMID**" - (four points that need to be proven to be connected):
 - a. Victim
 - b. Poison
 - c. Poisoner
 - d. Motive

C. Battery by Poison

- 1. One may commit a battery by causing injury through poisoning.

2. Battery may result when a person is injured in a dangerous situation intentionally created by the defendant.
3. A defendant is held to be culpable in a battery charge if he acts with either an intent to injure or with criminal negligence.
4. "Aggravated battery", punishable as a felony, results from actions taken with the intent to kill. Usually, the defendant must have intended to cause the specific result; otherwise the crime is considered a "regular battery" charge.

VIII. CONCLUSION - "The game is afoot" - (*Sherlock Holmes*)

- A. Unless we remain ever vigilant, we will loose the game!
- B. Unless poisoning is considered in the first place, the evidence will most likely be buried with the victim, and the poisoner will walk off into the sunset with a feeling of superior intellect and smugness!
- C. The **Prime Directive** for criminal investigation!

Every death must be considered a HOMICIDE until the facts prove otherwise!

- D. The **Sub-Directive** for criminal investigation!

Every death, with no visible signs of trauma, must be considered a POISONING until the facts prove otherwise!!

- E. Putting the clues together -- when all the clues overlap, one will match the offender.
 1. **WHO?** - specific or random target.
 2. **WHAT?** - one must prove poison is systemic! Solid, liquid, or gas, the weapon is a chemical molecule.
 3. **WHERE?** - a poisoning may have multiple crime scenes.
 4. **WHEN?** - time from administration till death?
 - a. *Acute dose = sudden onset.* Analysis of Blood, Urine, Gastric (= BUG).
Look for rapid action (Cyanide, Strychnine)
 - b. *Chronic dose = prolonged symptoms.* Analysis of hair. Look for heavy metals.

5. **WHY?** - victim stood between what goal?
6. **HOW?** - look at the items the victim used routinely,

POISONER SCHEMATIC

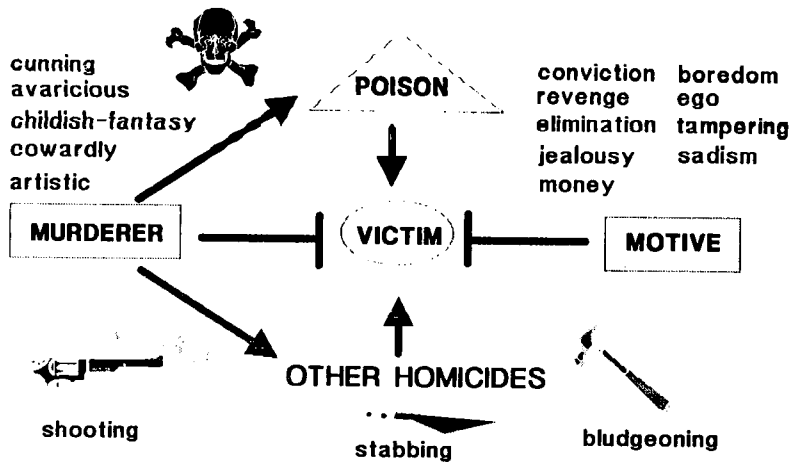


Figure by: JI Testrad - 061994

POISONER TYPES

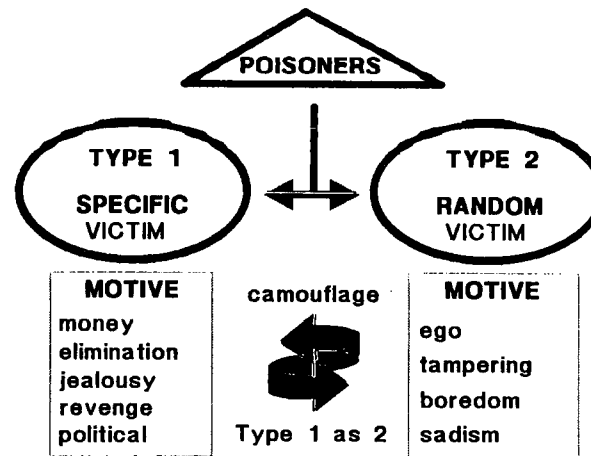


Figure by: JI Testrad - 050092

POISONER THINKING

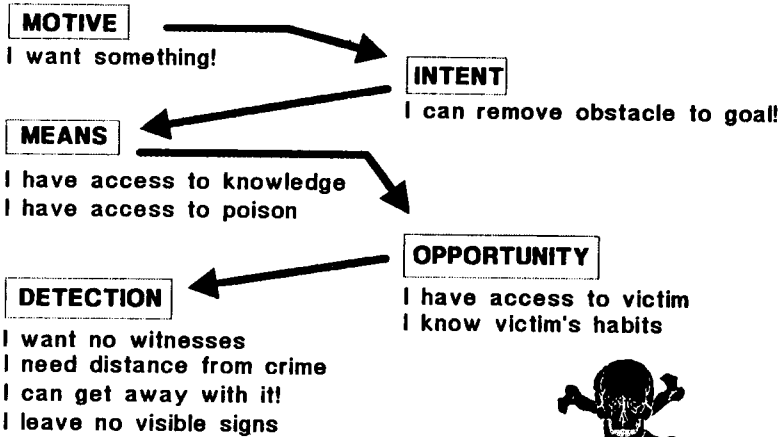


Figure by: JI Testrad - 061992

ACCESS TO POISON

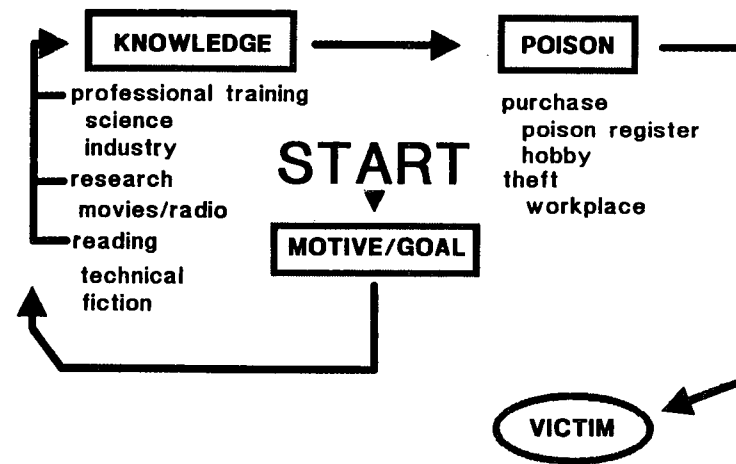
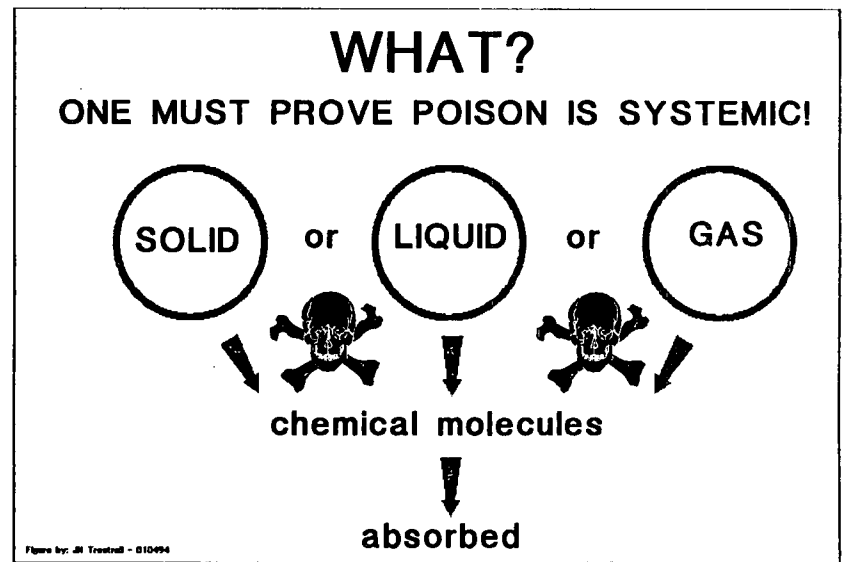
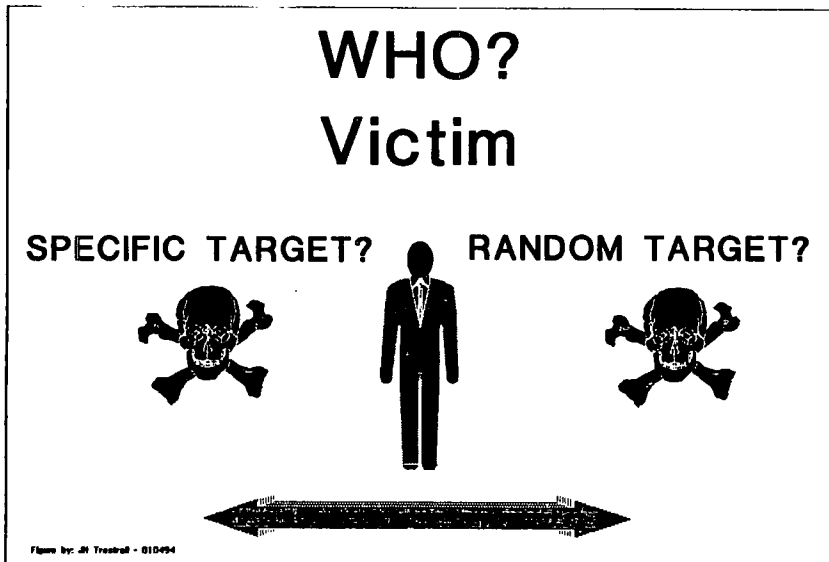
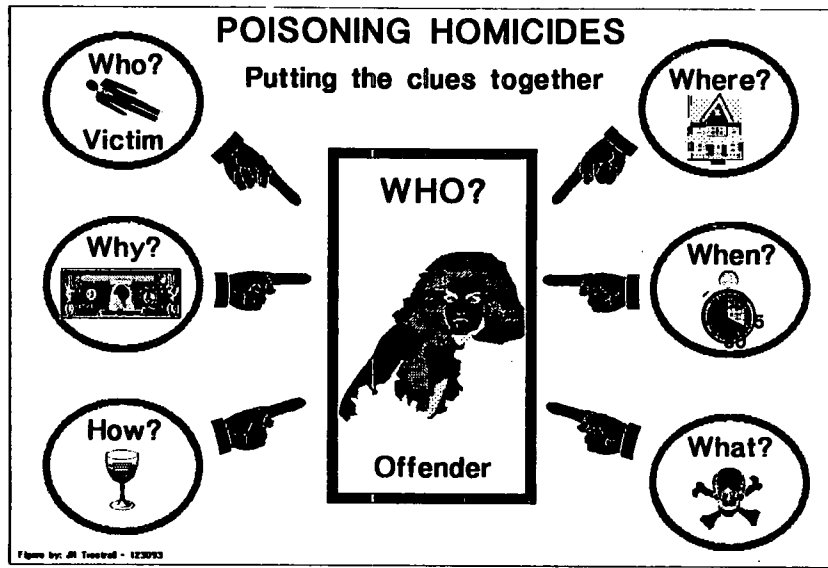
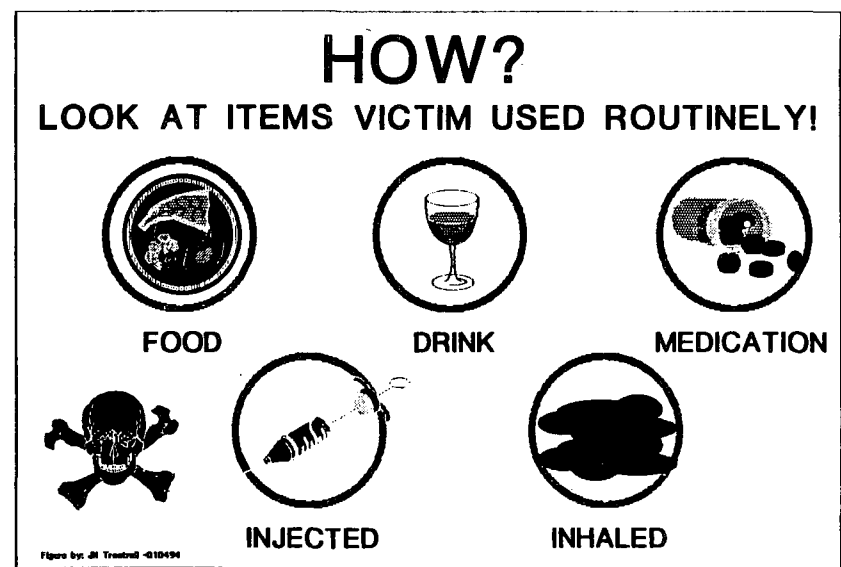
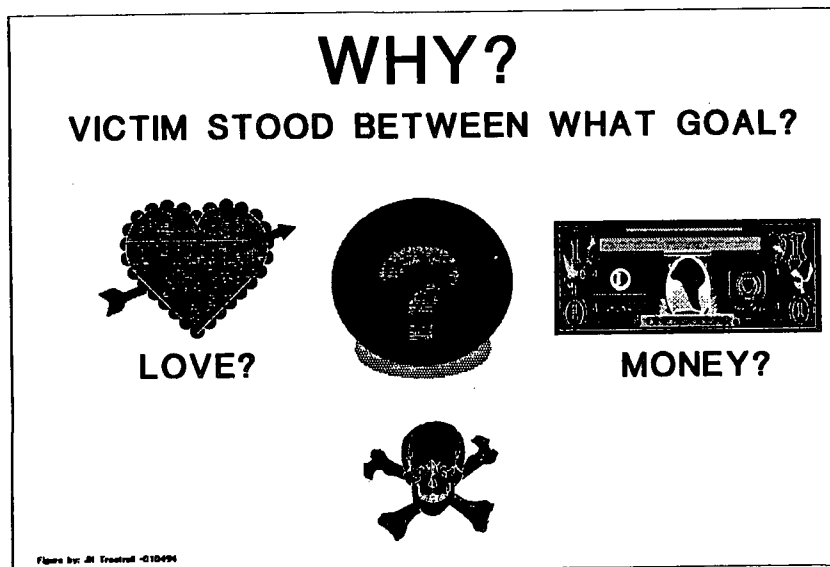
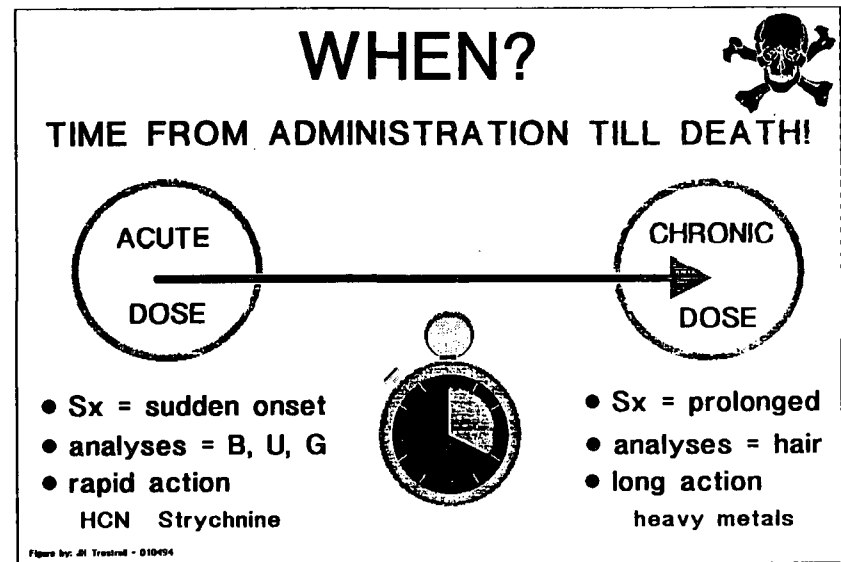
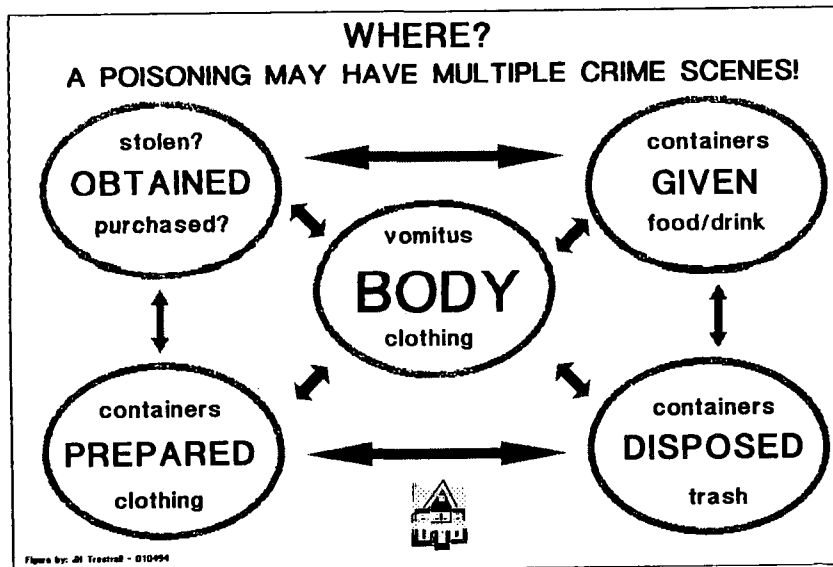
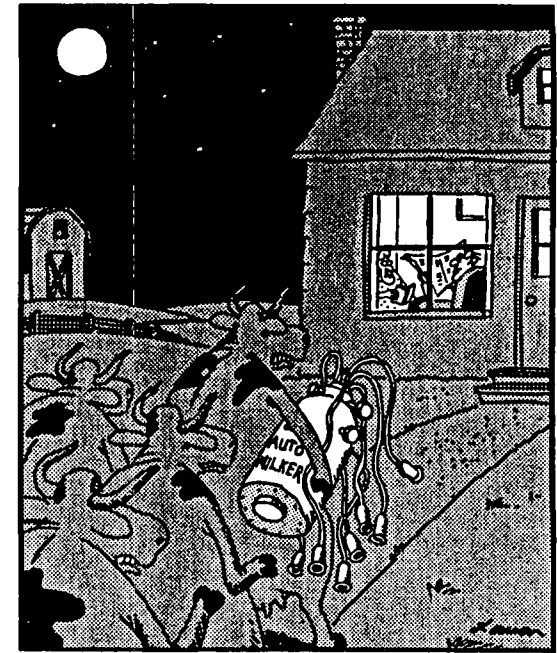
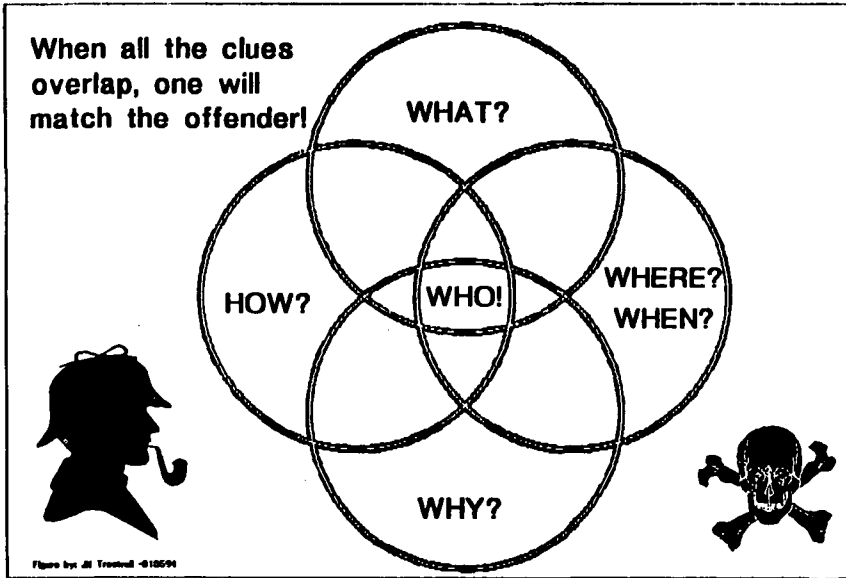


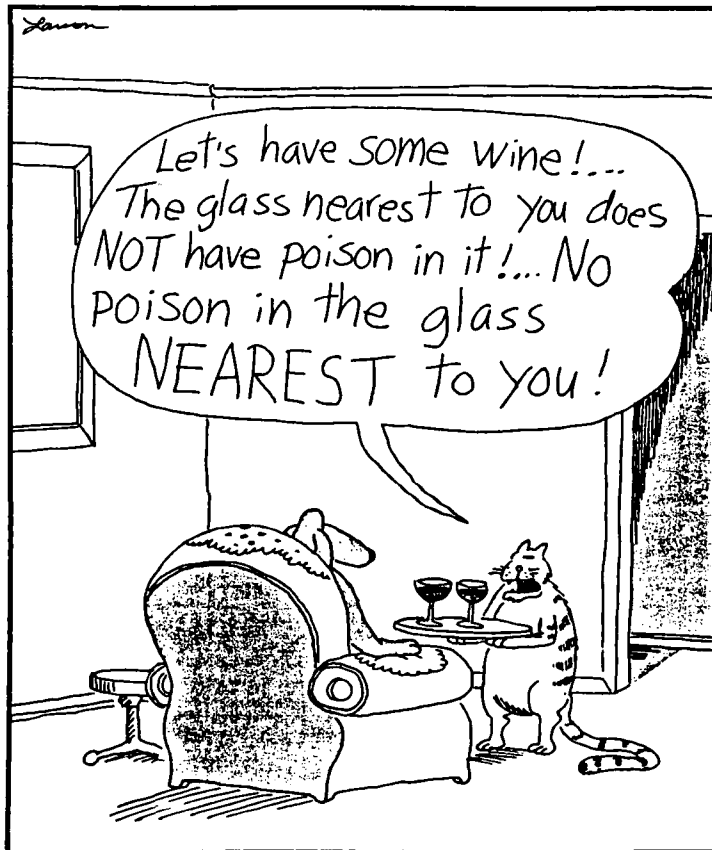
Figure by: JI Testrad - 061992







That night, their revenge was meted out on both Farmer O'Malley and his wife. The next day, police investigators found a scene that they could describe only as "grizzly, yet strangely hilarious."



When dumb animals attempt murder.



"Same as the others, O'Neill. The flippers, the fishbowl, the frog, the lights, the armor. . . Just one question remains: Is this the work of our guy, or a copycat?"

HOMICIDAL POISONING - CASE REGISTRY
(Please print or type, and use one form per VICTIM)

DATE OF REPORT: _____ DATE OF DEATH: _____

ABOUT THE VICTIM

VICTIM'S NAME: _____

VICTIM'S: AGE _____ GENDER _____ RACE _____

ABOUT THE OFFENDER - (if known)

OFFENDER'S NAME: _____

OFFENDER'S: AGE _____ GENDER _____ RACE _____

OFFENDER'S RELATIONSHIP TO VICTIM: _____

OFFENDER'S MOTIVE: _____

OFFENDER'S CONVICTION STATUS: _____

ABOUT THE POISONING

POISON(s) USED: _____

ROUTE OF POISON ADMINISTRATION: _____

SOURCE OF POISON: _____

LOCATION OF POISONING: _____ (City) _____ (State)

ABOUT YOUR REPORTING AGENCY

YOUR CASE #: _____

YOUR NAME: _____

YOUR TITLE: _____

YOUR ADDRESS: _____

AGENCY

STREET

CITY - STATE - ZIP

TELEPHONE: _____ FAX: _____

USE REVERSE SIDE FOR ADDITIONAL NOTES & COMMENTS.

THANK YOU, PLEASE MAIL COMPLETED FORM AND ANY SUPPORTING MATERIALS TO:

John H. Trestrail, III, RPh, ABAT
Toxicologist
BLODGETT REGIONAL POISON CENTER
1840 Wealthy, S.E.
Grand Rapids, MI 49506

Telephone: (616) 774-5329

FAX: (616) 774-7204



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Revised: November 16, 1997

Homicidal Poisonings in the United States: An Analysis of the Uniform Crime Reports from 1980 through 1989

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We performed analyses of data on 292 homicides by poisoning in the United States. The data, from the *Uniform Crime Reports* (UCR) 1980 through 1989, involved cases of one poisoned victim and one poisoning offender. Demographic factors analyzed for each victim and offender include age, gender, race, relationship of victim to offender, major category of poison, month, year, geographic location, and crime classification. The goal of this study is to identify homicidal poisoner demographics that could assist forensic scientists and law enforcement personnel in their criminal investigations and to serve as the foundation for a more formal investigative analysis of this kind of subtle killer.

Key Words: Crime—Demographics—Forensic science—Homicide—Poison—Toxicology.

Poisoning homicides have remained among the most difficult crimes to detect and to bring the offender to justice (1).

The following four cases selected from FBI and police files (2) represent homicides in which the nature of the poisoning homicide was initially missed by criminal and medical investigators, but determined at a later date.

CASE REPORTS

CASE 1

In 1980, Audrey Marie Hilley ("The Black Widow"), a middle-aged Alabama woman, gained notoriety by using arsenic to murder her husband, and later made a similar attempt on her 19-year-old daughter. The poisoner managed to elude capture for 3 years by creating new identities for herself. Hilley subsequently remarried under a new identity, and when she thought she had been discovered, faked her own death and returned to her husband as her own twin sister. The death of her first husband was initially attributed to hepatitis. The classification of homicidal poisoning was concluded only after the discovery of arsenic in Audrey Hilley's own daughter.

Case Disposition

The offender was subsequently convicted and sentenced to life in prison for the 1975 murder of her first husband, Frank Hilley, and the 1979 attempted murder of her daughter. Audrey Marie Hilley died in 1987 while on a 3-day pass from prison to visit her second husband.

Case 2

In 1983, Texas-licensed vocational nurse Genene Jones was tried on a single charge of murder, even

Manuscript received March 4, 1996; accepted March 18, 1996. From the Behavioral Science Unit, FBI Academy, Quantico, Virginia; and the Blodgett Regional Poison Center (J.H.T.), Blodgett Memorial Medical Center, Grand Rapids, Michigan, U.S.A.

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though those who had worked with her believed she had been responsible for the deaths of more than a dozen children under her care. As a poisoner, she used succinylcholine, a powerful muscle relaxant. She was finally jailed in 1982. In her first 31 days of work for a pediatrician, nine incidents of respiratory arrest involving eight patients occurred before Jones was finally arrested.

Case Disposition

The offender was sentenced to 99 years for the murder of one patient and 60 years for the attempted murder of a second.

Case 3

In 1988, Blanche Tyler Moore was sentenced to death after discovery that while her boyfriend lay in a hospital bed, she was feeding arsenic-laced food to him in the form of peanut butter milk shakes and banana pudding. She was then subsequently charged with the death of her first husband and the poisoning of her estranged husband, who had become sick after their honeymoon but survived.

Case Disposition

Moore died by execution.

Case 4

In 1988, George James Trepal of Florida spiked a neighboring family's Coca Cola bottles with thallium because of his dislike for the family. The poison eventually killed Peggy Carr, the mother, after she had been hospitalized for a number of weeks and erroneously diagnosed with a nervous system disorder of unknown cause. The poisoner was charged with first degree murder, attempted murder of the other members of the family, and product tampering.

Case Disposition

Trepal was sentenced to death and is awaiting execution.

ning, and also not infrequently the repetition of the act of administering poison. . . . Its characteristic being one of premeditation, it is a method of murder which therefore cannot be the subject of extenuation as some other forms of killing can.

Rowland (4) listed the following as characteristics of the poisoner: has an unfortunate married life, fails to make an impression on life, is connected with the medical world, is vain, possess a mind without sympathy and/or imagination, and is spoiled by his/her parents. Another author, Wilson (5), described the characteristics of the poisoner as weak-willed, a daydreamer, a fantasist, possessing an artistic temperament, cowardly, and avaricious. Are the current perceptions of law enforcement and some of the medical profession's statements about a poisoner's characteristics accurate?

When a death investigator thinks of a poisoner, the following stereotypes might come to mind: female, highly intelligent, cowardly, artistic, domestic, subtle, and manipulative. When homicidal poisoners and their victims are studied as a group, what relationships and characteristics are, in fact, observed?

Other than the published reviews of some famous historical poisoning cases, such as the four referred to earlier, little has been written about the characteristics of the poisoner and of his or her victim. A review of international forensic literature did not locate any published epidemiological studies about the criminal investigative analysis or psychological profile of the homicidal poisoner. As a first attempt to give forensic scientists and law enforcement personnel a clearer picture of some characteristics of poisoning homicide victims and offenders, we believed an analysis of reported poisoning homicides might help clarify the most salient characteristics of this kind of killer. Although it is limited in detail, we decided that the most accurate statistical document on poisoning homicides is the FBI's *Uniform Crime Reports* (UCR) (6). The period we selected for analysis was the decade 1980 through 1989.

CHARACTERIZING THE POISONER

Only a few efforts have characterized the poisoner. The subtlety of the homicidal poisoner was ideally summed up by the toxicologist Glaister (3): Poisoning, of course, differs considerably from many other crimes frequently committed in uncontrolled passion and in the heat of the moment. The innate character of the crime of homicidal poisoning demands subterfuge, cunning and, what is equally important, usually a period of careful plan-

MATERIALS

The UCR program has traditionally been used to look for fluctuations in the level of crime and to provide criminologists with statistics for varied research and planning.

In the US, the UCR is the result of a nationwide, cooperative effort of >16,000 city, county, and state law enforcement agencies, who voluntarily report crimes that come to their attention. In 1991, those law enforcement agencies active in the pro-

gram represented 96% of the country's population, some 241 million individuals. The demographic information compiled by UCR contributors is forwarded directly to the FBI from local law enforcement agencies or through a UCR program at the state level. The FBI then edits and reviews each individual agency report for completeness and accuracy.

For UCR purposes, *criminal homicide* and *non-negligent manslaughter* are defined as the willful (nonnegligent) killing of one human being by another. The classification is based solely on police reports, as opposed to the determination of a court, medical examiner, coroner, jury, or other judicial body. Not included in the reports are deaths caused by negligence, suicide, or accident; justifiable homicides; and attempts to murder or assaults to murder, which are scored as aggravated assaults.

METHOD

For this study, the total number (202,785) of UCR homicides in the US for the 10 years from 1980 through 1989 were computer analyzed to yield demographic data on crimes in which a chemical (nondrug) poison or a drug/narcotic was used by an offender for homicidal purposes.

Any substance taken in extreme amounts can be lethal. Even water, in excessive amounts, can cause death by creating an electrolyte imbalance or hyponatremia. Certain substances are known to be toxic (e.g., arsenic, cyanide) and require very small amounts to cause death. The dose alone determines what is a poison.

This search was conducted by using specific UCR codes identifying every case within the database in which chemical (nondrug) poison or a drug/narcotic was a weapon for homicidal purposes.

If obtainable, after the percentage for the poisoning homicide criterion in the database will be the notation {AH%}, which represents a corresponding percentage value for the poisoning criterion compared to "all homicides." To be cost-effective, the "all homicides" values were obtained from a sample of UCR homicide reports by averaging the published UCR homicide data for the years 1980, 1985, and 1989. Those data represented values from the beginning, middle, and end of the decade, as published in the annual report *Crime in the United States*.

RESULTS

Of the 202,785 UCR-listed homicides in the US for the decade studied, 292 (0.14%) or 14 per

10,000 were homicidal poisonings involving a single victim and a single offender.

Criminal investigators approach a crime to answer the basic questions of Who?, What?, Where?, When?, Why?, and How?. The results of this demographic study have been grouped together into these same investigative categories. Because of rounding to the nearest whole percentage, percentages may not total 100. Demographic information relating to race and gender are shown in Tables 1 through 4.

Poisoning Victim Gender Versus Offender Gender

Victims of homicidal poisonings were almost equally divided between male and female genders as seen in Table 1. If the victim was a female, the offender was predominantly a male. If the victim was a male, the offenders were almost equally divided between males and females.

Poisoning Victim Gender Versus Offender Race

As shown in Table 2, whether the victim was male or female, the poisoning offender was predominantly of the white race. Far fewer black offenders were involved with male or female victims. The rate of unknown poisoning offenders compared to all other unknown homicide offenders was 20 to 30 times higher, probably because there were no witnesses to the crime and therefore no helpful clues to offender identification.

Poisoning Victim Race Versus Offender Race

It appears typical that homicidal poisonings with identified offenders have not crossed racial lines; predominantly, the offender had the same racial background as the victim.

Poisoning Victim Race Versus Offender Gender

For poisoning homicides involving known offenders, as in Table 4, whites were predominantly the victims of a male offender, blacks were almost equally the victims of male and female offenders, and people of other racial backgrounds were predominantly the victims of female offenders.

Poisoning Victim Race Versus Victim Gender

By race, blacks were victims of poisoning homicides at a rate almost one third that for all homicides on black victims. By gender, black males were victims almost twice as often as black females. White victims were almost equally divided between males and females. Victims of other racial backgrounds were females three times as often as males.

TABLE 1. Victim gender/offender gender

Victim gender	UCR no.	UCR %	AH %	Offender gender	UCR no.	UCR %	AH %
Male	145	50	74	Male	55	38	83
				Female	40	28	17
				Unknown	50	34	1
Female	147	50	25	Male	87	59	90
				Female	25	17	9
				Unknown	35	24	1
Total	292	100	99		292	200	201

UCR, *Uniform Crime Reports for the United States* (5); AH %, corresponding percentage value for the poisoning criterion compared to "all homicides" in the UCR database.

Poisoning Offender Race Versus Offender Gender

By race, black poisoning offenders were males almost twice as often as females. White poisoning offenders were almost twice as often males as females.

By gender, the result that 49% of the poisoning offenders were male, compared to 22% female offenders, might challenge the popular perception that poisons are primarily used by female offenders. Note that the gender of 29% of the offenders remains unknown.

Age of Poisoning Victims

The victims' ages ranged from one aged <1 week to 13 aged ≥75 years. The age range for the greatest number of victims was 20 to 34 years, which constituted 140 (48%) of the victims. The age of the victim was unknown in 4 (1%) of the homicides.

Age of Poisoning Offenders

The offenders' ages ranged from two offenders in the 10 to 14 year range, to seven who were ≥75 years. The group aged 20 to 34 years accounted for 102 (35%) of the offenders. The age of the offender was unknown in 85 (29%) of the homicides.

Relationship of Poisoning Victim to Offender

Homicide carried out on a victim who was related to the offender accounted for 100 (34%) of the poisonings. The four most frequent relationships within the family were wife (34 or 12%), son (17 or 6%), husband (16 or 6%), and daughter (14 or 5%). Victims who were outside of the family of the offender accounted for 114 (39%) of the poisoning homicides. The five most frequent relationships outside of the family were acquaintance (57 or 20%), friend (14 or 5%), girl friend (13 or 4%), stranger (12 or 4%), and other (12 or 4%). In 78 (27%) of the homicides, the victim had an unknown relationship to the offender.

For UCR data including the relationship of the offender's victim, slightly more of the victims were outside (39%) than within the family (34%) of the offender.

Poisoning Offender Gender Versus Class of Poison

UCR data do not identify the exact kinds of poison involved, but only its major classification as chemical (nondrug) or drug/narcotic. Thirty-three (30%) of the female offenders and 49 (45%) of the male offenders used an unspecified chemical (nondrug) poison. Thirty-two (17%) of the female offenders and 93 (51%) of the male offenders used

TABLE 2. Victim gender/offender race

Victim gender	UCR no.	UCR %	AH %	Offender race	UCR no.	UCR %	AH %
Male	145	50	74	White	71	49	48
				Black	23	16	52
				Other	1	1	2
				Unknown	50	34	1
Female	147	50	25	White	97	66	53
				Black	13	9	44
				Other	2	1	2
				Unknown	35	24	1
Total	292	100	99		292		

UCR, *Uniform Crime Reports for the United States* (6); AH %, corresponding percentage value for the poisoning criterion compared to "all homicides" in the UCR database.

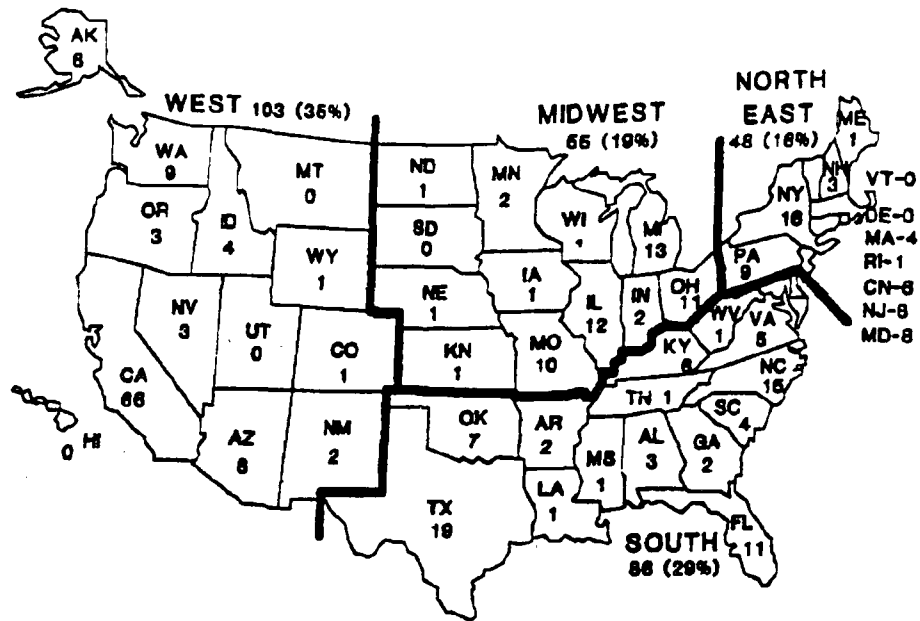


FIG. 1. Homicidal poisonings, arranged by state.

of analytical toxicology laboratories in the area, or the workload of local law enforcement and/or forensic pathology personnel.

Poisoning Homicide Rate by Population

In the US, the rate of poisoning homicides per decade averaged 1.47 per million inhabitants, for the 44 states involved. The five states with the highest rate of poisoning homicides per million inhabitants were California (21.72), Illinois (10.40), Florida (8.29), Idaho (3.85), and New Hampshire (2.71). California had a homicidal poisoning rate per million inhabitants 18.7 times the average rate (1.16), compared to the remaining 43 states in the group.

Poisoning Homicides by Year and by Month

The number of poisoning homicide reports for each year in the decade studied remained relatively constant, and the number of poisoning homicide reports for each month in that decade remained relatively constant.

Poisoning Homicides by Circumstance

The 112 (38%) homicides whose circumstances were determined had occurred under the following circumstances and involved the following number of victims: rape (2), robbery (2), other sex crime (5), narcotic drug laws (51), other—not specified (13), lover's triangle (6), child killed by baby-sitter (1), brawl influenced by alcohol (1), brawl influenced by narcotics (3), other arguments (14), gangland killings (1), and all suspected felony type

(20). We cannot determine from UCR data an exact motive in 180 (62%) of the reports; they fall into such general UCR categories as "Other," "Other—not specified," or "Unable to determine circumstances."

In only six (2%) of the reports was the circumstance related to a "Lover's triangle," which seems contrary to the popular perception that poisons are often used in domestic situations to remove a "significant other" and to allow the offender to achieve a romantic goal.

However, because of the large number of reports that fall into the generalized "unknown" categories, it is impossible to determine exact motive as related to the relationship of the victim and offender. It is interesting that three times as many husbands were victim in the "Lover's triangle" as were wives. Also, in two reports, the victims were the acquaintances in the "triangle."

It is not possible from the UCR data to determine how poison was administered.

CONCLUSION

Because of the unusual circumstances of poison cases, this study is limited to those reported cases in which poison was determined by the investigating agency to be the cause of death. Many poison cases are undetected because many of the symptoms displayed by toxic substances mask themselves as symptoms of disease. It is our intention through this study to make the forensic and law enforcement community more aware of these

TABLE 3. Victim race/offender race

Victim race	UCR no.	UCR %	AH %	Offender race	UCR no.	UCR %	AH %
White	242	83	51	White	164	68	87
				Black	10	4	11
				Other	1	0	1
				Unknown	67	28	1
Black	46	16	47	White	3	7	5
				Black	26	57	94
				Other	0	0	0
				Unknown	17	37	1
Other	4	1	1	White	1	25	27
				Black	0	0	11
				Other	2	50	60
				Unknown	1	25	68
Total	292	100	99		292		

UCR, *Uniform Crime Reports for the United States* (6); AH %, corresponding percentage value for the poisoning criterion compared to "all homicides" in the UCR database.

an unspecified drug/narcotic as homicidal agent. In the remaining cases, of unknown offender's gender, an unspecified chemical (nondrug) poison was used in 27 (9%) of homicides, and an unspecified drug in 58 (20%) of homicides.

Chemical (nondrug) poisons were used in a ratio of 1.5:1 by male compared to female offenders. A drug/narcotic was utilized in a ratio of almost 3:1 by male offenders compared to female offenders.

Poisoning Homicides by Geographic Area

From the 292 studied cases, a total of 44 (88%) of the 50 states had poisoning homicides reported for the decade. The five states with the most cases, accounting for a total of 129 (44%) of the reported homicides, were California (66 or 23%), Texas (19 or 7%), New York (16 or 5%), North Carolina (15 or 5%), and Michigan (13 or 4%). The six states that had no UCR poisoning homicide reports for the decade were Delaware, Hawaii, Montana, South Dakota, Vermont, and Utah. Analyzing the 292

poisoning homicide reports by geographic region: of the United States gave the following results: Northeast (48 or 16%) {AH 17%}, South (86 or 29%) {AH 43%}, Midwest (55 or 19%) {AH 19%}, and West (103 or 35%) {AH 21%}. Figure 1, a map of the United States, shows the geographic distribution of homicidal poisonings by state and region.

Homicidal poisonings have occurred throughout almost the entire country, with 44%, as noted, reported from only five states. The reason for this higher incidence from the states and regions could not be ascertained from the UCR data, but speculatively could be related to population.

The fact that fewer UCR reports were received from one geographic area over another does not necessarily mean that certain areas had lower poisoning homicide rates. Factors that could affect the number of reports from a jurisdiction include legislation requiring autopsies or toxicology screens on all deaths of unknown cause, the sophistication

TABLE 4. Victim race/offender gender

Victim race	UCR no.	UCR %	AH %	Offender gender	UCR no.	UCR %	AH %
White	242	83	51	Male	125	52	88
				Female	50	21	11
				Unknown	67	28	1
				Black	46	16	47
Black	46	16	47	Male	16	35	81
				Female	13	28	19
				Unknown	17	37	1
				Other	4	1	1
Other	4	1	1	Male	1	25	86
				Female	2	50	11
				Unknown	1	25	11
				Total	292	100	99

UCR, *Uniform Crime Reports for the United States* (6); AH %, corresponding percentage value for the poisoning criterion compared to all homicides" in the UCR database.

crimes so that fewer cases of homicide by poison are undetected.

From this study, it is evident that the incidence of reported poisoning homicides made up only a small portion of the UCR data for the decade.

We note that the race or gender of poisoning offenders remained unknown more frequently than in other homicides of the decade. This could indicate that homicide investigators were more often presented with a poisoning homicide victim, and were never able to identify the offender.

Levels of awareness need to be raised among homicide investigators and medical examiners so they become more wary of crime scene details that may indicate poisoning: lack of external trauma to the body; sudden, unexpected death of an individual in good health; past history of flu-like symptoms; repeated visits to clinics or hospitals with flu-like symptoms. If suspicion of homicide by poison arises, specific screening tests must be ordered by the medical examiner to rule out death by poison.

Closer examination and study of individuals who have been charged and convicted of poisoning need to be made. Characteristics of individuals who choose poison as their instrument of homicide should be compared to the characteristics of other homicide offenders to determine whether specific profile traits surface regarding the poisoning offenders.

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ASPHYXIAL DEATH

Asphyxial Death

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. **Asphyxia (Definition):** A lack of oxygen or excess of carbon dioxide in the body that is usually caused by an interruption of breathing and that causes unconsciousness and death.

II. General Points & Artifacts of Asphyxia

- A. After pressure is applied [to the neck], unconsciousness supervenes in a matter of seconds. The heart may continue to beat for 15-20 minutes.
- B. Pressure on the base of the neck may cause the tongue to protrude between the teeth. The exposed portion of the tongue will dry and become dark (post-mortem artifact).
- C. Fracture of bone or cartilage is rare except in judicial hanging, where the cervical vertebrae is fractured and death is instantaneous.
- D. Asphyxial death may cause the face to be congested or discolored (cyanosis).
- E. Petechial Hemorrhage may be observed in the face and conjuncture of the eye and the mucous membrane of the mouth and throat.

III. Manner of Death

- A. Homicide
- B. Suicide
- C. Natural: heart failure, pneumonia, diseases that interfere with oxygen supply
- D. Accidental: allergic reaction to shellfish, bee sting, or medication

IV. Types of Asphyxia

- A. Compression of the neck
Amount of pressure necessary to cause asphyxiation:

Jugular veins	4-5 lbs
Carotid arteries	11 lbs
Trachea	33 lbs
Vertebral Arteries	66 lbs

1. Hanging
 - a. Suspension or partial suspension of the body; the body weight provides the restricting force for cutting off the oxygen.
 - b. The blood supply to the brain and airway is generally obstructed in hangings.
 - c. Furrow tends to angle toward suspension point (inverted V)
 - d. Abrasions or contusions may be present
 - e. Fingers may be trapped under ligature
 - f. Not to be confused with manual strangulation
 - g. In nontotal suspension hangings, internal bleeding or local hemorrhage is uncommon.
 - h. If a fall is involved, as in judicial hangings, some tearing of internal muscles, organs, and blood vessels may occur, and there may be some bone fractures or damage to the cervical vertebrae.
2. Strangulation: Compression of the neck structures without suspension of the body.
 - a. Manual: hands (throttling) or arm (yoking)
 - b. Ligature
 - (1) Hemorrhage may be present between the strap muscles and the ligature
 - (2) Abrasions may be present due to struggle
 - (3) Furrow or groove will usually be lower than that of a hanging

B. Obstruction of the airway

1. Choking

- a. blockage of the internal airway by a foreign object.
- b. Many are accidental:
 - adults in restaurants (cafe coronary)
 - hospitals
 - children (marbles, balloons)

2. Smothering

- a. blockage of the internal airway, or the nose and mouth
- b. Mechanisms and methods:
 - (1) hands
 - (2) pillows
 - (3) plastic bags
 - (4) gags

C. Compression of the chest: normal mechanism for respiration cannot occur

D. Depletion of Oxygen

- 1. Sudden loss of cabin pressure at high altitudes
- 2. Consumption of available oxygen in a sealed space

E. Replacement of Oxygen (Chemical Intoxication)

- 1. Carbon monoxide: deprives the body of oxygen by restricting the ability of the red blood cells to carry oxygen to the tissues of the body.
- 2. Cyanide intoxication: chemical reaction on the body cells that prevents them from utilizing the oxygen carried to them by the blood.
- 3. Central Nervous System (CNS) depressants: inhibit the respiratory centers, causing respiratory depression. Using the chemical agents in combination creates a synergistic effect (they work off each other). Breathing slows, then stops, resulting in asphyxial death.
 - a. alcohol
 - b. opiates
 - c. barbiturates

F. Positional Asphyxia

NOTES

ASPHYXIATION

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Clinical Assistant Professor, University of South Alabama, School of Medicine, Department of Pathology

Sudden unexpected death - general type of cases referred to a medical examiner's office

typically these cases involve trauma or disease affecting 1 of 3 organ systems:

- lungs (respiratory system)
- heart (cardiovascular system)
- brain (central nervous system)

these all have one thing in common: **oxygen**

simply stated, the body must have oxygen in order to live

these systems are those which are immediately required for the delivery of oxygen

- lungs - fuel
- heart - fuel pump
- brain - engine

one additional system is involved in the delivery of oxygen to the tissues:

chemical / biochemical - this is basically respiration of the individual cell

ASPHYXIATION

loss of consciousness as a result of too little oxygen & too much carbon dioxide in blood (Webster's)
failure of cells to receive or use oxygen (DiMaio & DiMaio)

manifests itself as

HYPOXIA - partial lack of oxygen

ANOXIA - complete lack of oxygen

Post-mortem findings are non-specific - there is no definitive finding at autopsy

acute visceral congestion - pooling of blood with pump failure

petechial (pinpoint) hemorrhages - breakage of capillaries with pooling of blood
fluid blood

OXYGEN CONTENT - humans require a fairly continuous supply of oxygen at a specific level

21% - normal air

16% - life threatening

5% - rapid death

oxygen levels below those required

loss of consciousness may occur within 20-30 sec.

Death may rapidly ensue within several minutes unless the situation is altered

DEATH CERTIFICATION

1) CAUSE OF DEATH

the disease process which caused irreversible cessation of life (“why person died”)
determined by autopsy

2) MANNER OF DEATH

determined by investigation
circumstances by which cause of death came to be
natural
accident
suicide
homicide
undetermined

depending on circumstances, a given form of asphyxiation may fall into several different manners
example: hanging (suicide or homicide)
choking (accident or homicide)

CATEGORIES OF ASPHYXIAL DEATHS (D. J. DiMaio, M. D. & V. J. M. DiMaio, M. D.)

1) SUFFOCATION - oxygen does not reach the blood

ENVIRONMENTAL
SMOTHERING
CHOKING
MECHANICAL ASPHYXIA
GASES

2) STRANGULATION - compression of neck structures from applied external force

HANGING
LIGATURE
MANUAL

3) (BIO)CHEMICAL - cellular lack of adequate oxygen utilization

4) OTHER

AUTOEROTIC
CRUCIFIXION
NECK COMPRESSION (choke hold / carotid sleeper)

These broad categories can be defined in another way:

- 1) air / airway obstruction - suffocation
- 2) vascular obstruction - strangulation
- 3) cellular obstruction - (bio)chemical

ENVIRONMENTAL OXYGEN DERANGEMENT

air without oxygen

relative or absolute depletion of oxygen in the air
requires a relatively enclosed space without access to exogenous (external) oxygen
deplete oxygen within air due to consumption

SUFFOCATING GASES - related but slightly different

act by displacing oxygen from air

examples:

enclosed well / cistern - plant life consume oxygen from the air at the bottom

refrigerator - sealed with door & oxygen consumed from within

SCUBA tank - faulty tank without adequate oxygen (rusted internally)

forced depletion of oxygen (see attached article)

carbon dioxide gas

heavier than oxygen - sinks to bottom

lighter oxygen is displaced from bottom creating relative lack

non-oxygen gas

actively / accidentally forces oxygen from enclosed space

methane gas (natural gas) - possibly detected by toxicology

SMOTHERING

block air from entering airway (obstruct nose / mouth)

very subtle form of homicide

must be excluded in all suspected Sudden Infant Death Syndrome (see "Child Deaths")

based on absence of any other indicators from history / autopsy

some SIDS deaths are actually homicidal smothering

autopsy findings may be limited and are non-specific

facial cyanosis / congestion

fine facial petechiae

struggle / resistance wounds

affect injuries inflicted

weapon

minimal or no injuries evident

broad soft surface (pillow / plastic sheet)

removable enclosure (plastic bag)

minor / marked injuries evident

hand

victim

struggle → injuries to face

minimal struggle (old / young / weak / unconscious) → minimal / no injuries

a previously incapacitated or unconscious victim offers little resistance

suspect suffocation in an otherwise healthy person with a low-level drug overdose

child victim

less able to resist force applied by stronger assailant

evidence of smothering may be absent

accelerate loss of consciousness & death sequence

co-existing natural disease (heart or lung disease)

CHOKING

blockage of airway from within

most common in children

foreign body aspiration (breathing object into airways)

ex: portion hot dog, balloon, peanut, etc.

reflex constriction of airways may occur subsequently & compound the problem

autopsy findings

foreign body (if not disturbed during resuscitation efforts)

minimal other findings

not to be confused with agonal aspiration of emesis

a large percentage of people (up to 1/2 vomit & breathe it in as they die)

to die from breathing in vomit, the larger airway branches must be truly blocked

other forms of airway obstruction

asthma - natural disease process where mucus plugs airways & airways constrict

food (café coronary)

subject chokes on a bolus (plug) of food while eating - Heimlich maneuver

often involves compounding alcohol intoxication (swallows too big a bite)

MECHANICAL

blockage of airway from expanding (unable to exchange air from outside to inside chest)

compression of chest by exogenous weight

may be applied to chest or abdomen

lungs cannot move an adequate amount of air to sustain life

examples:

entrapped by automobile on top of chest

crushed under load of material

peine forte at dure - old English torture by placing weights on chest

riot - weight of crowd crushes victim underneath

POSITIONAL ASPHYXIATION

often intoxicated victim

inverted or pinned such that lungs are unable to adequately exchange air

autopsy findings

hemorrhage into soft tissues of chest / abdominal wall - may be negligible

rib fractures - may be absent

facial / conjunctival petechiae - with acute congestion in positional asphyxia (inversion)

may have an associated component of smothering

overlay - (usually intoxicated) lays over an infant while sleeping in the same bed

must exclude SIDS (difficult if not impossible)

Burking - adult body weight applied to chest by sitting on victim

GASES

displace oxygen from the air → *air without oxygen*

see "ENVIRONMENTAL"

STRANGULATION - *compression of neck structures from applied external force*

compression of the neck vessels blocks flow from the pump to the engine

→ death ensues due to lack of oxygen to supply the brain

pressure required to effect vascular compression in the neck

relative forces:

jugular veins - 9.7 kg (4.4 lbs.)

carotid arteries - 24.2 kg (11 lbs.)

trachea (airway) - 72.6 kg (33 lbs.)

vertebral arteries - 145.2 kg (66 lbs.)

****low pressure lines are blocked first**

jugular veins initially blocked

if flow continues within carotids, eventually veins become engorged

forward flow unable to continue (veins blocked) - no place to go

eventually vessels break at weak point (capillaries) → **PETECHIAE**

loss of consciousness occurs within 30 seconds (as little as 10 seconds reported)

brain death occurs with blood flow to brain absent for several minutes

ligature marks are preserved with decomposition - dried compressed skin without blood

1) HANGING

can occur with body in any position - suspended / standing / kneeling / laying down

death results from vascular compromise - rarely is airway obstructed

****neck is usually not fractured**

despite stretched neck observed at scene with complete suspension

judicial hanging designed to break the neck (minimizes suffering)

if neck is fractured, other circumstances enhance effects of trauma

obese subject (increased mass)

long drop (increased velocity)

bone disease (prone to trauma)

SCENE - ***leave body suspended if possible*** (if victim obviously dead)

ligature can be any available object - belt, rope, electric cord, sheets, etc.

suspension point - side, back, or front of neck

AUTOPSY FINDINGS:

abrasion furrow - a chevron (inverted "V") caused by rope rubbing against skin

point of furrow directed toward suspension point

depth / pattern of furrow varies depending on ligature used

broad, soft ligature (sheet) may leave minimal or no furrow

minimal blood associated

vessels occluded → no flow into injury

petechial (pinpoint) hemorrhages of skin

Tardieu spots - due to rupture of vessels with gravity

veins blocked & arterial flow continues → face suffused with blood

fingernail marks - superficial scratches from agonal grabbing at ligature

protruding, dried tongue - pressure on floor of mouth from ligature

neck structures - >1/2 without internal injury

soft tissues - 4/5 minimal or no hemorrhage (no blood flow)

larynx / thyroid cartilage

1/10 fractured superior thyroid (*no hyoid fractures*)

1/5 neck muscle hemorrhage

1/4 conjunctival petechiae (incomplete arterial obstruction)

2) STRANGULATION

a) LIGATURE

use of a ligature (rope, etc.) to encircle & compress neck
may be a component of a sexual homicide

AUTOPSY FINDINGS:

face suffused with blood & conjunctival (possibly facial) petechiae
much more typical for strangulation than hanging
subtotal arterial & complete venous blockage → blood flows in
with struggle, more likely to have incomplete block

abrasion (ligature) furrow

may be subtle or minimal

weak victim (elderly / child)

soft, broad ligature

typical furrow (thin ligature used)

skin similar to appearance of hanging abrasion furrow

**** mark is horizontal rather than chevron**

may directly overly bony structures of the neck

fingernail marks

may have horizontal to vertical crescentic marks at neck

victim attempting to remove ligature

neck structures $\geq 1/3$ with injury

trauma is more directly applied to bony structures (hyoid / thyroid)

blood at fracture site indicates a pre-mortem injury

vessels incompletely occluded (victim struggles)

b) MANUAL

use of body (hand or arm) to compress neck

***impossible to manually strangle oneself to death** - lose consciousness & release
often seen as a component of sexual homicide

AUTOPSY FINDINGS:

face suffused with blood & conjunctival (possibly facial) petechiae

much more typical for manual strangulation

subtotal arterial & complete venous blockage → blood flows in
with struggle, more likely to have incomplete block

most visible *above* compression point

additional blunt force injuries

abrasions & contusions about face

result from struggle with assailant

fingernail marks - crescentic abrasions on neck

horizontal - victim attempting to remove assailant's hand

vertical - assailant's hand compressing neck

fingertip bruises

oval bruises about $\frac{3}{4}$ to 1 inch diameter corresponding to fingers

neck structures - injury expected due to nature of attack (>90%)

trauma is more directly applied to bony structures (hyoid / thyroid)

blood at fracture site indicates pre-mortem injury

vessels incompletely occluded (victim struggles)

minimal internal & external injury possible with incapacitated victim

petechiae should still be present

(BIO)CHEMICAL

inability of the cells to use oxygen provided

many different chemicals may result in asphyxiation

CARBON MONOXIDE (CO)

produced by incomplete combustion of hydrocarbons (fire / auto exhaust)

two synergistic effects on body

binds to hemoglobin (which carries oxygen) 300x more than does oxygen

no sites available to bind & carry oxygen

decreases release of oxygen to the tissues (shifts dissociation curve)

cannot supply oxygen once hemoglobin reaches tissues

levels

normal $\leq 5\%$

smoker $\leq 10\%$

firefighter / auto tunnel $\leq 15\%$

lethal

natural disease (impaired oxygen delivery) $\geq 20\%$

elderly $\geq 20\%$

house fire 55% (30-40% common)

auto exhaust $\geq 70\%$

flash fires or conflagration from a fire ball (exploding burning fuel)

CO may be low normal or negative

oxygen is absent from the involved air

CO may be a factor in motor vehicle crashes

impairs driver's ability

source is defective / leaky exhaust system

AUTOPSY FINDINGS

bright red ("cherry red") livor mortis & tissues

externally, the person appears as though alive but sleeping

other findings non-specific asphyxiation

CYANIDE (CN)

blocks cellular respiration through cytochrome oxidase

death is rapid in a confined space with a high concentration of CN

otherwise may take several minutes at a lower concentration

AUTOPSY FINDINGS

bright red ("cherry red") livor mortis & tissues

other findings non-specific asphyxiation

toxicology - difficult to prove levels

decomposes & forms with time

HYDROGEN SULFIDE (H₂S)

used in petroleum industry & formed from organic fermentation

rotten egg odor

may be encountered in wells, sewers, etc.

AUTOPSY FINDINGS

dark livor mortis & tissues (cyanotic)

other findings non-specific asphyxiation

caution should be exercised in dealing with potentially lethal gases & chemicals

≥ 2 living creatures (animal or human) are dead on scene

no visible injuries evident to explain sudden death

AUTOEROTIC - covered in detail elsewhere

CRUCIFIXITION

complicated mechanism of death involving shock & impair chest wall movement

NECK COMPRESSION

external force applied to neck with arm (sublethal manual strangulation)

previously used in law enforcement to temporarily subdue & restrain a suspect

two forms are described

CAROTID SLEEPER

arm is bent in a "V" with the sides of the neck compressed by the arm

vessels are compressed

airway is unaffected by the force

described as safe if the pressure is released when the subject ceases to resist

BAR ARM

horizontal arm (or flashlight / baton) is applied across the front of the neck

vessels are relatively unaffected

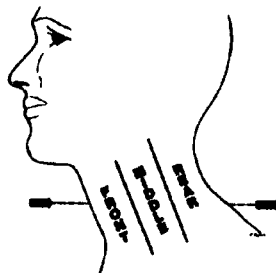
airway is compressed

highly prone to neck injuries in the subject

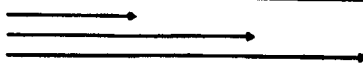
problems arise in suboptimally trained individuals

carotid sleeper converted to bar arm with struggle during arrest procedure

failure to release hold once subject ceases to resist



Front	Middle	Rear
Superficial	Partial	Full
Mild	Moderate	Severe



from: Strangulation - A Conceptual Approach For Courtroom Presentation

M. L. Taff & L. R. Boglioli

American Journal of Forensic Medicine & Pathology 10(3):216-20, 1989

SPECIAL CONSIDERATION: INMATE HANGINGS

recently (within 24 hours) incarcerated inmates at high risk of suicide

especially those arrested while alcohol-intoxicated

suicide risk screening suggested if indicated

if jailers consider subject a potential risk, suicide precautions should be implemented

regularly scheduled observation

remove potential ligatures

inmates are ingenious in finding devices

example: a towel may be wedged into a door frame

clothing / bedding

if one is intent on killing oneself, one will often find a way to do so

jailers can & do take heroic efforts to avoid inmate suicides, however, they still occur

families are often highly upset

death occurred while the subject was under another's care (jailers)

family denied access to subject

much anger is a reaction to not being able to prevent death

allegations that the subject was murdered by police

typical denial response seen in suicides

"they wouldn't have done it"

all such cases should be treated as homicides until this is excluded

very rarely the investigation will uncover a homicide - usually by another inmate

contact an outside agency to lead the investigation

leave the scene as undisturbed as possible (leave body suspended if obviously dead)

have crime lab / medical examiner investigator examine / process scene

detailed complete autopsy to exclude trauma (including sexual intercourse workup)



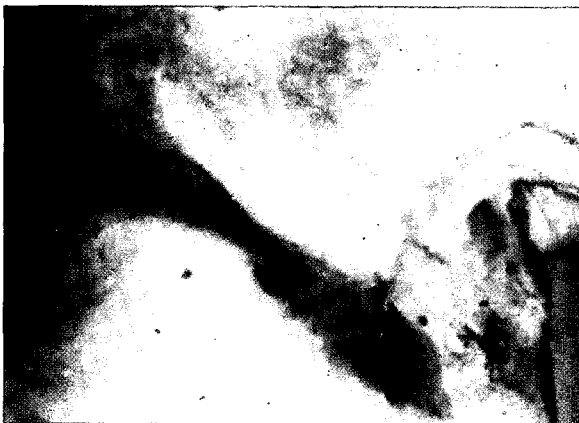
← Asphyxiation (hanging)

The typical pattern from a suicidal hanging by noose is a dried yellow-orange abrasion furrow which forms a chevron with the point directed toward the point of suspension (usually the back of the head or the side of the neck). The uppermost aspect of the furrow may be indistinct or absent due to a lack of contact with the skin surface. The hands may be found underneath the ligature as if attempting to remove the noose. This is a reflex action (loss of consciousness occurs in ~ 15-20 seconds) and does not indicate the victim suffered. The neck may appear elongate due to stretching of soft tissues with gravity. The neck vertebrae are rarely fractured except in judicial executions.



← Asphyxiation (hanging)

A close up view of the typical dried orange-yellow abrasion furrow seen with hanging deaths. The weave of the ligature may be imparted on the skin surface as evident here. In contrast to suicidal hanging, a homicidal ligature throttling would impart a horizontal abrasion furrow on the skin surface. The furrow may be indistinct or absent with a broad, soft ligature (sheet, towel, etc.).



← Asphyxiation (hanging)

Irregular or crescentic abrasions (fingernail marks) can be seen in suicidal hanging, ligature strangulation (throttling), and manual strangulation. These may be a result from the assailant grabbing the victim's neck during the commission of a homicide or from the victim's conscious (homicide) or reflexive (suicide) attempts to remove the offending agent (see above).



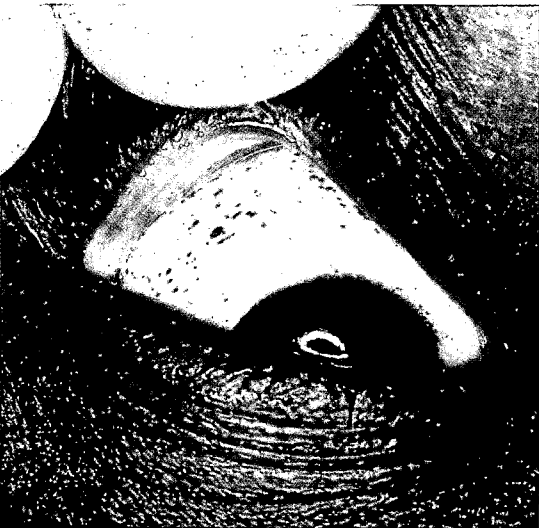
← Asphyxiation (all neck compressions).

A step dissection of the muscles & soft tissues of the neck should be done with layer by layer reflection of the tissue to expose the thyroid cartilage & hyoid bone. This should be performed after the chest, abdomen, & head cavities have been eviscerated in order to exclude possible artifact.



← Asphyxiation (strangulation).

The right horn fracture is obvious here. The neck structures including the hyoid bone & thyroid cartilage should be removed by the dissecting pathologist after the chest, abdomen, & head cavities have been eviscerated in order to exclude possible artifactual blood. Or fracture. A pre-mortem fracture is confirmed by fresh blood surrounding the site.



← Asphyxiation (strangulation).

Palpebral & bulbar (eyelid & eye) conjunctival petechiae (pinpoint hemorrhages) are common in manual strangulation and are due to rupture of the small vascular branches. Petechiae may also be seen in hanging deaths with continued arterial flow but obstructed venous return (partially suspended position).



← Asphyxiation (mechanical compression).

Victim pinned underneath car which had been lifted on two automobile jacks. The jacks gave way, entrapping the deceased underneath the vehicle.



← Asphyxiation (carbon dioxide).

See accompanying article. Both the deceased & his cat were dead at the scene. Whenever ≥ 2 living creatures are found dead at a scene and a traumatic cause of death is not apparent, a gas should be considered as a possible agent. Some gases are highly toxic (cyanide, hydrogen sulfide, carbon monoxide, etc.) and can kill responders rapidly. Others are less toxic but act by displacing oxygen from the air (carbon dioxide).



← Asphyxiation (environmental hypoxia).

Two individuals went into the hold of a ship to clean up a long-standing water spill. Both were rendered unconscious within several minutes and one died; toxic or suffocating gas should be suspected. In this case, the rust formation of the metal walls of the hold depleted oxygen from this relatively confined space.

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Positional Asphyxia During Law Enforcement Transport

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Allan D. Stilwell, M.D., and Judy Arnold

Three cases of positional asphyxia are described that occurred while victims were in a prone position in rear compartments of police patrol cars. These deaths are attributed to positional asphyxia. Autopsy findings and specific scene and circumstantial correlations of the investigation are discussed with emphasis placed on the limitations of interpretation of the anatomic changes at autopsy.

Key Words: Asphyxia—Hog-tied restraint—Positional asphyxia—Death in custody.

We have previously reported our concerns about the deleterious physiologic effects of a restraint maneuver that employs a "hog-tied" prone position (1). This method is commonly employed by law enforcement to incapacitate a suspect and occasionally is used during transport. We have had occasion to study three deaths where this method of restraint was employed by law enforcement while transporting suspects. Autopsy findings in these deaths did not demonstrate anatomic or toxicologic findings sufficient to explain death. Additionally, historical information indicated that the victims were thought to be alive at the time they were placed in the rear seat of police vehicles. Following several minutes of transport, the suspects became quiet and inactive. When they arrived at their destination, it was not immediately determined that each was experiencing respiratory difficulty although each remained motionless. After a few minutes, it was determined that the victims were not breathing and the alarm of a cardiac arrest was sounded. All three deaths are strikingly similar in circumstances and findings. Because of this, we reason that deaths in each instance were the result of adverse physiologic effects created by a semiprone and hog-tied position in a confined space. We report these deaths to alert law enforcement agencies to the potential consequences of this restraint during transport and to share with other death investigators the critical importance of historical information and the mechanics of events necessary to understand this type of respiratory death.

CASE REPORTS

Case 1

The first victim was a 28-year-old white man who, 4 years prior to his death, had been seen for a nonclassified psychiatric illness for which psy-

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Accepted for publication at the office of the Editor Emeritus.

POSITIONAL ASPHYXIA

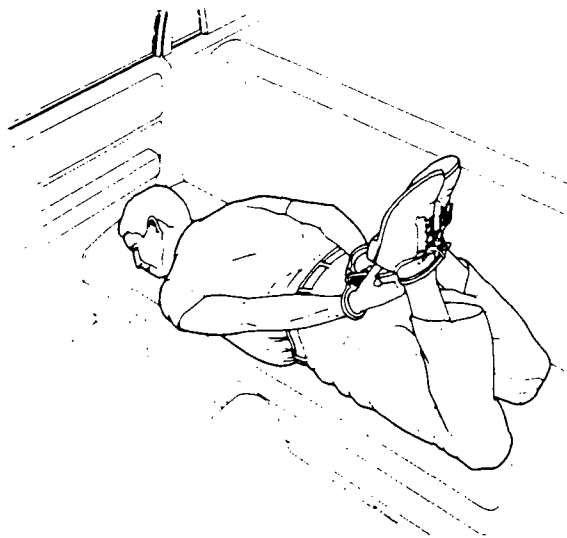


FIG. 1. A sketch of the resting position of the first victim during transport to hospital.

chotropic medications had been prescribed, leading to improvement in his behavior. One month prior to his death, he became more agitated and was again seen for psychiatric evaluation. He was diagnosed as manic depressive. All medications were stopped and he was started on lithium therapy. On the day of his death in the early morning hours, the victim became extremely agitated, and assaulted and threatened to kill his wife. His mother-in-law intervened, but was choked and escaped to a neighbor's house and called for police assistance. Two officers responded to the scene where a violent confrontation ensued. One police officer was choked. The victim was forced to release his hold only after the officer's partner struck him with a nightstick and choked him. The victim subsequently ran from his house and was cornered in the yard when he became trapped between dense bramble bushes and the front end of a law enforcement patrol car. Once cornered, he was overpowered by several police officers who placed him facedown on the ground and handcuffed him in a hog-tied fashion. Flexcuffs immobilized the ankles while handcuffs were used on the wrists. During the restraining maneuver, he continued to resist; once subdued, he became more relaxed, but was still responsive. At no time was it witnessed that a neck hold was applied during the restraining maneuver. The victim was then loaded onto the rear seat of a mid-sized patrol sedan for transport (Fig. 1).

Because of the two nightstick blows to the head that caused lacerations and bleeding, and because of multiple scratches over the body surface sus-

tained when the victim contacted the bramble bushes, a police officer was directed to rush the victim to a local hospital. A high-speed transit ensued that was estimated to have taken 5–7 min. The victim, although not monitored during this period of time, did not show noticeable activity.

Upon arrival at the emergency room, he remained prone when he was removed from the vehicle and transferred to an emergency room stretcher. Nursing personnel reported a faint, slow carotid pulse and spontaneous respirations, but the emergency room physician who saw him within a minute of arrival reported no respiration, poor facial color, and no blood pressure. Restraints were removed and the victim was placed on his back. Vital signs and cardiac telemetry demonstrated cardiopulmonary arrest with asystole. Resuscitation was initiated, which resulted in ventricular fibrillation, eventually converting to a sinus tachycardia. Administration of lidocaine and a dopamine drip resulted in maintenance of this rhythm with a blood pressure of 90–100 mm Hg. His blood lithium levels sampled during this period were determined to be subtherapeutic. The victim remained totally unresponsive during this period, with fixed and dilated pupils. Because there was concern that he might have a head injury, he was transferred to a larger medical center in a comatose, unresponsive condition and was admitted with a diagnosis of anoxic encephalopathy. Cerebral flow studies showed no perfusion and his condition rapidly deteriorated. He died 5 h after admission. The autopsy was performed 68 h after death.

The body at the time of autopsy measured 73 in. (1.85 m) in length and weighed 267 lb (121.36 kg). A noteworthy feature was the abundant abdominal panniculus. A proper assessment of the body habitus was limited because of early postmortem gas distention of soft tissues along with early skin slippage, the result of inadequate refrigeration. The surface examination of the body showed multiple bruises of the extremities and back and there were two gaping lacerations of the occipitoparietal scalp. In addition, multiple scratches were present over the surface of the extremities. All of these findings corroborated the historical information that this man had been struck with nightsticks and had become entangled in bramble bushes. Other noteworthy findings at the time of autopsy included a few petechial hemorrhages in the conjunctiva of the right upper eyelid with a single flame-shaped hemorrhage in the inner canthus of the left lower eyelid. Internal examination showed that there was no injury to the cranial cavity and brain except for subga-

leal hemorrhages attributed to impacts to the head. The brain further demonstrated some features suggestive of cerebral edema. Layered dissection of the neck was essentially free of any injury except for a small 1.3 cm area of bruising in one submandibular gland. There was mild to moderate focal coronary arteriosclerosis and a heart weight of 415 g. Moderate fatty change of the liver was likewise noted.

Toxicologic examination of antemortem blood showed the presence of 0.2 mEq/L of lithium (therapeutic level, 0.8–1.2 mEq/L). Lidocaine and caffeine were also detected, but no other drugs were demonstrated. Death was attributed to positional asphyxia.

Case 2

The second victim was a 28-year-old healthy white man who was house sitting and drinking beer with his brother most of one afternoon. A small group of men arrived and tried to enter the house. A verbal confrontation took place and the group left. Later, the brothers went out to their van for a trip to the store for more beer. They noticed their van had been tampered with and began shouting at each other about the problem. Neighbors assumed they were fighting and called police.

Two police officers arrived and tried to calm the brothers and get them to go into their house. During this time, a records search found outstanding traffic warrants on the victim. The victim would not quiet down and became increasingly agitated. When faced with the option of going into the house or being arrested, he ran. A pursuit and struggle ensued. He was struck several times with nightsticks, once to the head. After the victim was partially subdued prone on the ground, a witness to the event ran out had held the victim's legs. Several officers arrived to help restrain and hog tie the victim. The witness heard the victim say during the struggle on the ground "gimme some air, gimme some air." The pursuit and struggle lasted ~7 min. There is no evidence that a neck hold was used at any time during the confrontation.

When the victim was at last restrained, and while still resisting and complaining, he was placed in a prone position in the back of a patrol car on a narrow, molded plastic, one-piece seat. The transporting officer left as soon as the victim was in the car. An officer at the scene called for an aid unit to meet them at the jail in order to treat the head injury.

While en route to the jail, the victim slipped down and became wedged between the front and back

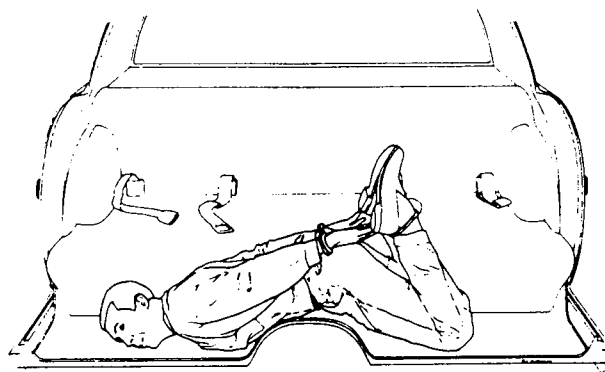


FIG. 2. A sketch of the final resting position of the second victim on the floor of the police vehicle used for transport to hospital.

seats with his left shoulder partway up the back of the front seat and his right shoulder against the bottom panel and foot well of the back seat (Fig 2). The transporting officer recalled that the victim had been "rustling" around a little bit and that his breathing had been raspy. About 3 min later, his breathing was "gurgly" and the transporting officer called a Code 3 upgrade to paramedics. Medics arrived at the jail about the same time as the officer and victim. Approximately 4 min had elapsed during the trip from the scene to the jail. The victim was unresponsive when removed from the patrol car. Despite all efforts, he never regained any vital signs. He was pronounced dead 26 min after CPR had been initiated.

At autopsy, the body measured 70 in. (1.78 m) and weighed 220 lb (99 kg). Deep neck muscle hemorrhage was present adjacent to the left carotid artery and structures of the neck. There was some vomitus in the airway. Other injuries included laceration and contusion to the right parietal scalp attributed to a nightstick blow. Other abrasions and soft tissue contusions to the body surface and extremities were also present and attributed to multiple nightstick blows. Also noted were minor circumferential abrasions and contusions to both wrists and one ankle from restraints. No petechial hemorrhages of the conjunctivae were noted. Findings in all thoracic and abdominal organs were within normal limits without significant anatomic change to account for death.

Toxicologic tests found a blood alcohol level of 0.12 g/100 ml, LSD blood level of 3.2 ng/ml, THC blood level of 4.1 ng/ml, and THC blood metabolite level of 108 ng/ml. No other drugs or chemical findings of note were present. Death was attributed to positional asphyxia.

POSITIONAL ASPHYXIA

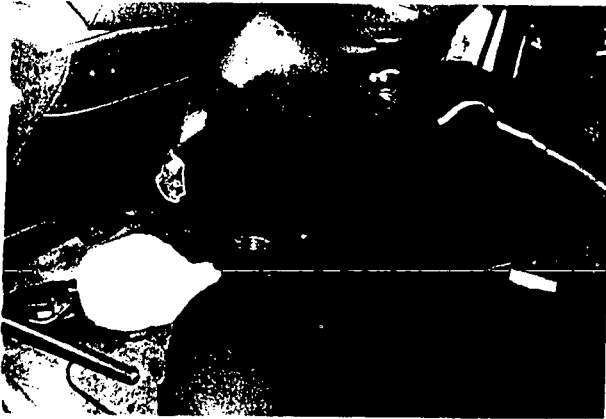


FIG. 3. Arresting officer demonstrating approximate position of decedent in back seat of patrol car. Note that the lower portion of the body still remains on the seat. The legs have not been tied and flexed as occurred during the actual transport of the victim.

Case 3

The third victim was a 34-year-old black man with a long psychiatric history of undifferentiated schizophrenia, who had stopped taking his medication on his own sometime prior to the described incident. On the day of his death, he began to show bizarre behavior in the home of his grandmother, including wandering about talking to himself and sticking his head in an oven and attempting to turn on the gas. The grandmother called the police. The victim apparently became quite agitated upon the arrival of the police officer and a verbal confrontation, followed shortly thereafter by a physical confrontation, took place. A backup patrol car was summoned. A scuffle took place inside the grandmother's home with one police officer admitting to several fistful blows to the decedent's chest and abdomen, but not to use of a baton or a neck hold. The victim was wrestled to the ground, whereupon his arms were placed behind his back, two sets of handcuffs were applied, and leg straps were placed around his ankles. He was taken to the waiting patrol car and placed into the back seat with his head, shoulders, and chest in the foot well behind the driver's seat and his right flank over the drive shaft hump. His legs were in a flexed position on the rear bench seat behind the front passenger seat (Fig. 3). The arresting officer got in the back and rode with the victim to the city jail, which was ~5-7 min away. The officer stated that the victim became quiet, but nothing was noted to be wrong until their arrival at the receiving dock at the city jail, at which time the arresting officer said to his partner, "I think he's dead." The victim was removed from

the vehicle and emergency response personnel pronounced him dead at the scene.

Upon the arrival of the Medical Examiner (A.D.S.) at the scene, the deceased was lying on his side on the concrete floor with his hands cuffed behind his back by two sets of handcuffs. The legs were tied together at the ankles. The body was immediately removed for a postmortem examination.

At postmortem examination, the body measured 68 in. (1.73 m) in length and weighed 150 lb (67.5 kg). Insignificant injury to the head consisted of two small abrasions to the skin of the left side of the face and a small abrasion of the right side of the nose. Two minor contusions of the scalp were noted. Petechiae were noted in both eyes and on the pleural surfaces of both lungs. No abnormalities other than congestion were noted. Complete microscopic examination showed no histologic abnormalities. Results of toxicologic analysis of body fluids including vitreous fluid were within normal postmortem limits. Death was attributed to positional asphyxia.

AUTOPSY FINDINGS AND PHYSIOLOGIC CONSIDERATIONS

The conclusions drawn from these investigations were based primarily on the reconstruction of events surrounding each death. Complete detailed autopsies showed limited findings that did not enable any anatomic cause of death to be established. In two of the victims, cutaneous injuries were compatible with impacts by nightsticks. There were scattered bruises over the bodies and lacerations of the scalp. In the first victim, considerable attention was given to the neck dissection since conjunctival petechial hemorrhages were present and there was evidence that the victim had been choked early in the confrontation. However, historical accounts of the choking episode indicate that it occurred 15-20 min before the victim was subdued. Multiple witnesses denied that choking occurred during the "take-down" and placement of restraints. Additionally, the victim had received vigorous chest compression during resuscitation. The second victim had no physical or historical evidence of cervical compression. Conjunctivae were congested, but free of petechiae. Neck compression, although considered to have been possible, could not be supported by historical accounts of witnesses. Hemorrhage in the soft tissues of the left side of the neck was probably impact injury from a nightstick. The third victim showed minimal cutaneous abrasions, but did show

conjunctival petechiae. Again no cervical injuries were present and no historical information to suggest choking was elicited. The presence of conjunctival petechiae appears to have resulted from the head placed at a lower level than the rest of the body. This would increase venous pressure in the head and promote petechiae. In all three victims, no significant natural disease process was present that could account for an independent "cardiac event."

Toxicologic analyses of the body fluids of two of the victims demonstrated subtherapeutic levels of lithium in one, while in the other there was evidence of alcohol, LSD, and THC. These findings were considered significant only in that the erratic and violent behavior of those two victims had some explanation. Subtherapeutic lithium levels in the manic-depressive illness of the first victim could account for an emergence of manic behavior. In the second victim, the presence of alcohol, LSD, and THC provides a reasonable explanation for irrational, violent, and uncontrollable behavior. In these two instances, toxicologic findings shed some light on the decedents' behavior, but do not explain their deaths.

Positional asphyxia occurs when the position of the body interferes with respiration, resulting in asphyxia. The deleterious positional effect may result either from interference with the muscular or mechanical component of respiration, from compromise of the airway, or from some combination of these. In addition, in all cases of positional asphyxia, one or more contributory factors provide an explanation for the inability of the victim to correct the deleterious and potentially lethal position, for example, alcohol/drug intoxication, concussive head injury, entrapment, restraint, or physical disability. In our view, the application of hog-tied-type restraints and subsequent positioning of the victim in a confined space are the critical factors that led to the respiratory compromise that caused these men's deaths. Hence, all three men died as a result of *positional asphyxia*. This conclusion is drawn from the totality of the investigation and depends on historical information and reconstruction of events. These deaths can only be properly evaluated with knowledge of the dynamics of the events preceding and surrounding death. In the first victim, obesity with a large abdominal panniculus interfered with respiration in the prone position in a confined space, whereas, in the other two deaths, mechanical displacement of the abdomen by the convex contour of the floor and the edge of the car seat accounted for loss of effective diaphragmatic

excursions of respiration. In each instance, the final fatal event was hypoxia.

DISCUSSION

Respiration depends on three critical elements: the gas exchange function of the lungs, the patency of the airway, and the muscular pump or bellows that ventilates the lungs. All three are vital to life. The parenchyma of the lung, if severely diseased or damaged by injury, results in failure of the gas exchange function and hypoxemia. If the airway is obstructed at any level, a similar consequence will ensue. The same result occurs in pump or bellows failure where the lung may be healthy and the airway patent, but the mechanical muscular bellows of the chest fails. Pathologic causes of respiratory bellows failure are detailed in the medical literature, but respiratory failure attributed to adverse body positioning has not been scrutinized (2). The three deaths in this report are the result of disturbed physiology because of failure of the respiratory bellows produced by an adverse position in a confined space.

The respiratory bellows or pump depends upon the output drive of central nervous respiratory centers that control respiratory muscle activity. This neural impulse center may not be capable of responding to oxygen demand. Such failure occurs when these respiratory centers are chemically depressed as in drug intoxications, for example with barbiturates or opiates. In these instances, the central nervous system drive is attenuated or dampened and fails to respond to biochemical demands of the body. Unless life is artificially supported, death occurs rapidly. Since the higher centers of cerebration are also affected by drug intoxication, the intoxicated person may be unaware of impending death. Only careful blood-gas monitoring and artificial support of respiration can overcome the deficits in central nervous system drive to maintain respiration and life.

Failure of the bellows or the pump function of respiration can result from a mechanical abnormality of the thorax that impedes a proper bellows action. A flail chest or severe chest deformity can cause bellows failure and, ultimately, respiratory failure and death. A nonfunctioning or poorly synchronized respiratory bellows causes severe biochemical disturbances. Since such anatomic abnormalities can be readily identified, the pathophysiology leading to hypoxia, hypercapnia, and death is easily understood and generally accepted.

Bellows failure can also occur from respiratory

muscular failure. Muscles of respiration may be unable to contract and generate the motion of respiration even though the central nervous system drive is functioning and the thorax is structurally intact. Physiologic inspiratory muscle fatigue can occur (3). The exact cause of inspiratory muscle fatigue has yet to be clearly defined, but there are other recognizable clinical conditions such as myasthenia gravis and other neuromuscular disorders causing muscle dysfunction, in which respiratory muscle fatigue results in hypercapnia and its attendant biochemical consequences (4). This is rarely a cause of sudden death, since the process, although insidious, is generally clinically recognizable and treatable.

There is an additional cause of bellows failure that has not been cited in the clinical or forensic literature, but is illustrated in the three deaths that form the basis of this report. Here the restrained position of the victims in a confined space creates a circumstance for bellows restriction and failure.

The chest wall depends on the interaction of the diaphragm with the musculature both of the rib cage and the abdomen. Breathing takes place by displacement of either the abdomen or the rib cage (5). The total volume displaced in the abdomen by the rib cage bellows action is the total volume of change produced during inspiration in the lungs. When the muscle of the diaphragm contracts, the dome of the diaphragm displaces abdominal viscera downward. Muscles of the diaphragm, in addition to displacing abdominal contents, also act on the costal attachments to lift the rib cage in a respiratory movement. Contraction of the intercostal muscles during inspiration expands the rib cage. If respiration depends totally on the intercostal and accessory muscles of the neck, as when the phrenic nerve is severed and the diaphragm is paralyzed, the bellows action of the thorax displaces the abdomen inward so that abdominal volume is displaced upward and reduced. Any increase in the lung volume is offset by abdominal displacement due to inward volume change. Roussos and Macklem detailed these observations in their report on the respiratory muscles, an excellent review of respiratory muscle physiology to which the reader is referred (6). In the normal supine person, breathing is primarily the result of diaphragm muscle activity. The excursion of the chest during respiration in a supine position is the result of diaphragm muscle contraction. On the other hand, a normal person in the erect position uses both the intercostal chest muscles and the diaphragm. Consider the adverse effects of the prone position in breathing, particularly where the abdominal panniculus is so large

that it displaces the abdominal volume or when the abdominal volume is displaced by an object. The consequence is that the effective abdominal excursions produced by contraction of the diaphragm are reduced and the tidal volume of respiration is substantially reduced. If uncorrected, this leads to hypercapnia and hypoxemia.

Roussos and Macklem point out that, as the work of breathing becomes very difficult, many muscles in the arms and trunk and neck are recruited and contribute to the total oxygen utilization of breathing. The specific role of the hog-tied restraint posture and its biochemical effects on those muscles is unclear at this time, although it is obvious that any restraint that prevents a change of position could restrict breathing further by preventing those muscles from assisting in respiration.

Another, more ill-defined, factor that is likely to augment respiratory muscle fatigue is related to prior violent muscular activity. Weakness of muscles due to hypercatabolic states occurs with sepsis or when long surgical procedures cause increased energy demands (7). During the violent confrontations that ensued in these instances that we report, the expenditure of muscular energy by each victim was probably substantial. Energy that is expended by the contractile muscle machinery of the body is subtracted from the respiratory muscle needs. Muscle fatigue may induce the central nervous system to shunt energy to contracting muscles. A deficit in energy supply to respiratory muscles can influence their performance. A decrease in chemical energy supply to respiratory muscles will hasten their failure as well as the failure of other muscle groups (8). All three victims were rendered more vulnerable to respiratory muscle fatigue through deficits of energy created by violent muscle activity before they were placed in their final restrained positions.

OTHER CONSIDERATIONS

The diagnosis of positional asphyxia should be considered when (a) circumstances surrounding death indicate a body position that could interfere with respiration; (b) historical information indicates "difficulty in breathing" or unusual physical respiratory signs such as cyanosis, gurgling, gasping, or any other physical manifestations that could be interpreted as evidence of respiratory distress; (c) there is absence of significant or catastrophic anatomic pathologic changes at autopsy that would conclusively account for death, including such catastrophic events as intracerebral hemorrhage or ruptured myocardial infarct; and (d) clearly toxic or

fatal levels of drugs or chemicals that are ordinarily incompatible with life (including carbon monoxide, cyanide, and lethal levels of therapeutic and abused drugs) are absent from body fluids.

During the evaluation of deaths such as those reported here, sudden cardiac death without pathomorphologic changes must be considered. A relationship between stress and death is known to exist, but there is a dearth of factual data because of the unpredictability and suddenness of such deaths (9). Certainly primary sudden cardiac death without pathomorphologic changes is a well-recognized entity. However, in view of the pathophysiology of the respiratory disturbance created by respiratory restriction, it is likely that any fatal cardiac event would be precipitated by the adverse respiratory physiology produced by respiratory restriction. Since it is known that biobehavioral stresses can augment cardiac susceptibility to ventricular fibrillation (10), one might contend that these deaths were caused by a malignant ventricular arrhythmia triggered by the psychological events and is unrelated to and independent of the position of the victim. Ventricular fibrillation has been reported spontaneously and has been triggered by psychiatric interviews, by stressful emotions, and during REM sleep stages (11). However, recognizing that biobehavioral factors predispose to sudden cardiac death does not allow for the conclusion that the deaths reported here are the result of such factors. There are no pathomorphologic changes that enable differentiation between death induced by psychobehavioral factors and the pathophysiologic disturbance created by body position. Until such time as we have a means of differentiating between these two physiologic events, it is our view that the best explanation for such deaths is positional asphyxia, which is supported by circumstantial events.

Another possible cause of death that needs to be considered, especially when sudden death occurs in psychiatric patients, is the so-called neuroleptic malignant syndrome (NMS). In the late 1800s, the diagnosis of "acute exhaustive mania" was given to sudden death of psychotic patients from apparently natural but undetermined cause. This condition is poorly understood and may be related to a "cardiac event" due to psychological stress as described above. NMS is a hyperpyretic syndrome that is frequently fatal and occurs in people who are taking antipsychotic agents, which include phenothiazines, butyrophenones, thioxanthenes, and other drugs (12). A drug's potential for inducing this syndrome appears to parallel its antidopaminergic potency. Additional predisposing factors include physical exhaustion, dehydration, organic

brain disease, and the use of long-acting depot neuroleptics (13). Classic features of NMS are hyperthermia, hypotonicity of skeletal muscles, and fluctuating consciousness along with instability of the autonomic nervous system. NMS has been seen in psychiatric and medical patients given neuroleptic drugs and is not related to previous exposure to the drug or to toxic overdoses. However, NMS may also occur in the absence of the administration of neuroleptic-type drugs and appears to be indistinguishable from the poorly understood "acute exhaustive mania" described prior to use of neuroleptics (14). Sudden phenothiazine-related deaths that lack the other distinguishing features seen in the typical NMS death have also been described (15). A history of neuroleptic drug use or the other clinical features of NMS in an unexpected death might suggest that this syndrome is the most likely cause of death. Because neither NMS nor positional asphyxia show definitive pathologic/toxicologic findings, positional asphyxia and neuroleptic malignant syndrome are not mutually exclusive and may coexist. Each death must be investigated not only by examining the morphologic features at autopsy and the toxicologic results, but also by evaluating the victim's medical history in conjunction with the scene and circumstances surrounding death. Without a consideration of all these factors, it is likely that some deaths due to positional asphyxia will go unrecognized.

There will be deaths, particularly those where cocaine, methamphetamine, and high levels of alcohol are present, in which it becomes tempting to assign the cause of death solely to these intoxicants, and to ignore or discount the final position in which the victim was found dead. In a previous report on cocaine deaths, Wetli and Fishbain (16) cite instances where victims were found dead in the back seat of police cars and in other unusual circumstances where there was the potential for the position of the body to adversely affect respiration. Whether any of these deaths had an unrecognized pathologic respiratory contribution because of body position is unknown. Such assessments must take into account the total death investigation and not focus on anatomic findings and toxicologic values without due consideration of the resting position of the victim.

The same dilemma occurs in deaths where significant, but not necessarily fatal, natural disease exists. Finding advanced coronary artery disease, cirrhosis, and even diabetic ketoacidosis in a person who is restrained in a position that can compromise respiration may tempt the death investigator to attribute death solely to the natural disease process and discount any contribution to death by the po-

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sition of the body. Again, we do not know of a clear or direct way to settle such issues. Because the positional asphyxia diagnosis is primarily based on scene and historical information, it is not often an unequivocal diagnosis in any given death investigation. Nevertheless, our view is that positional asphyxia should be seriously considered whenever unusual positional stress has been placed on respiration. Until postmortem methods are developed to better assess physiologic disturbances, the ultimate judgment will be in the hands of the examining pathologist. Because of the complexity of the issues involved, there certainly will be a spectrum of opinions and no clear answer. The ultimate and difficult assessment as to cause of death is in the hands of the certifying physician who is left to make a judgment that incorporates the bias and prejudice inherent in each of us, but is also based on the important principle of forensic pathology which requires that each death be evaluated using all available information, especially historical and scene investigative material, rather than relying solely on anatomic-toxicologic information. □

Acknowledgment: The authors acknowledge the contribution of Mrs. Patricia Luckman in preparation of the manuscript.

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FIREARMS INJURIES

Firearms Injuries

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Common misconceptions regarding bullet wounds

- A. An entrance wound is always smaller than an exit wound
- B. An exit wound never resembles an entrance wound (shored wound)
- C. Right-handed individuals commit suicide by shooting themselves in the right side of the head
- D. More than one shot indicates murder, not suicide

II. Manner of death in firearm cases

- A. Homicide
- B. Suicide
- C. Accidental

III. Factors of firearms injuries

- A. Direction
- B. Distance
- C. Damage

1. Penetration: The tissue through which the projectile passes, and which it disrupts and destroys.
2. Permanent Cavity: The volume of space once occupied by tissue that has been destroyed by the passage of the projectile. This is a function of penetration and the frontal area of the projectile. Quite simply, it is the hole left by the passage of the bullet.
3. Temporary Cavity: The expansion of the permanent cavity by stretching due to the transfer of kinetic energy during the projectile's passage.
4. Fragmentation: Projectile pieces or secondary fragments of bone that are impelled outward from the permanent cavity and may sever muscle tissues and blood vessels, etc., apart from the permanent cavity. Fragmentation is not necessarily present in every projectile wound. It may or may not occur and can be considered a secondary effect.

- D. Device

IV. Types of powder

- A. Flake (18-24 inches)
- B. Flattened ball (36 inches)
- C. Ball (42-48 inches)

V. Types of wounds

A. Entrance wounds

- 1. Contact-near contact
 - a. over firm tissue
 - b. over soft tissue
- 2. Intermediate range
- 3. Long-range or any range covered by clothing
- 4. Direction and ranging factors
 - a. hot gases, charring, singeing or burning
 - b. smoke and lead vapors--soot or smudging
 - c. lead or bullet and barrel lubrication
 - d. powder grains: tattooing, stippling, or peppering
 - (1) unburned
 - (2) partially burned
 - (3) burning
 - e. bullet: abrasion collar or marginal abrasion

B. Exit wounds

- 1. Usually stellate
- 2. Slit--fragmented
- 3. "Shored"

C. Perforating wound

- 1. Also known as a "through and through" wound
- 2. The projectile passes all the way through the body
 - a. Enter and exit wounds

D. Penetrating wound

- 1. The projectile enters the body and lodges inside
 - a. Entrance wound only

E. Direction from grazed wounds

1. Abrasions
2. Tears

F. Rifle wounds

1. high-velocity comparison

.38-caliber revolver	800-950 ft/sec
30-30 caliber rifle	2700-3000 ft/sec
2. Beveling of bone
3. Keyhole wound

VI. Patterns of intersecting fractures

VII. Formula of wounding power of missiles

$$E = \frac{WV^2}{2G}$$

$$\text{Ft/Lbs} = \frac{\text{Grains} \times (\text{Feet per second})^2}{2 \times 32.16 \text{ ft. per sec.} \times 7000}$$

$$\text{Ft/Lbs} = \frac{\text{Grains} \times (\text{ft/sec})^2}{450,240}$$

NOTES

GUNSHOT AUTOPSY

1. WERE INJURIES PRODUCED BY BULLETS?
2. DID DEATH RESULT FROM GUNSHOT INJURIES?
3. WAS VICTIM DEAD BEFORE SHOT WAS FIRED? IF SO, WHAT IS CAUSE OF DEATH?
4. OTHER INJURIES NOT BY GUNSHOT? WHAT TYPE OF WEAPON?
5. IF MULTIPLE WOUNDS, PRODUCED BY **ONE** BULLET?
6. RECOGNITION OF ENTRANCE AND EXIT WOUNDS.
7. DISTANCE BETWEEN MUZZLE OF WEAPON AND VICTIM.
8. DIRECTION OF FIRE - CORRELATED BY FINDINGS AT SCENE AND TRACK OF MISSILE WITHIN THE BODY.
9. LOCATION OF BULLET, PELLETS OR SHOTGUN WADDING BY MEANS OF X-RAY OR FLUOROSCOPY.
10. TYPE OF WEAPON (REVOLVER, AUTOMATIC, SHOTGUN, ETC.)
11. CHARACTERISTICS OF WEAPON.
12. PROPER RECOVERY OF MISSILE (NO MARRING BY METAL INSTRUMENT) .
13. EXAMINATION OF CLOTHING FOR POWDER OR OTHER RESIDUES, MATCHING WOUNDS WITH HOLES, ETC.
14. EXAMINATION OF HANDS OF VICTIM FOR SOILING, BURNS, OR OTHER INJURIES.
15. KNOWLEDGE OF SCENE AND CIRCUMSTANCES OF CASE.

COMMON ERRORS OF OBSERVATION AND INTERPRETATION IN GUNSHOT CASES

1. FAILURE TO PERFORM A COMPLETE AUTOPSY
2. NONRECOGNITION OF GUNSHOT WOUNDS IN OBSCURE OR UNEXPECTED LOCATIONS (MOUTH, EYE, VAGINA, AXILLA) AND IN BURNED OR DECOMPOSED BODIES.
3. FAILURE TO UTILIZE X-RAY OR FLUOROSCOPY FOR LOCATION OF BONE INJURIES OR MISSILES.
4. MISINTERPRETATION OF LACERATED (EXPLOSIVE) CONTACT WOUNDS AS EXIT WOUNDS (OR BLUNT FORCE INJURIES).
5. FAILURE TO EXAMINE BULLETS FOR EVIDENCE OF RICOCHET
6. MISINTERPRETATION OF GREASE AND OTHER BULLET FOULING AS POWDER RESIDUE.
7. INCORRECT IDENTIFICATION OF THE LARGER OF PAIRED WOUNDS AS THE EXIT WOUND MERELY BECAUSE OF ITS SIZE.
8. INCORRECT IDENTIFICATION OF THE EXIT WOUND HAVING MARGINAL ABRASION, CAUSED BY PRESSURE ON SKIN UPON EXIT OF MISSILE, AS A WOUND OF ENTRANCE.
9. PREMATURE RELEASE OF INFORMATION BEFORE CORRELATING ALL INVESTIGATIVE, AUTOPSY AND LABORATORY FINDINGS.

Man leaves hospital with 6 bullets still inside head

SANTA ROSA, Calif. (AP)—A man who was shot six times in the head as he slept in his home has been released from the hospital with six .22-caliber bullets still lodged in his skull.

"He's perfectly alert, fully conscious," Dr. Stephen C. Cary said of James L. Sexton, 40. "Hasn't a single defect. It's really amazing."

"He has the entry wounds, of course, but aside from those and a stiff neck, he's all right," Cary said.

Sexton left Santa Rosa Memorial Hospital on Monday and went home. A man who responded to a knock on Sexton's door refused to answer questions.

"We aren't supposed to talk to anyone," he said, slamming the door.

Sexton was shot six times late Saturday, authorities said. His former roommate, Daniel Frost, 32, was shot and wounded by a sheriff's sergeant after a lengthy pursuit. He is listed in stable condition at Palm Drive Hospital in Sebastopol.

Police say they wanted to question Frost in the shooting. No charges have been filed, and authorities are unsure of a motive.

"We just don't know," Petalumas police Sgt. Dave Dohn said, noting that the extent of Frost's injuries have prevented questioning. "They told us he is in and out of consciousness and not able to be interviewed."

Sexton was initially listed in critical condition, but X-rays showed that none of the six bullets penetrated the brain. None was life-threatening or even disabling, Cary said.

"They're all still there, all in the right side that was exposed as he slept," he said.

One of the slugs is lodged behind Sexton's right eye but it hadn't affected his vision; two are behind the tongue and esophagus but don't impair his swallowing ability or speech, Cary said. Others are near important arteries or the spine but none requires excision.

The only bullet visible is on the back of Sexton's neck. It might be removed later for cosmetic purposes or police ballistics tests, Cary said, but there are no plans to remove the other slugs.

"It's a common misunderstanding that bullets should be removed," Cary said, "but that's not true if they're doing no harm. It seems unlikely these would affect any critical areas."

Sexton asked whether the bullets would cause lead poisoning, Cary said.

"The lead in this case is almost chemically inert," the doctor said. "He may have a problem going through the metal detectors at the airport in the future, though."

11-18-87

A Summary Of Gunshot Wounds

Vincent J.M. Dimaio, M.D.

I. Gunshot Wounds In General:

A. Discharge of a Gun

On discharge of a gun, the following material leaves the barrel:

1. the bullet;
2. gas;
3. powder (burning and unburned);
4. soot;
5. bullet and jacket fragments;
6. primer compounds (lead, antimony, and barium);
7. copper, brass, and nickel from the cartridge case.

B. Contact Wounds

1. The muzzle is in contact with the body.
2. In all contact wounds there are:
 - a. scorching of the wound edges;
 - b. soot (powder blackening) deposited on the wound margins;
 - c. soot and powder particles driven into track.
3. In all contact wounds, there may be:
 - a. a muzzle impression, due to blow-back of the skin, caused by the gases;
 - b. soot on the skin adjacent to the wound.
4. In contact wounds over bone, as in the head:
 - a. soot is usually deposited on the outer table of the skull around the entrance in the bone.
 - b. a stellate wound of entrance is often produced by subcutaneous expansion of the powder gases between the skin and bone.
 - c. soot may also be deposited on the inner table of the skull and on the dura.
 - d. discontinuous skull fractures may be present.

5. Loose contact wounds differ from hard contact wounds in that:
 - a. there is an area of powder blackening (soot) around the entrance wound not confined to the edges of the wound.
 - b. stellate tears usually do not occur.
6. In contact wounds over clothing, the clothing may absorb all the external soot and powder. Powder grains and soot will still be inside the wound track, however.

C. Intermediate Gunshot Wounds

1. The range is greater than for contact wounds, but close enough to cause "powder tattooing" of the skin.
2. Maximum range of powder tattooing for handguns is 24 inches for flake powder, 35 inches for flattened ball powder, and 48 inches for ball powder.
3. Powder tattooing occurs as a result of the impaction of unburned and burning grains of powder in the skin.
4. The diameter and density of the powder tattoo pattern can be used to determine the range. The same weapon and ammunition should be used, as powder patterns are variable from gun to gun and ammunition to ammunition.
5. Soot (powder blackening) is also present on close-up gunshot wounds out to 6 to 10 inches.
6. Soot can be wiped off, but powder tattooing cannot be.
7. Hair and clothing may interfere with powder to some degree. All clothing should be examined.

D. Distant Gunshot Wounds

1. The range is greater than intermediate wounds. No soot or powder tattooing is present.
2. The exact range cannot be determined.
3. An entrance wound can be differentiated from an exit wound.

E. Entrance Wounds

1. Every entrance wound has an abraded margin, called the abrasion ring. This is due to the bullet's scraping the margins of the bullet hole as it enters the skin.
2. The abrasion ring is present in contact, close-up, and distant gunshot wounds.
3. Entrance wounds, with the exception of contact wounds over bone, tend to be small, circular, and regular.
4. Symmetrical abrasion rings suggest a head-on shot and oval rings an angular shot. This is not necessarily so, however. The course of a bullet can only be determined by internal examination of the body.

F. Exit Wounds

1. These are usually larger and more irregular than entrance wounds, because of:
 - a. lack of support (reenforcement) of the skin;
 - b. bullet tumbling;
 - c. bullet deformation.
2. There is usually no abrasion ring.
3. Very rarely an abrasion ring is present. This occurs when the exit is "shored up" by a firm object such as a belt or a wall, as in the case of a wound inflicted on an individual leaning against a wall.

G. Bullet Wounds of Bone

1. The entrance wound is a punched out, circular or oval hole with sharp edges. The opposite surface is bevelled. In skull, for example, the entrance bullet hole is bevelled on the internal table.
2. The exit wound is bevelled or cratered. In skulls the exit hole is bevelled on the outer table.

H. Bullet Wipe

1. The bullet wipe is a grey ring around the entrance hole in skin or clothing, appearing when bullet grime is wiped off on the skin or cloth as the bullet enters.

2. It is more common with revolvers.
3. It must not be mistaken for soot on the wound margin.

I. Miscellaneous Points

1. It is impossible to tell the caliber of a bullet by x-raying it in the body, due to x-ray distortion.
2. The caliber of a bullet cannot be determined from the entrance hole in the skin.
3. The trajectory of the bullet through the body is dependent on :
 - a. the position of the victim;
 - b. the position of the assailant;
 - c. the angle at which the weapon was held.

II. Notes On Suicide

1. Right-handed individuals occasionally fire the gun with the left hand, steadying the barrel with the right.
2. Multiple bullet wounds do not rule out a suicide. One woman shot herself nine times in the chest, while a man shot himself five times in the head.
3. A fatal "accidental" shooting of an individual while he is "cleaning " his gun is almost always a suicide. Most one-man hunting accidents are suicide.

Firearms Evidence For The Homicide Detective

Eric W. Witzig

Introduction

The purpose of this monograph is to familiarize the reader with terms and conventions used in the field of small arms firearms examination. To the newcomer firearms examination often sounds like a collection of seemingly contradictory, obtuse rules that have no readily apparent foundation, little direction, and too many exceptions. In truth, the art and science of firearms is more than a thousand years old and is the result of contributions made by hundreds of individuals.

Chapel wrote that gunpowder was known as early as 846 and that in 1267 the monk Roger Bacon mentioned gunpowder in his writings.¹ The Chinese knew of gunpowder as early as the seventh century.² It is possible that the Chinese were the first to use gunpowder in a firearm that took the form of a cannon. In Europe firearms were used to propel projectiles as early as the 12th century.³ What little is known today about the early development of firearms was gleaned from a few drawings and surviving examples of the gunmakers' art. It is little wonder, then, that the field of firearms seems arcane and sometimes difficult to understand.

In an effort to create a common language among firearms examiners, in 1977 the Association of Firearm and Toolmark Examiners (AFTE) formed a standardization committee to prepare a glossary of terms used in the science of firearms examination.⁴ AFTE published its first Glossary in 1980. Terms and expressions used in this work are consistent with the AFTE Glossary.

The term ballistics is frequently used incorrectly as a synonym for firearms examination. Ballistics is the science of projectiles in motion. Ballistics for firearms is divided into three types: internal ballistics, or projectile motion within a firearm; external ballistics, or projectile motion outside of a firearm; and terminal ballistics, the impact of a projectile on a target or other object. This work will concentrate on the forensic aspects of internal ballistics.

¹Charles Edward Chapel, The Boy's Book of Rifles (New York: Coward-McCann, Inc., 1961), p. 3.

²National Rifle Association, NRA Firearms Fact Book, 2nd. ed., (Washington, D.C.: National Rifle Association, 1988), p. 31.

³Ibid.

⁴Association of Firearm and Toolmark Examiners, Glossary of the Association of Firearm and Toolmark Examiners (Augusta, GA: Fonville Printing Company, March 1980), p. iii.

Firearms identification can provide the homicide detective with invaluable evidentiary information. Among the many benefits to the detective, examination of firearms evidence can prove that:

- o A bullet or casing was fired from or in a class of firearms (an aid in search warrant preparation) or one specific firearm (the firearm recovered in the defendant's possession).
- o Multiple bullets or casings recovered on a scene were fired from one firearm (suggesting one shooter) or multiple firearms (possibly involving several shooters).
- o Bullets or casings recovered from multiple scenes were fired from one firearm (thus linking the cases together).
- o The defendant did know how to use the pistol, as evidenced by markings on unexpended rounds showing that they were worked through the action of the pistol.
- o The defendant(s) handled individual rounds as evidenced by the recovery of their fingerprints on expended rounds or rounds within a pistol's magazine.⁵

Rifle And Handgun Ammunition

For rifles or handguns, a finished cartridge, or round of ammunition, is composed of four parts:

- o Casing, usually made of brass.
- o Primer (seated in the base of the casing).
- o Powder; smokeless powder of either single-base or double-base composition; black powder was historically used.⁶
- o Bullet, typically made of lead or lead with a copper jacket.

Casing

The cartridge casing, usually yellow or silver metal in color, is the most visible component of ammunition and the one that holds together the other three components. A round of ammunition may be properly called fixed, or live ammunition.⁷

⁵Vincent J. Dimaio, Gunshot Wounds (New York: Elsevier, 1985), pp. 35-36.

⁶Omark Industries, Inc., Speer Reloading Manual Number 11 (Lewistown, ID: Omark Industries, Inc., 1987), pp. 30-39.

⁷AFTE, Glossary, p. 5.

Primer

The primer is a small metal cup containing an explosive mixture used as an ignition device.⁸ When struck by the firing pin in a modern firearm, the primer is compressed, the mixture explodes and, in turn, ignites the powder, or main propellant charge, in the round of ammunition.

Powder

Powder may be either black powder or smokeless powder. The latter is by far the more popular for fixed ammunition. Black powder is composed of charcoal, saltpeter, and sulphur. This is the mixture that was recorded by the Chinese.⁹ Black powder has three disadvantages: when ignited it produces a large volume of smoke; it produces low pressures in a firearm which translates into low projectile velocity; and it leaves debris, or fouling, in the barrel of the arm, making difficult the loading of bullets from the muzzle of the barrel.

A few cartridges are assembled today with black powder, or Pyrodex, a black powder substitute. These cartridges are designed for use in antique arms manufactured from the 1860's through the 1880's or in reproductions of those arms.

Smokeless powder became available in the 1880's. Single-based powder contains nitrocellulose; double-based powder contains nitrocellulose with the addition of nitroglycerine.¹⁰ Smokeless powder eliminated the three disadvantages experienced with black powder. Modern ammunition is exclusively loaded with smokeless powder.

In any discussion of powder it must be stressed that firearm propellants, whether black powder or smokeless powder, do not explode in a firearm. Both types of powder burn in a firearm. Black powder burns slowly; smokeless powder burns very quickly. Although there is a loud report associated with the discharge of a firearm, the report is the result of high pressure gases escaping quickly from the firearm and not the result of an explosion within the firearm.

⁸Ibid., p. 141.

⁹NRA, Fact Book, p. 31.

¹⁰Omark, Reloading Manual, pp. 30-39.

Bullet

The bullet is an elongated "non-spherical projectile for use in a rifled barrel."¹¹ Historically bullets were manufactured of lead or with a lead core, although there has been success with steel or tungsten carbide cores.¹²

Bullets made of lead were satisfactory until the introduction of smokeless powder. The new powder burned with a higher temperature and melted the lead before the bullet traveled through the barrel. Cladding, or jacketing, the bullet core with metals whose melting point was higher than lead, such as copper, proved to be a solution to bullet melt down.

Modern handgun ammunition is manufactured with bullets made of lead or of lead with a copper jacket. Modern rifle ammunition is typically assembled with jacketed bullets.

Cartridges

Cartridges are referred to by a measurement and frequently a few letters or a word or two. When interpreting cartridge information three symbols should be considered: the period (.), the hyphen (-), and the letter "x". Each of these symbols marks and separates information in a cartridge name.

In the United States the unit of measurement is the inch. For cartridge names the usual practice is to state the caliber, or diameter, of the bullet, written in hundreds of an inch. The measurement is preceded by a period. Examples of such calibers are .22, .32, or .38.

But the caliber alone does not give enough information to specifically identify a cartridge because a number of cartridges fire a bullet with the same caliber, or diameter. We need more information to state with certainty the cartridge name. Additional information about a cartridge's name is provided by the one or two words following the measurement of bullet diameter. For example, in caliber .22 there are cartridges named .22 Short, .22 Long, .22 Long Rifle (all of which are rim fire cartridges with the primer material located in the rim of the casing), .22 Hornet, .222 Remington, and .223 Remington (all of which are center fire cartridges with the primer located in the center of the casing).

In a cartridge name the word or words following the measurement of bullet diameter can be as short as few letters, like the 6mm PPC, or as long as .38 Special, .45 Long Colt, or .600 Nitro Express. The word or words after the measurement can specifically identify a cartridge within a caliber.

¹¹AFTE, Glossary, p. 30.

¹²Lyman Gun Sight Corporation, Handbook of Cast Bullets (Middlefield, CT: Lyman Gun Sight Corp., 1958), pp. 72-73.

Cartridge names become a little confusing when exceptions to conventions are introduced. Examples of exceptions include the .30-40 Krag, the .30-30 Winchester Center Fire, and the .30-'06 Springfield. The first two cartridges are about a hundred years old and were introduced at a time when black powder was loaded into cartridge cases.

Cartridge names in the 1870's included the bullet diameter in thousands of an inch¹³ followed by the number of grains of black powder loaded into the brass casing. Examples of 1870's cartridge names include the .47-70, the .32-40, and the .38-55.¹⁴ One cartridge name, the .45-70-500 Government, carried this to an extreme, giving the caliber of the bullet in thousandths of an inch, followed by the amount of black powder measured in grains, and finally the weight of the bullet in grains.¹⁵

Smokeless powder was perfected contemporaneously with the creation of the .30-40 Krag. The .30-40 Krag was a military cartridge fired in the first bolt action rifle adopted by the United States Military in 1892.¹⁶ The rifle was designed by Norwegian Army Capt. Ole H. J. Krag. Slightly modified for the United States Military, the rifle became known as the Krag-Jorgensen. The cartridge for the Krag fired a bullet .30 inches in diameter¹⁷ and the casing was loaded with 40 grains of smokeless powder. Note that in the name of this cartridge (.30-40 Krag) the number after the hyphen is not preceded by a period. Although this cartridge was introduced in 1892, popular usage continued to refer to the round as the .30-40 Krag, a name unique to this cartridge and one which specifically identifies it.¹⁸

The .30-30 Winchester Center Fire (WCF), also known as the .30 Winchester or simply the .30-30, fired a bullet with a diameter of .30 inches.¹⁹ Again, note that the number after the hyphen is not preceded by a period. The second number was a measurement of the grains of smokeless powder loaded into the casing, in this case 30

¹³Some writers omit the period before the measurement, assuming that the reader knows what is being discussed. The omission of the period is but another exception to convention. In the interests of clarity the period is included at all times in this work.

¹⁴Clay Harvey, Popular Sporting Rifle Cartridges, (Northfield, IL: DBI Books, Inc., 1984), p. 156.

¹⁵NRA, Fact Book, p. 53.

¹⁶*Ibid* p. 69.

¹⁷The precise measurement of the bullet diameter is .308 inches. The last digit, representing thousandths of an inch, is typically omitted in cartridge names. Some cartridges, however, do extend the measurement out to the third place and include that information in the cartridge name. See: Omark, Reloading Manual, p. 221.

¹⁸Harvey, Cartridges, pp. 167-70.

¹⁹The precise measurement of the bullet diameter is .308 inches.

grains. Introduced in 1895 as the .30-30, the cartridge has continued to be known as such.²⁰

In 1903 the United States Military adopted its second bolt action rifle, the .30-'06 Springfield. The cartridge fired a .30 caliber bullet²¹ and was initially called the .30-'03. The hyphen in the cartridge name separated the caliber from other information about the cartridge, i.e., the year the round was adopted. When the cartridge was improved in 1906 it became known as the .30-'06, or .30-'06 Springfield, thus specifically identifying the cartridge as that adopted in 1906 and designed to be fired in the rifle manufactured at the military armory in Springfield, Massachusetts.²²

In Europe the unit of measure is the meter, subdivided into millimeters, or thousandths of a meter. By convention, the millimeter is expressed in lower case letters as "mm". European calibers, or bullet diameters, are expressed as 5mm, 6mm, 7mm, 7.62mm, 8mm, or 9mm. But the caliber of the bullet alone does not sufficiently identify the cartridge, or finished unit of ammunition. Again, we need more information.

European cartridge names include the length of the cartridge case in millimeters and possibly a word. The length of the casing is separated from the caliber by the letter "x". Thus, the 9mm Luger, also known as the 9mm Parabellum (a center fire handgun and submachinegun cartridge), becomes the 9mm x 19, and the cartridge adopted by the North Atlantic Treaty Organization (NATO) as a standard rifle cartridge becomes the 7.62mm x 51, also known as the 7.62 NATO.²³

European use of the metric system appears to provide a more accurate and scientific system for cartridge names. Nonetheless, confusion can enter the scheme of things. Consider that in the United States one cartridge is known as the .380 ACP (Automatic Colt Pistol), while in Europe it may be called the 9mm Browning Short, the 9mm Corto, or the 9mm Kurz.²⁴

²⁰Harvey, Cartridges, pp. 156-61.

²¹The precise measurement of the bullet diameter is .308 inches.

²²Julian S. Hatcher, Maj. Gen. (USA Retired), Hatcher's Notebook (Harrisburg, PA: Stackpole Publishing Company, 1962), pp. 19-31.

²³The millimeter notation (mm) is sometimes omitted in metric measurements just as the period is sometimes omitted in inch measurements. When either is omitted the writer of the piece makes the assumption that the reader knows what is being discussed.

²⁴Omark, Reloading Manual, p. 382.

Cartridges can be named by units of measure expressed in inches or in millimeters. Examples include:

<u>Metric</u>		<u>Inches</u>
7.62 x 63	also known as	.30-'06 Springfield
7.62 x 51	also known as	.308 Winchester (7.62 NATO)
7.62 x 51R	also known as	.30-30 Winchester
6.5 x 52R	also known as	.25-35 Winchester
5.6 x 52R	also known as	.22 Savage High Power ²⁵

Shotgun Ammunition

Shotgun shells have many of the same components as rifle and handgun cartridges. Shotgun shells contain:

- o Casing, usually made of plastic or paper, occasionally made of metal.
- o Lead or steel shot ranging in sizes from the large 00 buck to the smaller number 4 buck, then from BB to number 12 shot; the cartridge can also contain one projectile commonly called a slug.
- o Powder; smokeless.²⁶
- o A primer of large size, frequently called a battery cup primer.
- o An over-powder/under-shot wad made of either plastic or paper; an over-shot wad is occasionally seen.

The convention establishing the gauge of a shotgun does not follow the measurement system used in rifles and handguns. Instead, the establishment of shotgun gauges follows long standing tradition. The gauge of a shotgun is equal to the number of lead spheres necessary to equal one pound in weight. If a pound of lead were divided into four equal parts and those four parts were reshaped into spheres, the gun firing one of those spheres would be a 4 gauge shotgun. If the same pound of lead were divided into twelve equal parts, the gauge of the gun firing one of these spheres would be a 12 gauge shotgun. The bore diameter of a 12 gauge shotgun measures .729 inches.²⁷

Most modern shotguns are chambered for ammunition in 10 gauge, 12 gauge, 16 gauge, 20 gauge, and 28 gauge. Shotgun ammunition in the United States is manufactured in

²⁵NRA, Fact Book, p. 56.

²⁶Omark, Reloading Manual, pp. 30-39.

²⁷NRA, Fact Book, pp.179-85.

lengths of two and three-quarters inches or three inches.²⁸ With conventions there is often an exception and this is true for shotguns. The exception to the rule is the .410 bore shotgun. The .410 shotgun has a period before the measurement telling the reader that the measurement is in inches. The .410 shotgun is not a gauge but rather a bore; the diameter of the bore being measured in inches.^{29 30} If the .410 bore were expressed as a gauge it would be 67 gauge.^{31 32}

Shotgun shells are usually filled with shot in sizes from large 00 buck shot down to small number 12 shot. Shotgun shells can be manufactured with only one projectile called a slug.

Interchangability Of Cartridges

Firearms chambered for a particular cartridge type cannot fire a different cartridge. This is a general observation. However, there are a number of exceptions to this generalization. As mentioned above, firearms chambered for the .22 Long Rifle cartridge will also fire the .22 Short and the .22 Long. Other cartridge alternatives include:

²⁸Ibid, p. 184.

²⁹Ibid, p. 179.

³⁰Elmer Keith, Shotguns by Keith (Harrisburg, PA: The Stackpole Company, 1950), p. 105.

³¹NRA, Fact Book, p. 179.

³²One should not confuse the .410 bore shotgun shell with a .41 Magnum handgun cartridge. The .410 shotgun measurement is carried to three places; the .41 Magnum handgun measurement is carried only to two places.

Firearm Chambered for:

May Fire:

.22 Win. Mag. Rimfire	.22 Winchester Rimfire
.32 Smith & Wesson Long	.32 Smith & Wesson
.32 H & R Magnum	.32 S & W or .32 S & W Long
.32 Long Colt	.32 Short Colt
.38 Long Colt	.38 Short Colt
.38 Special	.38 Short Colt, .38 Long Colt
.357 Magnum	.38 Special, .38 Short Colt & .38 Long Colt
.38 Super	.38 Automatic Colt Pistol
.41 Long Colt	.41 Short Colt
.44 Special	.44 Russian
.44 Magnum	.44 Russian, .44 Special
.45 Colt	.45 Smith & Wesson ³³

A twenty gauge shotgun shell can be loaded to and through the chamber of a twelve gauge shotgun. A twelve gauge shotshell can then be chambered behind the twenty gauge shell and the shotgun can be discharged in this configuration. The combination is known as the 12/20 and usually destroys the shotgun because of excessively high pressures.

Use of one cartridge in a firearm chambered for another is an occurrence that can be discovered by the experienced firearms examiner. The use of alternate cartridges is usually not the result of a shooter attempting to inject confusion into the interpretation of recovered evidence but is typically predicated on ammunition availability.

Rifling

A rifle is a firearm "... having rifling in the bore and designed to be fired from the shoulder."³⁴ Rifling is a set of grooves cut or pressed into the inner surface of a barrel and designed to impart rotary motion, or spin, to a bullet.³⁵ Imparting spin to a bullet enhances gyroscopic stability and is a great aid to accuracy.

Peterson wrote that the inventor of rifling was unknown.³⁶ Carmichael agreed and questioned whether rifling was an intentional or accidental invention because some early barrels exhibited grooves that were straight and of no use in imparting spin to a bullet.³⁷

³³NRA, Fact Book, p. 66.

³⁴AFTE, Glossary, p. 154.

³⁵Ibid, p. 155.

³⁶Harold L. Peterson, The Treasury of the Gun (New York: Golden Press, 1962), p. 133.

³⁷Jim Carmichael, Jim Carmichael's Book of the Rifle (New York: Outdoor Life Books, 1985), pp. 1-2.

Olson credited Kollner, a gunsmith from Vienna, Austria, with developing the first rifled barrel in 1498.³⁸

There are four methods by which rifling is produced in the bore of a barrel: broach, button, hook (or scrape), and swage.³⁹ Rifling is created by cutting, or pressing (depending on the method) a spiral set of grooves into the inner surface, or bore, of the barrel. In addition to creating lands and grooves in the bore, the machine tools used during the rifling process leave behind microscopic markings that are cut (or pressed) into the lands and grooves. The microscopic markings are used to identify the one rifled barrel through which a bullet was fired.

Lands and grooves cut into a barrel can be measured in terms of number, direction of twist, and width. The number of lands and grooves in a barrel ranges from a low of two to as many as twenty-two. The depth and width of lands and grooves varies from manufacturer to manufacturer and with the model of firearm made by a manufacturer. The direction of twist is either left or right.

A bullet fired in a rifled barrel will have engraved upon its surface the number of lands and grooves in the bore of the barrel, the width of the lands and grooves, and the direction of twist. All three of these characteristics are of great value in firearms identification.

Rifle Actions

A discussion of rifle actions must include the distinction between muzzle-loading and breech-loading arms. Muzzle-loading arms are those which receive powder and projectiles through the muzzle end of the barrel.⁴⁰ Muzzle-loading firearms, fired from the shoulder, were in use by the 16th century.^{41 42} These arms were the best possible product of then-available manufacturing technology. One of the most difficult problems faced by those arms makers was the issue of a good gas seal at the breech end of the barrel, that end of the barrel closest to the shooter's face. Although the muzzle-loader was slow and cumbersome to reload for second and subsequent shots, the design had a life cycle of more than three hundred fifty years and continues to be manufactured today in small numbers.

Creation and manufacture of a successful breech loading shoulder arm firing fixed ammunition was technologically possible by 1837. In that year the Dreyse needle fire bolt

³⁸John Olson, John Olson's Book of the Rifle (Chicago: J. Philip O'Hara, Inc., 1974), p. 7.

³⁹AFTE, Glossary, p. 155.

⁴⁰AFTE, Glossary, p. 122.

⁴¹Peterson, Treasury of the Gun, pp. 39-48.

⁴²Lyman, Handbook of Cast Bullets, pp. 34-36.

action rifle was manufactured in Europe.⁴³ Metallic cartridge development continued after that date. Colonels Berdan and Boxer completed their improvements to the cartridge in 1866.⁴⁴ There have been no major changes in cartridge design since that date.⁴⁵

Design of gas sealing metallic cartridges, coupled with ingenious methods for breechblock or breech bolt mechanisms completed the development of the breach loading firearm. Breech loading made possible the rapid reloading and firing of a firearm.

The action of a rifle is the mechanism by which the breech end of the arm is opened and closed. Action functions assigned by the designer can include extracting an expended cartridge from the chamber and ejecting it from the arm, cocking the firing mechanism, and loading a fresh cartridge into the receiver. Rifle actions manufactured today include:

- o Automatic, which will cycle the action and fire rounds as long as the trigger is pulled; sometimes referred to as a machine gun.
- o Bolt action, where a turn bolt or straight pull bolt is manually operated by the shooter.
- o Lever action, where the breech mechanism is cycled by a manually operated lever.
- o Semi-automatic, which cycles the action and fires one round with each release and pull of the trigger; often referred to as an autoloader.
- o Slide, where the breech mechanism is cycled by a manually operated forearm moving parallel to the barrel; also known as a pump action.⁴⁶

Modern sporting arm rifle manufacturers such as Browning, Stevens, Remington, Ruger, and Winchester make a number of different rifle models. Remington alone offers nineteen rifle models for sale. Each of these rifles may be chambered for a different caliber. The Remington Model 700 bolt action rifle may be chambered for sixteen different calibers ranging from the small .17 Remington to the large .338 Winchester Magnum.⁴⁷ Thus, although various makes and models of rifles may be chambered for different cartridges, a rifle is chambered for and fires only one specific cartridge.

⁴³Peterson, Treasury of the Gun, p. 173.

⁴⁴Ibid, p. 180.

⁴⁵Ibid.

⁴⁶AFTE, Glossary, pp. 2-3.

⁴⁷Potomac Arms Corporation, Catalog (Alexandria, VA: Potomac Arms Corporation, 1993), pp. 40-42.

Handgun Actions

The handguns most likely to be encountered by police officers today include the revolver and the semi-automatic pistol. The barrels of both the revolver and the pistol are rifled. Unlike the traditional rifling of lands and grooves, certain pistols of very modern manufacture feature polygonal rifling.⁴⁸

The revolver is fitted with a cylinder chambered to hold between five and nine cartridges. Each chamber in the cylinder is in line with the axis of the barrel and is successively rotated into firing position behind the barrel by action of the revolver's mechanism. Mention the word revolver to most people and they think of the standard, police type revolver where the cylinder swings out of the frame on the left side. However, Smith defined seven different types of revolvers including one that is semi-automatic.⁴⁹

As specified by the designer, with each pull and release of the trigger a semi-automatic pistol fires a cartridge, extracts the expended casing, cocks the action, and chambers a fresh round. Smith classified the designs into simple blow back, blow forward, delayed blow back, and locked-breech.⁵⁰ More than thirteen designs fall into the category of locked-breech.⁵¹

Both the revolver and the pistol create markings on bullets and casings that are of use to the firearms examiner. The pistol creates additional markings on the casing as it is fed into and through the magazine.

Shotgun Actions

The major difference between rifles or pistols and the shotgun is that the latter has no rifling in the bore. The three most frequently encountered shotgun actions are the semi-automatic, the slide action or pump, and the hinged frame. The hinged frame design allows the barrel(s) to pivot away from the standing breech in an up, down, or sideways direction.⁵²

Shotguns of the hinged frame design are typically equipped with one or two barrels. If the design includes two barrels they may rest side-by-side or one on top of the other.

There are some exceptions to the convention of shotgun action design. One exception is a shotgun action of turnbolt design. A second exception is a shotgun action which includes

⁴⁸Dimaio, Gunshot Wounds, p. 26.

⁴⁹W. H. B. Smith, Smith's Book of Pistols & Revolvers, 2nd ed., (New York: Castle Books, 1968), pp. 43-51.

⁵⁰Ibid, pp. 35-43.

⁵¹Ibid, pp. 40-42.

⁵²AFTE, Glossary, p. 2.

a cylinder that turns and aligns a fresh cartridge with the bore, visually very much like a revolver. This type of shotgun action is marketed under the brand name "Street Sweeper."

When a shotgun is fired in the commission of a crime only the expended casing can exhibit markings of value for identification with a particular firearm. The brass head of the casing may bear breech face impressions, firing pin impressions, or extractor markings that could identify the casing as having been fired in a particular shotgun.

Because the shotgun is not equipped with rifling, markings on the wadding or the shot are unlikely to be of value in identification of an individual firearm. Nonetheless, over-powder wadding recovered on the scene of a homicide or from the body of the decedent, will be helpful in establishing the gauge of the firearm used in the commission of the offense.

A count of the pellets recovered on the scene or evidenced on the scene by passage through an intervening object (such as through a door or wall) can greatly assist in the determination of the gauge of the shotgun discharged. If at the time of autopsy the decedent presented with one gunshot wound to the body and nine pellets of 00 Buck were recovered from him, this would strongly suggest that a 12 gauge shotgun was discharged at the decedent because 12 gauge shotshells are loaded with nine pellets of 00 Buck shot.

Firearm Discharge

Regardless of action type, when the trigger is pulled in a rifle or handgun a hammer is released and strikes the firing pin. In some designs the trigger will act more directly on the firing pin releasing it under spring loaded tension. The firing pin moves forward to strike the rear of the primer with some force. The impact of the firing pin creates a potentially distinctive mark on the primer. In a center fire round the firing pin compresses the primer material against an anvil. The pressure associated with that event causes the primer material to detonate.

The explosion of the primer material ignites the charge of propellant, or powder, contained in the cartridge casing. The power begins to burn and creates a large volume of gas. As the gas pressure builds the head of the casing is forced against the breech face and tool marks from the breech face are transferred to the head of the casing. Gas expansion within the casing causes it to obturate, or grip the walls of the chamber, providing an effective seal and preventing the gas from traveling with destructive force through the breech of the arm. The contact between casing and chamber walls, under pressure, can create discrete chamber markings on the sides of the casing. All of these markings are useful to the firearms examiner.

Contained within the casing and allowed to travel in only one direction, continued expansion of the gas overcomes the inertia of the bullet causing it to gain speed and travel through the rifled barrel. As the bullet moves down the barrel it engages the rifling, begins to spin in the appropriate direction, and has engraved upon its surface discrete markings from the lands and grooves and the tools used to create them.

After the round is fired and pressures subside within the barrel and chamber, the action is opened automatically or manually, and the expended round is extracted from the

chamber. The process of extraction typically places on the casing markings that are of value to the firearms examiner.

Principles of Identification

The firearms examiner will begin the examination of bullet or casing evidence by looking for class characteristics and individual characteristics. For bullets, class characteristics include the number of lands and grooves, the diameter of the lands and grooves, the width of the lands and grooves, and the direction of twist.⁵³ Individual characteristics are those discrete markings placed on the bullet by the set of lands and grooves in the barrel through which the bullet was fired.

Class characteristics for casings include breech face impressions, the placement, size, and shape of the ejector and extractor markings, the shape, size, and depth of the firing pin impression, chamber markings, and magazine markings (if any).⁵⁴ The individual characteristics are those discrete markings made by the one extractor, firing pin, chamber, or breech face with which the casing came into contact during firing.

When working with fired bullets, the firearms examiner begins his work by weighing the bullet and noting evidenced class characteristics. Measurement of the lands and grooves, coupled with their number and direction of twist, will allow the examiner to determine the make and model of firearm through which the bullet was fired. The weight of the recovered bullet aids the examiner in determining its manufacture and possibly the cartridge.

There are several different methods by which lands and grooves may be measured. Each firearms examiner using the measurement methods will obtain slightly different results. As a control on this human variable, firearms laboratories use one examiner to make all measurements. Use of one examiner will introduce systematic error into the measurements. However, all measurements made in that laboratory will have the same systematic error. The issue for the investigator is that although land and groove measurements from different laboratories may contain the same numbers, only visual examination of the fired bullets is sufficient for identification purposes.

The absolute identification of one bullet being fired from one rifled barrel is predicated upon the fact that when two metallic objects are in contact with each other the harder metal object will engrave markings upon the softer metal object. In the case of a rifled barrel and a bullet, certain imperfections in the barrel's manufacture will engrave individual, discrete, and reproducible markings upon the bullet. These markings have individual characteristics.

In order to make a comparison between a questioned bullet recovered at the scene of a homicide and a firearm recovered from a suspect, the firearms examiner will examine the weight, construction, and manufacture of the questioned bullet. The examiner will identify

⁵³DiMaio, *Gunshot Wounds*, pp. 30-31.

⁵⁴Ibid, p. 33.

the questioned bullet and select an identical cartridge from his laboratory's reference collection of ammunition. The identical cartridge will be fired in the recovered firearm. The bullet will be stopped, unharmed, in a water recovery tank.

Good firearms identification laboratory practice calls for two or more rounds of ammunition from the reference collection to be fired in the recovered firearm. The recovered bullets are called test fires, or known bullets. The examiner will mount both of the known test fired bullets in an optical comparison microscope. Each of the test fires is compared against the other for the individual characteristics consisting of microscopic, engraved markings (also known as striations). If the two test fires compare favorably, the examiner knows that engraved markings from the rifled barrel are reproducible.

The examiner then mounts the questioned bullet on the optical comparison microscope and compares it with one of the known test fires. If the striations on the questioned bullet match those on the known bullet then the questioned bullet was fired through the same barrel as the known bullet.

The firearms examiner begins his examination of a fired casing by noting the words and numbers stamped into the head of the casing (if any) and looking for individual markings engraved on the casing. When a cartridge is fired firing pin impressions are struck into the surface of the primer. In certain instances the shape and size of firing pin impressions will immediately suggest the brand name of the firearm. As the powder in the casing burns the casing expands in all directions and breech face impressions and chamber impressions are forcibly pressed into the casing. Finally, when the casing is extracted from the chamber of a firearm, extractor impressions are engraved on the casing.

It is possible that casings can be better evidence than bullets. Depending on the composition of the material they strike, bullets can be mutilated and their engraved surfaces rendered useless for comparison purposes. Cartridges are usually not subject to such mutilation and the individual characteristics on their surfaces may be more suitable for identification by the firearms examiner.

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Firearm Residues

Vincent J.M. Dimaio, M.D.

Detection of firearm residues on the hands of an individual may be of great importance in evaluating deaths due to gunshot wounds. Detection of such residues on the hands of a deceased individual is often confirmatory evidence of a suspected suicide.

One of the earliest methods of determining whether an individual discharged a weapon, the "paraffin test" or "dermal nitrate test," was based on the detection of nitrates on the surfaces of the hands. Paraffin was employed for the removal of powder particle residues from the hands. Diphenylamine was the reagent used to detect the nitrates picked up by the paraffin. This test is no longer considered valid, as no distinction can be made between nitrates of gunpowder origin and those from other sources, which are quite commonly encountered in day-to day living.

In 1959 Harrison and Gilroy developed a series of chemical spot tests for detection of metallic components of firearm discharge residues. Such metallic substances mainly originate from the primer, though they can also come from the bullet or cartridge case. The authors developed spot tests for the presence of antimony, barium, and lead, substances found in most primers. These tests are inconclusive, as they are essentially qualitative rather than quantitative in nature.

The concept of detecting metallic primer components has led to more sophisticated approaches now in general use. Compounds of antimony, barium, and lead are used in modern non-corrosive primers. One or more of these substances are present in a primer, depending on the manufacturer. When a handgun is discharged, discrete particulate matter containing these elements is deposited on the thumb, forefinger, and connecting web, i.e., the "back" of the hand holding the weapon. The metallic compounds are removed from the hand, either paraffin, or more commonly, with cotton swabs saturated with a dilute solution of acid. This material is then submitted for analysis.

The two methods for the detection of firearm discharge residues now in general use are neutron activation analysis and atomic absorption analysis. Neutron activation analysis is used for the determination of antimony and barium concentration deposited on the hand where a gun is discharged.

It is based on the principle that when materials are irradiated in a nuclear reactor, some of the atoms present are converted into radioactive isotopes. The type and energy of the irradiation, and the decay rate, are specific for each material. A quantitative estimation can be made by comparing the elements' radioactivity with a suitable standard. Lead is not analyzed by this method. Neutron activation analysis, while extremely sensitive, requires expensive, elaborate equipment and access to a nuclear reactor. In contrast, atomic absorption equipment is relatively inexpensive and is found in most laboratories. In addition, atomic absorption procedures will detect not only antimony and barium, but also lead.

Whatever the system of analysis to which the pathologist has access, the procedures, for removal of firearm discharge residues from the hand are the same. The solution most commonly used is a dilute solution of acid. Four cotton swabs are used to remove the firearm discharge residues from the hands. Two swabs are used on each hand: one for the palmar aspect, the other for the "back" of the hand. The swabs of the nonfiring hand and the palm of the hand suspected of discharging the weapon act as controls. If a person has discharged the handgun, firearm discharge residues should appear only on the "back" of the hand that fired the weapon, not on the palm of that hand or on the other hand. Some people, because of their occupations, may have high levels of barium, antimony, or lead on their hands. Thus if the "back" of the hand were the only area submitted for examination in such an individual might not have discharged the weapon. If analysis of the hand washings reveals firearm discharge residues only on the palms, this is strongly suggestive that the individual had his hands around the weapon at the time of discharge or was trying to ward off the weapon.

When swabs of the hand are taken, a control swab dipped in the acid should also be submitted as a blank. Cotton swabs with wooden shafts should not be used, only those with plastic shafts. This is because wood may be contaminated with some of the aforementioned metallic elements; as wood shows great variation in the concentration of such elements, no blank can be used.

It must be realized that determination of whether an individual fired a gun cannot be based on absolute quantities of primer residue on the hands. Rather, it is based on contrast of the levels of these compounds from right to left and from palm to back.

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Glossary of Common Terms

Vincent J.M. Dimaio, M.D.

Ballistics: Study of the motion of a projectile.

Exterior Ballistics: Study of the motion of a projectile after it leaves the barrel of the firing weapon.

Interior Ballistics: Study of the motion of a projectile within the firearm from the moment of igniting the primer to the time the projectile leaves the barrel.

Terminal (Wound) Ballistics: Study of the effect of a projectile's impact on the target.

Barrel: Tube that guides the bullet or projectile (shot charge); interior passage grooved in rifles and handguns, smooth in shotguns.

Bearing Surface: That part of the bullet that comes in contact with the lands and grooves as it moves through the barrel; that part of the bullet that mirrors the engraving of the rifling in the barrel.

Bore: Diameter of the barrel; in a rifled firearm, the bore diameter measured from land to land. Measurement is expressed in thousandths of an inch or in millimeters.

Breech Block: That part of the firearm that blocks and locks the breech of the firearm before firing, whether as a bolt, slide, or cylinder.

Bullet: Projectile of a pistol or rifle; one of the parts of the cartridge (term accurate only when referring to the projectile). Composed of lead hardened by an alloy of tin and antimony. Sometimes semi-jacketed or fully-jacketed with an outer layer of hard metal, usually copper-zinc alloy; style variable, e.g., boat tail, flat nose, hollow point, round nose, spire point, and wad cutter.

Burning Rate: Relative speed at which smokeless powder burns when confined within the firearm.

Caliber: Technically, the bore diameter expressed in hundredths of an inch or in millimeters; practically, often used in designating the name of the firearm or cartridge. For example, the .32-30 W.C.F. (Winchester Center Fire), .303 Savage and .308 Winchester are .300 bore, as are the better-known .30-30 W.F.C., .30 M1 Carbine and .30-06 Gov.

Cartridge: One unit of ammunition composed of case, primer, powder, and bullet; sometimes referred to as one round of ammunition.

Cartridge Case: Metal cap generally made of brass; may be nickel-plated and can be made of steel (best example of steel case is .45 ACP made in World War II); holds the primer, powder and bullet in a waterproof container. Also referred to as fixed ammo. Three basic shapes: straight, tapered, and bottlenecked. Head of the case is rimmed, semi-rimmed, rimless, rebated rimless, or belted.

Centerfire Cartridge: Cartridge in which the primer compound is located in primer cap in the center of the base.

Chamber: Special enlarged area of the breech of the barrel where the cartridge fits when it is fired.

Class Characteristics: Those unvarying characteristics of a particular make of firearm or ammunition; e.g., number of grooves in rifling, direction of the twist of the rifling.

Clip: Mechanical device for holding cartridges to speed the loading of a magazine; commonly mistaken by the layman for the magazine.

Deterrent Coating: Chemical coating used on smokeless powder particles to control combustion rate.

Drift: The lateral deviation from its trajectory of a bullet in flight.

Ejector: Part of the firearm action that kicks out or ejects the cartridge case from the firearm after firing or during hand operation.

Erosion: Removal of metal from the inside of the barrel by friction of bullet and action of the voluminous high temperature gases; generally first seen in the "throat" of the rifle (the junction of the mouth of the cartridge case and the barrel); will make some changes in individual characteristics.

Extractor: Part of the action of the firearm that pulls or withdraws the cartridge case from the chamber.

Firing Pin: Part of the action that transmits the blow that detonates the primer.

Flash Hole: Aperture through the web of a centerfire case from the primer pocket through which primer flame passes to ignite the powder.

Groove Diameter: Diameter of a bore measured from depth of groove to depth of opposite groove.

Grooves: Spiral cuts or impressions inside a barrel that rotate the projectile and stabilize its flight.

Hammer: Part of the action that strikes the primer or moves the firing pin forward, causing it to strike the primer.

Handgun: Short firearm intended to be aimed and fired from one hand. Three types:

Automatic Pistol (semiautomatic) - Common term for a self-loading handgun that fires, ejects the empty cartridge, reloads, and cocks itself each time the trigger is pulled; accurate designation of this type of firearm is "semiautomatic," since the fully automatic weapon will continue firing as long as the trigger is held back and ammunition lasts.

Derringer - Small, easily concealed handgun; may have one, two, or four barrels; fires a single shot from each barrel.

Revolver: Repeating handgun with a revolving cylinder chambered to hold the cartridges; cylinder may contain as few as five chambers or as many as twelve, most common number being six. Two types:

Single Action - Hammer must be cocked each time before firing.

Double Action - Trigger pull alone will cock and fire, although hammer may be cocked by hand.

Individual Characteristics: Those characteristic markings or details of a firearm that serve to distinguish it from all other firearms, including those of the same caliber, make, and model.

Keyhole: Shape of wound caused by bullet's not striking nose- or point-first; caused by loss of gyroscopic stability (*spin*) of bullet.

Land: Original part of the bore left after rifling grooves are formed; width and number constitute class characteristics.

Leading: Deposit of lead in the bore of the rifle or pistol when lead bullets are fired; extensive, positive bullet identification is difficult if not impossible.

Magazine: Holder for cartridges in a repeating firearm from which cartridges are automatically chambered; sometimes detachable (as in semiautomatic pistols); commonly, though inaccurately, referred to as clip.

Magnum: Cartridge of greater power than earlier standards for the same caliber; also, firearm with the capacity to use magnum cartridges. Manufacturers sometimes use word for glamour, not to indicate increased power.

Metal Fouling: Deposit of metal in bore, from bullet or jacket.

Muzzle Energy: Amount of energy of the bullet at the muzzle expressed in foot pounds (Fp).

Muzzle Velocity: Speed of the bullet or shot at the muzzle expressed in feet per second (fps); measurement customarily made a few feet away from the muzzle.

Penetrating and Perforating Wound: Penetrating - wound with an entry but no exit. Perforating - a "through-and-through" wound; has an entry and an exit. The terms "penetrating" and "perforating" apply to missile wounds as well as stab wounds. In a penetrating missile wound, the projectile is retained within the anatomic region or in organ or the tissue involved; in a perforating missile wound, the projectile is not retained.

Powder: Two basic types -

Black Powder: Mixture of 10 parts sulfur, 15 parts charcoal and 75 parts potassium nitrate by weight; presently used in muzzle loading rifles and shotguns and cap and ball pistols; ignitable by shock, friction, or spark.

Smokeless Powder: High-energy chemical compound that requires a high kindling temperature for ignition; does not ignite from shock or friction; grains usually ball-shaped or tubular; burns rather than explodes; rate of burn increases with confinement.

Two types -

Single base smokeless powder: composed of nitrocellulose.

Double base smokeless powder: composed of nitroglycerin absorbed in nitrocellulose.

Primer: Small metal cap holding compound that is detonated by blow from either the hammer or the firing pin; replaceable in centerfire cartridges; compound variable, but customarily contains some or all of the following: antimony, barium, lead, mercury, and potassium.

Range: Maximum distance a bullet will travel. Examples: maximum range at muzzle elevation between 20° and 35° - .22 long rifle with 40 grains of powder = 1500 yards; .45 ACP with 234 grains of powder = 3500 yards. Also, distance that bullet traveled from muzzle to target.

Recoil: "Kick"; backward motion of gun when fired.

Ricochet: Glancing shot.

Rifling: Spiral grooves, parallel-cut or engraved on the inner surface of the barrel; sometimes formed by forcing a tungsten carbide steel button in the negative image of the rifling through the bore by hydraulic pressures; primarily to impart to bullet a rotation or spin around its own axis in order to keep it gyroscopically straight or point-first, and secondarily to retain the bullet in the barrel to await more complete combustion of the propellant. A class characteristic.

Rim Fire Cartridge: Cartridge in which the primer compound is positioned in the hollow rim of the cartridge case.

Squib Load: Defective load that does not impart full propulsive power to the projectile; hence bullet fired has less destructive effect.

Striker: Firing pin or part of the action that strikes the firing pin found in hammerless firearms.

Trajectory: Path of bullet in air.

Velocity: Speed of a projectile in feet-per-second (fps); important in determining trajectory, stopping power, and extreme range. Low velocity for bullet fired from a rifled firearm is from 600 to 1750 fps, high velocity from 1750 to over 3000 fps. Usually expressed in terms of muzzle velocity.

Yaw: Deviation between the long axis of the bullet and the axis of the path of the bullet; can cause keyhole entry wound. Two types:

Nose Yaw: Nose of bullet spinning around the axis of flight; variable causes such as defect in bullet and imperfect seating of bullet in case; tends to increase in flight, eventually causing bullet to tumble.

Base Yaw: Base of bullet spinning around the axis of flight; variable causes such as excessive velocity, wrong combination of rifling twist, and bullet weight.

FIRE DEATHS

Fire Deaths

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Introduction

A. Manner of death

1. Homicide
2. Suicide
3. Natural
4. Accidental
5. Undetermined

B. The investigation

1. Scene
 - a. Photograph and sketch
 - b. Examine and move body carefully, preserve evidence; may be brittle due to heat
 - c. Sift debris under body for evidence or identification
 - d. Clothes, cloths smelling of accelerates should be collected and placed in a clean, airtight container
2. History
3. Autopsy
4. Toxicology

C. Fire investigations require team effort

1. Fire investigation: fire, police, or both
2. Death investigation: police
3. Forensic pathologist
4. Toxicologist
5. Radiologist
6. Odontologist
7. Anthropologist

D. Questions to be answered

1. Are the remains human?
2. Who is the victim?
3. What was the cause of death?
4. What is the manner of death?

5. Was the person alive at the time of the fire?
6. If alive, why did the victim not escape?
 - a. escape route blocked
 - b. heavy smoke, fumes
 - c. explosion, extreme heat
 - d. exits locked, barred, or obstructed
 - e. victim unconscious
 - f. drugs/alcohol
 - g. physically unable
 - h. mental condition
 - i. restraints

E. Identification

1. Human or animal
2. Bones, blood, organs, hair, teeth
3. Weight and length unreliable
4. Sex--internal organs
5. Fingerprints
6. Teeth--most reliable

II. Burns

A. Severity of burns

1. intensity of heat, flames
2. duration of exposure
3. chemical

B. Classification of burns by depth of tissue destruction:

1. 1st degree: burned area red, swollen, and painful
2. 2nd degree: typically sun blistered; scarring may occur
3. 3rd degree: entire thickness of skin destroyed; scarring is usual
4. 4th degree: complete destruction of the skin and charring of underlying tissues

C. Classification of percent of body burned--surface area (Rule of Nine)

1. Head	9% = 9%
2. Each Arm	9% = 9%
3. Each Leg	18% = 36%
4. Chest and Abdomen	18% = 18%
5. Back	<u>18% = 18%</u>
	99%

III. Complete Destruction of the Body

- A. The average house fire seldom reaches temperatures above 1200 degrees F. Skin will char; soft tissue will remain because of the significant percentage of water in tissues.
- B. Cremation: requires a temperature of 1800 to 2100 degrees F. for two hours or longer. Still leaves two to four pounds of ashes, bones, and some teeth.
- C. Exceptions:
 - 1. Chemical fires
 - 2. Magnesium, thermite, etc. may reach into 1000s F.
 - 3. "Candle Effect"

IV. Cause of Death in Fires

- A. Heat
- B. Flames
- C. Toxic gases
- D. Disease
- E. Blunt Force
- F. Others

V. Artifacts of Fire Death

- A. Contraction of muscles
- B. Fracture of the large bones
- C. Fracture of the skull
- D. Splitting of the skin

VI. Generalities Known From Fire Cases

- A. Two out of three fatalities in fires are the result of asphyxiation caused by the replacement of life-sustaining air with toxic gases.
- B. Soot deposit in larynx and trachea indicates the victim was alive at the time of the fire.
- C. Carbon monoxide combines with the hemoglobin of the blood and forms a complex called carboxyhemoglobin.
- D. Carboxyhemoglobin restricts the amount of oxygen carried by the blood to the tissues of the body, resulting in asphyxiation.

- E. In nearly all fires, the supply of oxygen is insufficient to allow complete combustion of all available carbon compounds, resulting in the production of carbon monoxide (CO).

VII. Carbon Monoxide From Fire

A. Sources of carbon monoxide

1. Defective heating equipment
2. Engine exhaust
3. Industrial processes, unintentional or deliberate
4. Fires involving structures, clothing, or furniture

B. Everyone is exposed to some degree of carbon monoxide

1. In the atmosphere
2. Urban areas--high levels of automotive exhaust
3. Factories
4. Tobacco smokers--as much as 5%

C. Physiological effects of carbon monoxide

- | | | |
|----|--------------------------|---|
| 1. | 0 - 10% | Slight loss of mental sharpness |
| 2. | 10 - 20% | Slight headache, dilation of skin vessels |
| 3. | 20 - 30% | Severe headache, throbbing |
| 4. | 30 - 40% | Severe headache, weakness, dizziness, confusion, nausea, vomiting, collapse |
| 5. | 40 - 50% | Fainting, rapid breathing, collapse, death in some individuals |
| 6. | 50 - 60% | Fainting, rapid breathing, possible coma, convulsions, respiratory irregularity |
| 7. | 60 - 70% | Convulsions, depressed heart action, death |
| 8. | 70 - 80%
(and higher) | Weak pulse, respiratory failure, death |

D. Factors to be considered

1. rate of inhalation of gas
 - a. most important--death from oxygen starvation is not rapid
 - b. persons unconscious from carbon monoxide inhalation continue to breathe, thus building a higher concentration of carbon monoxide

Example 1: Victim exposed to a marginally excessive quantity of carbon monoxide over a period of time. Blood saturation increases slowly, mixed with good air being breathed. When

enough blood hemoglobin has been affected, victim will die. The carboxyhemoglobin level will be low.

Example 2: Victim exposed to a very high level of carbon monoxide. Victim breathes in excessive levels of carbon monoxide rapidly, even after unconsciousness. Blood level very high (70-80%).

Significance: Victim with minimal % of carbon monoxide indicates a long exposure to relatively low concentration of gas; victim with high % of carbon monoxide indicates a much shorter exposure to a high concentration of gas.

2. requirement of oxygen--activity or lack of activity
3. individual variation in susceptibility

VIII. Filicide Involving Fires¹

A. Types of filicide

1. Acutely psychotic--e.g. mother hears voices
2. Spouse revenge--e.g. husband/boyfriend wants to get back at the mother of the children
3. Murder for profit--e.g. collect life insurance

B. Characteristics of filicide

1. Victims: children, very young (elementary school or younger)
2. Fires occur at night or early in the morning when the children are sleeping
3. Crime scene may be staged: children may have already been killed and then placed in bed, etc.
4. Flammable liquid frequently used--crucial to case
5. Escape route blocked--perpetrator thinks fire will destroy all

¹Information in this section is from research conducted by the Arson & Bombing Investigative Support (ABIS) Subunit, Investigative Support Unit, FBI.

6. Parents:
 - a. may include step-parent or lover
 - b. state they were in bed when fire occurred
7. Faint-hearted rescue attempts (not a lot of effort)
 - a. no sign of heat exposure
 - b. eyes not watering
 - c. skin not reddened
 - d. hair not singed
8. Inappropriate behavior (front-lawn scenario)
 - a. little or no grief exhibited
 - b. little said about victims
 - c. discuss material losses (clothes, stereo, TV, etc.)
 - d. make declarations about future
9. Careless comments made with neighbors before fire occurred
10. Not appropriately dressed; not in night clothes, hair and makeup are fixed, etc.
11. Families usually known to social service agencies, indicating lack of income
12. Homes were rented or mobile homes, apartments, etc.
13. Parents in mid-20s to mid-30s
In some cases where the mother is older than mid-30s, she had had children die previously where death was indicated to be SIDS

C. Arson Filicide Interviews

1. Elements
 - a. can't be too detailed
 - b. interviewed separately
 - c. step-by-step (how they became aware of the fire)
 - d. smallest detail, times, duration
 - e. observations
 - f. walk through
 - g. micro-interview (heard, saw, felt, smelled)
 - h. document detail for any reader
 - i. use sketch

2. Who to interview
 - a. fire fighters
 - b. other witnesses
 - c. neighbors
 - d. friends
 - e. relatives
 - f. parents of playmates

3. Investigate parents and check backgrounds. If unmarried or single parent, be sure to check the following:
 - a. insurance coverage (any recent purchases?)
 - b. determine if boyfriend/girlfriend is in the picture, and interview
 - c. what is the relationship like between the couple?
 - d. what is the boyfriend/girlfriend/s attitude about the children?

4. If the parents are married
 - a. problems in the marriage?
 - b. financial situation (insurance, etc.)
 - c. expressed desire to be free of children?
 - d. document/stressor(s)

5. Autopsies
 - a. insist upon
 - b. X-ray
 - c. photograph separately (fire victims)
 - d. blood tested

6. Delay cremation
 - a. often foul play not suspected
 - b. lab results
 - c. interviews completed

Fire & Heat Related Deaths

Fire Marshal Eugene J. West, FDNY/BFI

The successful investigation of a fatal fire is usually the result of a team effort. To varying degrees, this type of investigation may involve the participation of firefighting personnel, fire investigator, police personnel, District Attorney, forensic pathologist, odontologist, toxicologist and radiologist.

Ideally, the most effective means of investigating fires is the fully integrated police/fire investigative team. Integral to the fire investigation team concept, is the qualified and experienced fire investigator. In addition to determining the cause and origin of the fire, this individual is uniquely qualified to collect, document and evaluate fire scene information. Since there are many facets of fire investigation, the fire investigator will also know how to access specific technical information and the specialized personnel necessary to successfully complete the fire investigation. The fire investigator should also be directly involved in the interview/interrogation of all persons having knowledge of facts surrounding the circumstances of the fire. The accuracy of statements made by individuals should be evaluated by him/her. The reliability of the information obtained should be supported by the fire investigator's own investigative determinations.

It is important that fire investigators make every effort to arrive at the fire scene as soon as possible, preferably while firefighting operations are still in progress. At this time, in addition to firefighting personnel, witnesses and/or victims may still be at the scene. Also, the fire investigator can personally observe fire volume, movement and extension; fire operations and extinguishment; and specific fire conditions of interest to the investigation. In cases of incendiary fires, it is not uncommon for the arsonist to remain at the scene to observe his/her handiwork. A timely arrival at the fire scene may also preclude certain legal problems specific to fire scene searches and criminal investigations (*refer to Appendix E*).

Investigators assigned to a fatal fire investigative team should not be discouraged by the degree of fire damage. Do not be unduly influenced by the severity of burns to the victim or fire damage to the fire scene. These factors can be, but are not necessarily, an indicator that the fire was incendiary in nature.

Be aware that the observations and opinions of firefighting personnel can be extremely beneficial to the fire investigator. However, he or she should also be aware that said personnel may have little, if any, fire investigation training. Inexperienced fire investigators and more commonly police officers with limited fire investigation awareness, have been known to assign a high degree of credibility to the unsubstantiated statements made to them by firefighting personnel regarding the accidental or incendiary nature of a fire. *Corroborate all information regardless of its source.*

Fire/police investigators must make every effort to protect the scene of a fatal fire or any other fire still under investigation for as long as necessary to complete said investigation. The fact that numerous persons may have entered the fire scene during firefighting operations and the postfire overhaul process does not mean that the scene does not warrant protection. Where evidence of a crime is determined, a CRIME SCENE LOG should be established.

Upon finding remains at the fire scene, first attempt to determine if the remains are human. If the remains are determined to be human, investigators will be faced with several problems.

1. Who is the victim?
2. What was the cause of death?
3. What was the manner of death?
4. Was the person alive at the time of the fire?
5. Why did he or she not escape?

Of course, it is entirely possible that some or all of these questions will remain unanswered until the entire investigation is completed and all investigatory findings are thoroughly reviewed and analyzed.

If the victim is known to be dead, *unless absolutely necessary, the body should not be moved*. Allow enough time to thoroughly examine the body and its immediate surroundings. Photograph the body where discovered. At this time complete a rough sketch of the scene and incorporate the body therein. Search the area immediately under the body once it has been removed. If the body has already been removed, it is important for the assigned investigator to examine the body at the location it has been removed to, as soon as possible. Photograph all evidence prior to removal and indicate the area of recovery in the rough sketch. Observe the clothing of the victim. Examine the body for tattoos, scars, jewelry and personal papers. This information may prove invaluable in ascertaining the identity of the victim.

Due to the nature of burn injuries, it is especially important that those charged with the investigation of a fatal fire control their emotions and not be overly influenced by the effects of heat when applied to the human body. Consciously maintain a professional demeanor at all times and view the body as another piece of the evidence puzzle.

Burns are classified by the depth tissue destruction:

- 1st Degree--Burned area red, swollen and painful
- 2nd Degree--Blistering, sloughing and scarring of the skin may occur
- 3rd Degree--Complete destruction of the skin and charring of the underlying tissues

Note: Some classification charts will list as many as 9 separate burn degree categories, with highest degree indicating the complete cremation of the human body.

In most cases a fatal fire victim will be found face down. The fact that a victim is found in the face-up position, by itself, is not necessarily indicative of foul play. However, if investigators cannot account for the face-up position of the body, they should be alerted to the possibility that a homicide has occurred.

Rarely will the human body be totally consumed by fire. Even under severe fire conditions, portions of the victim's torso and skull will remain. It is also not unusual for the fatal fire victim to sustain extensive surface burns and yet the internal organs will remain

relatively unaffected by fire.

Burn patterns and degree of burn evident on the body of a fire victim should be consistent with the fire conditions at the incident scene. Conduct a visual comparison of the body and other nearby combustibles. Ask yourself the following questions: Do other combustibles in close proximity to the body exhibit the same degree of burn? Is there a discernable burn pattern on the victim's body and/or in the surrounding area? Is there a protected area under the victim? Are there differences in the degree of burn to various parts of the victim's body? Does the body fit properly into the fire scene reconstruction? If not, why?

One of the most important issues that must be determined by a fatal fire investigation is whether or not the victim was alive or dead at the time of the fire. Some on-scene factors to consider include whether there is evidence that the victim attempted to escape; sign of struggle; visible soot (carbonaceous materials) in the victim's nostrils, mouth or throat; presence of cherry red lividity, or nonheat/fire related injury. A careful, on-scene analysis of ante- or postmortem injuries and/or burns may also enable the investigator to make a preliminary determination regarding the status of the victim when the fire occurred. Needless to say, a timely on-scene determination of whether the victim was alive or dead when the fire occurred can be of tremendous value to the investigator. Note: Although a field investigator may be able to ascertain, to a reasonable degree of certainty, that a victim was alive at the time of the fire, this preliminary determination should be considered tentative pending a final analysis of the victim's injuries at autopsy.

It is necessary that those assigned to a fatal fire investigation be aware that certain postmortem changes occur when heat is applied to the human body. These changes are natural and should not be misinterpreted by the investigator.

- **Pugilistic Stance:** The pugilistic stance or boxer's pose is frequently exhibited by fatal fire victims. It is not a defensive posture on the part of the fire victim, nor is it caused by rigor mortis. This phenomenon results from the contraction of the joints and large muscles of the body under high heat conditions.
- **Skull Fractures:** Extreme heat may cause fluids in the skull to boil and expand, resulting in an explosive skull fracture. This explosive reaction, in some cases, can expel brain matter and bone up to twelve inches from the victim. A careful examination of the victim's skull may enable the investigator to differentiate between an explosive skull fracture caused by the fire and an implosive fracture caused by a whole range of accidental and homicide possibilities.
- **Bone Fractures & Shrinkage:** When exposed to high heat conditions, human bones will fracture, and the large bones of the body will shrink up to 25%. The preformative bones of children are particularly susceptible to this type of shrinkage.
- **Splitting, Sloughing & Blistering Of The Skin:** (Can be postmortem or antemortem) Exposure to high levels of heat will cause the skin to shrink, resulting in a rip or tear that may resemble stab or incised wounds. In fatal fire cases, especially when the

victim evinces a pugilistic stance, this type of fire-induced injury can easily be confused with defensive wounds.

Heat will also cause the skin to separate or slough from underlying tissue. This sloughing can be relatively localized or in some instances, large sections of skin will separate from the body in sheets or folds.

Note: Tattoos may still be identifiable even after the surface layers of skin have sloughed.

Human skin can blister after death. Usually postmortem blisters are smaller than antemortem blisters and contain only air and a small amount of body fluids. A more complex mix of body fluids are contained within antemortem blisters. Additionally, due to antemortem inflammatory reaction, this type of blister will usually be surrounded by a reddish ring.

REMEMBER - DAMAGE CAUSED BY FIRE IS RARELY LOCALIZED AND SURROUNDING TISSUE WILL USUALLY EXHIBIT SOME DEGREE OF DISRUPTION.

- **Asphyxiation by Carbon Monoxide:** Asphyxiation by carbon monoxide (CO) is responsible for 60%-70% of all fire-related fatalities. Carbon monoxide, an odorless, colorless gas, is a product of incomplete combustion of carbon-based materials. It is directly related to the supply of oxygen available during the fire and is present to varying degrees in all structural fires. There is a measurable amount of CO in most of the air we breathe. It is present in relatively high levels in the atmosphere of big cities, due primarily to auto exhaust emissions. Smokers also inhale comparatively high concentrations of CO and it is not unusual for a smoker to have a CO blood saturation level in the 4% to 5% range.

Carbon monoxide has an affinity for red blood cells that is 210 times greater than oxygen. CO combines with blood hemoglobin and produces a complex called carboxyhemoglobin. As the victim inhales CO, oxygen is gradually displaced, resulting in CO asphyxiation. In determining if the victim was alive at the time of the fire, the pathologist will test for blood carboxyhemoglobin levels. A CO level of less than 10% is a good indicator that the victim was dead at the time of the fire. Inhalation of CO results in cherry-red postmortem lividity; therefore the presence of cherry-red lividity is also a sign that the victim was alive at the time of the fire.

0-10%	Slight loss of mental sharpness
10-20%	Slight headache, dilation of skin vessels
20-30%	Severe headache, throbbing
30-40%	Severe headache, weakness, dizziness, confusion, nausea, vomiting, collapse.
40-50%	Fainting, rapid heartbeat, collapse, death in some individuals
50-60%	Fainting, rapid heartbeat, possible coma, convulsions, respiratory irregularity
60-70%	Convulsions, depressed heart action, death
70-80% +	Weak pulse, respiratory failure, death

(Source: Besant-Matthews, P.E. "Investigation of Fire Related Deaths," Arson Investigation, California District Attorney's Association, Sacramento, CA., 1980, pp. vii-8.)

Relevant factors in reactions to carbon monoxide exposure include:

1. Rate of inhalation (most important)
2. Oxygen requirements--activity or lack thereof
3. Individual susceptibility

The synergistic or enhanced reaction between alcohol and/or drugs and carbon monoxide can increase an individual's rate of carbon monoxide absorption. Alcohol and drugs restrict oxygen to the brain and allow CO to replace oxygen in the blood more rapidly.

Case #1 - Long Exposure To A Relatively Low Concentration Of Carbon Monoxide

Small smoldering mattress fire produces marginally excessive amounts of CO which is inhaled by the victim. Blood saturation gradually increases over a relatively long period of time. When carboxyhemoglobin concentrations reach lethal levels, the victim dies. Blood saturation will show concentrations minimally compatible with death (40-60% CO saturation). Note: In the above scenario, actual flaming may never occur and the victim may sustain little, if any, burn injuries.

Case #2 - Short Exposure To High Concentration Of Carbon Monoxide

A large, fast-moving fire traps a victim in a rear room of a burning building. Initially a closed door provides some protection from heat and direct flame impingement. However, smoke quickly fills the room and CO levels rise rapidly. Victim inhales high concentration of CO and is rendered unconscious, but continues to inhale additional CO due to the time lag in absorption and death. Blood saturation will be relatively high (70-80% CO saturation). Note: If the fire extends to the victim, he/she may also sustain extensive thermal burns.

Other Types Of Fire-Related Asphyxiation:

A reflexive constriction of the pharynx or epiglottis, caused by the inhalation of superheated gases, can cause a cessation of breathing. Inhalation of these gases can also cause an edema of the tongue and/or the pharynx producing same symptoms as asphyxiation. (Note: Victim CO saturation will be low).

REMEMBER - DEATH BY OXYGEN DEPRIVATION IS NOT A RAPID PROCESS

Large amounts of the victim's blood at the fire scene is considered unusual and should alert investigators to the possibility that the fire may not have caused the victim's death. It is not uncommon for a fire to be intentionally set to cover up evidence of a homicide and/or other crime(s). If blood is observed, examine the victim's body closely for evidence of nonheat-related injuries. Keep in mind, however, that victims of a fire may sustain nonheat-related

injuries in a myriad of ways. Such persons may jump or fall from great heights be struck by falling structural members injured in an explosion cut or impaled by sharp objects or sustain crushing injuries in a collapse. These and other similar injuries sustained during fire are to be classified as *fire related*. Fire-related injuries can account for substantial amounts of blood at the fire scene. A systematic examination and reconstruction of the fire scene will, in most cases, reveal how the victim sustained specific nonheat-related injuries. This information, combined with other investigatory findings, will be of great assistance to the forensic pathologist in determining the cause and manner of death during the medicolegal autopsy.

The forensic pathologist must be provided with all available information of relevance to the death of the fire victim. This information should include, but is not limited to, the following:

1. Any determination if the fire is accidental or incendiary.
2. A description of the fire conditions with an emphasis on the specific environment the victim was found, e.g. smoke and heat levels, structural failures, explosions, description of objects that burned.
3. Presence of flammable or combustible liquids. (The pathologist will then order specific toxicologic analyses of the victim's lung tissue and blood.)
4. A listing of any protective gear worn by the victim. This is especially important in fire investigations that involve the deaths of firefighters, refinery personnel, chemical plant workers, etc.
5. Did victim collapse immediately, fall any distance, exhibit signs of incoherence/disorientation or loss of motor function? Did victim become trapped or entangled by debris? Was victim caught in a blast, struck by falling objects, injured by sharp objects or shrapnel?
6. Did other person(s) in close proximity to victim manage to escape? Why/how?
7. Why did victim fail to escape?

Thermal burns to the body of a fatal fire victim are frequently so severe that nonheat-related injuries are difficult to discern. Even the most experienced fire investigator may not be able to visually identify these injuries during an on-scene examination of the body. It is therefore necessary that the pathologist x-ray the body of the fire victim prior to autopsy. He or she may then be able to locate and identify foreign objects in the body, such as spent bullets, shotgun pellets, shrapnel, or knife blades. It is good practice to x-ray not only the body but associated debris also, as foreign objects will sometimes pass through the victim (antemortem) or fall from the body as it desiccates when subjected to heat produced by the fire (postmortem).

Due to the degree of burn sustained by many fatal fire victims, the fire investigative team may not be able to establish the sex, race, approximate age or height or identity of the victim by an examination of the victim's body at the fire location. When all other field

investigative means have been exhausted, it may be left up to the pathologist to attempt to complete the identification process during the medicolegal autopsy.

In many cases of death by fire, the odontologist may be called upon to assist in the identification of the fire victim. Teeth and dental work are rarely destroyed by fire. The swelling of the victim's tongue may serve to protect not only the teeth but the inner mouth as well. The odontologist will x-ray the victim's teeth, remove the upper and lower jaws and prepare a dental chart. If a presumed identity of the victim is established, antemortem dental records can be obtained and a comparison made. Even if a presumed identity has not been established, the odontologist may be able to identify the "style of dentistry" (materials used) and thereby the socioeconomic status of the victim.

The effects of fire on the human body can greatly complicate the work of those involved in fatal fire investigations. Lividity, rigor mortis, body temperature are often compromised by fire, making time of death difficult to estimate. Thermal burns can mask wounds or cause wound configurations to change. As we have seen, certain artifacts of fire can be misinterpreted as blunt force injuries, incised wounds, a defensive posture, etc. Fire can increase the degree of difficulty during the postmortem analyses of the victim's blood and body fluids. In extreme cases, only the deceased's teeth and/or dental work, together with small sections of the pelvis and skull may remain. The crime scene itself can be severely contaminated and physically changed. Yet those charged with the investigation of fatal fires, working as a team, with clearly defined areas of responsibility to maximize interagency coordination and individual expertise, can bring most fire investigations to a successful conclusion. Remember, even fires that result in ruin and ash will provide some evidence for the fire investigator and/or the fire investigative team, to build upon and **the fatal fire will usually provide more evidence than any other type of fire.**

APPENDIX A

HEAT RELATED ILLNESSES

HEAT CRAMPS

Due to water and salt depletion. Characterized by progressive lassitude, vomiting, tachycardia and hypotension. Body temperature may be normal or slightly elevated.

HEAT STROKE

A life-threatening emergency usually characterized by:

1. Severe CNS Disturbances
2. Hyperthermia (41-43°C)
3. Hot, dry skin

Predisposing Factors

1. Common to exercise- and nonexercise-induced heat stroke:
 - a. High temperature and humidity
 - b. Drugs that increase heat production
 - c. Drugs that decrease thirst and sweating
2. Nonexercise-induced heat stroke:
 - a. Chronic illness
 - b. Abnormal sweat gland function
 - c. Abnormal hypothalamic function, imbalance or body temperature
3. Exercise-induced heat stroke:
 - a. Inadequate Acclimation
 - b. Obesity
 - c. Potassium depletion

APPENDIX B

FATAL FIRE CHECKLIST

1. Name, age and sex of victim.
2. Exact point of origin.
3. Sketch of fire scene.
4. Photographs of fire scene.
5. Last person at the point of origin. Purpose and movements up to the time of the fire.
6. Who discovered the fire? Who transmitted the alarm and how?
7. By what means was discovery made? Their actions after discovery.
8. Who was the last to see the victim alive? Circumstances of contact and condition of deceased.
9. Where was body found and by whom?
10. What was the physical position of the body (face up/down)?
11. Why did the deceased fail to escape?
12. Were there any violations in the building (illegal occupancy, sprinklers, means of egress, smoke alarms, etc.)?
13. How did the deceased appear to have died (fire, smoke or other)?
14. Any unusual conditions noted by firefighters upon arrival? What were the conditions of all doors and windows? Locks?
15. Habits of the deceased.
16. Physical condition of the deceased (physical handicaps that would have impaired escape. Intoxication of any type?
17. Mental or emotional state of victim prior to fire.
18. Source of income of the deceased.
19. Possible sources of friction between the deceased and any other person(s). (This information can be obtained through interviews with relatives, co-workers, friends and neighbors of the deceased).
20. Amount of life insurance. Has amount remained constant? Beneficiary?
21. Amount of fire insurance held by both the building owner and the deceased. Has this amount remained constant? Beneficiary?

(Source: BUREAU of FIRE INVESTIGATION REFERENCE MANUAL, NYC Fire Department, March 1991.)

APPENDIX C

Cremation of the Human Body: Requires the body to be exposed to a well-ventilated constant fire for one to two hours, at 1800°F to 2200°F. Even under these conditions, parts of the skull, pelvis, teeth and dental work will remain. A typical structural fire will seldom result in a fire that exceeds 1900/2000°F for an extended period of time. Fires involving high temperature accelerants (combustible metal fuel/solid oxidizer mix, e.g. solid rocket fuels, thermite mixtures, etc.) can result in temperatures between 2500° to 5500°F. Depending on the length of exposure, temperatures in this range can reduce the human body to a few pounds of calcium and silicon salts.

Hair Discoloration: White hair will turn yellow at 290°F, but other colors will remain unchanged. Human hair will char at 500°F.

Blood: Blood can still be typed if the temperature of the stain does not exceed 120°F. At temperatures above 400°F blood will deteriorate rapidly and will probably not be recognizable as blood.

Fingerprints: Don't give up on fingerprints. Although many fingerprints will be destroyed by fire, in some cases fingerprints have been fixed in place by heat, and soot from a fire may actually protect some fingerprints. Even the partial print of a burn victim can be of value as can sole or palm prints.

Spontaneous Human Combustion: There is no scientific evidence that the human body suddenly bursts into flame. When this phenomenon is alleged, the typical victim is elderly, partially incapacitated and in many cases, obese. Commonly the torso is cremated, with the head and feet remaining. An examination of these cases has shown that ignition is the result of an accident, such as careless smoking. The victim is overcome by smoke, and the fire progresses as a slow, smoldering fire consuming the victim's clothing and other fuel such as bedding and upholstery. The victim's body fat begins to render, and if the body is positioned right, the rendered fat fuels the fire. The body is slowly consumed. This type of fire is affected by the insulative qualities of the materials burned (clothing, furnishings, etc.), producing a smoking flame, with a low heat output. The localized temperatures are high enough to destroy tissue and bone but insufficient heat is generated to ignite nearby combustibles. The manner in which the body burns has been referred to as the *Candle or Wick effect*.

Backdraft: Fire occurs in an area that is relatively airtight. The fire soon becomes oxygen depleted. Due to incomplete combustion, carbon monoxide and other toxic gases are produced. When an oxygen source is introduced, such as by opening a door, the collected gases ignite, producing a powerful, low-order explosion. Backdrafts are relatively rare, and conditions necessary for creating a backdraft are extremely difficult to intentionally reproduce.

Flashover: Heat from a fire is confined by walls and ceiling of a room or compartment. A layer of superheated gases is formed at ceiling level. As the fire grows, the temperature of

the hot smoke and gases increases. Radiant heat raises the surface temperatures of combustible materials below. When temperatures reach approximately 1100°F, all combustible contents ignite simultaneously. Once flashover has occurred, survival, even for firefighters wearing protective fire gear, is limited to no more than a few seconds. Flashover is therefore of great concern to firefighting personnel and is also a much more common phenomenon than a backdraft. Flashover is usually preceded by a *rollover*.

Rollover: Superheated gases at the ceiling level ignite and propagate across the ceiling surface. This condition poses an extreme danger to firefighting personnel, as rollover results in a rapid rise in temperatures directly below, and the flame front can extend behind advancing firefighters.

Flame Front: Leading edge of flaming combustion. A flame front in a rolling cloud of fuel and air can reach speeds of 15 feet per second.

APPENDIX D

Source of Ignition: Heat producing device, substance or circumstance that could have caused ignition.

Point of Origin: The exact physical location where a source of ignition and a fuel come together and a fire results.

Fire Cause: The circumstances under which a fuel, air or oxygen and an ignition source come together.

Plant: Used by arsonist to increase or boost the fire, e.g. kerosene-soaked clothing, cans of gasoline, etc..

Trailer: Used by arsonist to carry the fire from one area to another, e.g. accelerant poured between plants, or gasoline-soaked rags tied end to end.

Accelerant: Any substance used to initiate or accelerate the spread of fire (usually a flammable liquid).

Fire Physical Breakdown:

(Point of Origin) Investigation discloses that the fire originated on the first floor of the subject premise, in the Bravest Uniform Supply Store, at the juncture of the west and south walls of said occupancy, on the floor, **(Fire Cause & Source Of Ignition)** in the vapors of a flammable liquid (gasoline) introduced thereto, in heat from an open flame (road flare). Fire extended north, approximately 20 feet, from the indicated point of origin via **(Trailer)** gasoline-soaked cotton rope, to a **(Plant)** plastic balloon suspended from the first floor ceiling via nylon string and containing approximately 1 liter of a flammable liquid (kerosene), igniting the vapors of said flammable liquid. Fire extended therefrom to all areas of subject premise first floor and the entire contents thereof. Fire was confined thereto and extinguished.

APPENDIX E

Michigan v Tyler, 436 U.S. 499, 94 S.Ct. 1942, 56 L.Ed.2d 486 (1978)

Michigan v Clifford, 464 U.S. 287, 104 S.Ct. 641 (1984)

PSNY v Calhoun, 90 Misc.2d. 88, 393 N.Y.S.2d 529 (Sup. Ct. Kings Co. 1977)

APPENDIX F

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SUBSTANCE ABUSE DEATHS

Substance Abuse Deaths

by Arthur E. Westveer, Behavioral Science Unit, FBI

- I. Toxicology and drug deaths
 - A. Toxicology: the study of poisons, their actions, and their analysis
 - B. Interpretation: must be in perspective of all available data

- II. Manner of death
 - A. Accident
 - B. Homicide
 - C. Natural
 - D. Suicide
 - E. Undetermined
 - F. Unclassified

- III. Autopsy of substance abuse deaths
 - A. Complete autopsy examination
 - B. Proper sample specimens required
 - 1. Blood
 - 2. Urine
 - 3. Liver
 - 4. Bile
 - 5. Stomach contents
 - C. Accurate interpretation of results

- IV. Drug death scene investigation
 - A. Medical history
 - B. Position
 - C. Last seen alive
 - D. Medications
 - E. Pill containers
 - F. Notes, prior threat messages, etc.

V. Types of abused drugs

A. Narcotics

1. Narcotic deaths

- a. Acute or sudden: respiratory depression, anaphylactic reaction
- b. Delayed

2. Types of narcotics

- a. Morphine
- b. Heroin: street form is diacetylmorphine (heroin) + lactose + quinine
- c. Demerol
- d. Codeine
- e. Dilaudid
- f. Darvon
- g. Talwin

3. Delayed medical complications of narcotic abuse

- a. AIDS
- b. Hepatitis
- c. Tetanus
- d. Heart infection
- e. Malaria
- f. Syphilis
- g. Gangrene

B. Depressants

1. Types of depressants

C. Barbiturates

- (1) Fast-acting: Secobarbital (reds)
- (2) Intermediate: Amytal
- (3) Combination: Secobarbital + Amytal
- (4) Phenobarbital

- a. Ethyl alcohol
- b. Tranquilizers: Librium, Valium
- c. Other sedatives: Quaalude, Placidyl

1. Death from depressants

- a. Respiratory depression

- b. Synergistic drugs
- c. Deaths during withdrawal effects

2. Sedative withdrawal

- a. 12-16 hours: improvement, alertness
- b. 16-24 hours: shakes, tremors, insomnia
- c. 24-72 hours: delirium, convulsions

D. Stimulants

1. Types of stimulants

- a. Amphetamines
- b. Cocaine
- c. Caffeine
- d. Strychnine

2. Effects of stimulant overdose

- a. Mania and aggression
- b. High fever, convulsions
- c. Unconsciousness, death

E. Hallucinogens

1. Types of hallucinogens

- a. Lysergic Acid Diethylamide (LSD)
- b. Phencyclidine (PCP)
- c. Tetrahydrocannabinol (THC)(Marijuana)
- d. Mescaline
- e. Glue and solvents (sniffing)
- f. Over-the-counter drugs

2. Dangers of hallucinogens

- a. panic
- b. paranoia
- c. flashbacks
- d. accidental deaths
- e. respiratory damage from aerosol/solvent sniffing

F. Anti-depressants

1. Types of anti-depressants

a. Tricyclics

(1) Indications of tricyclic use

- (a) psychiatric history
- (b) pill container
- (c) prior attempts (suicide)
- (d) depression

(2) Effects of tricyclic intoxication

- (a) coma
- (b) pyrexia (fever)
- (c) seizures
- (d) arrhythmias (irregular heartbeat)
- (e) respiratory depression

b. Amitriptyline

c. Imipramine

d. Doxepin

e. Loxapine

f. Elavil

g. Tofranil

h. Sinequan

i. Loxitane

j. Phencyclidine (PCP)

(1) Methods of PCP abuse

- (a) smoking
- (b) snorting
- (c) ingestion
- (d) intravenous
- (e) cutaneous

(2) PCP death

- (a) intoxication
- (b) behavioral
 - i) accidents
 - ii) homicides
 - iii) suicides

2. Effects of anti-depressants

- a. body image changes
- b. disorganization of thought
- c. estrangement
- d. hostility
- e. apathy
- f. negativism

3. Duration of effect

- a. early: 2-5 minutes
- b. plateau: 15-30 minutes
- c. loaded: 4-6 hours
- d. normal: 24-48 hours

G. Diluents

1. Types of diluents

- a. Procaine
- b. Mannitol
- c. Talcum

NOTES

INVESTIGATION OF DRUG-RELATED HOMICIDES¹

By Lt. Cmdr. (Ret.) Vernon J. Geberth

This article should provide law enforcement officers with an effective and practical strategy for the investigation of drug-related homicides. Drug related homicides are defined as those murders that occur as a direct result of the use, sale, and distribution of narcotics and other illegal drugs.

The classification of drug-related homicides can be divided into four specific categories: drug hits, which represent the largest percentage of drug-related homicide and take into account the killing of undercover police officers involved in narcotics enforcement; interpersonal violence drug disputes; the murder of innocent bystanders; and drug assassinations. Although each of these categories involves violence and criminal enterprise, the cause, reason, and intentions for the murderer present authorities with additional investigative options and considerations. These categories are listed numerically based on their frequency of occurrence.

1. Drug Hits

Premeditated murders intended to eliminate competition or enforce control over the members of a cartel or drug group are drug hits. Or the victim may have been murdered because he provided information to police authorities or was a potential witness in a drug prosecution and considered to be a risk to the drug group. Murders that occur during "drug rip-offs" are also considered drug hits.

2. Interpersonal Drug Disputes

Homicides that occur spontaneously, usually without any premeditation, are often the result of interpersonal drug disputes. Such murders take place during drug-related disputes and interpersonal violence scenarios among and between those who under the influence of drugs and/or are involved in illicit drug activity.

3. Murder of Innocent Bystanders

Drug-related homicides also include the murder of innocent civilians and bystanders, including those caught in a shooting cross-fire or hit by random shots fired between rival gangs or participants during drug-related disputes. The number of civilian casualties, especially within the inner cities, has dramatically increased with the proliferation of drugs and the high-powered weaponry utilized by drug dealers.

Adapted from: Geberth, V. J. (1990, Nov). Investigation of drug-related homicides Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques. Third Edition, 1996. Used with permission of the author.

4. Drug Assassinations

Premeditated murders directed towards government officials, law enforcement personnel, and civilians are considered drug assassinations. Such attacks are actually a form of terrorism and are intended to discourage active drug enforcement policies and/or create the impression that the drug groups or cartels are as powerful as authorities.

Drug assassinations rarely occur in the United States. However, United States authorities and government officials operating or traveling within countries that operate as home bases for the major drug cartels are certainly potential targets of an assassination as this country continues to put pressure on drug-producing countries.

On February 26, 1988, New York City Police Officer Edward Bryne was assassinated by members of a drug cartel while guarding the home of a drug witness. The subsequent homicide investigation revealed that the officer was killed on the orders of a jailed drug lord because he wanted revenge on the police. The drug dealer had been prosecuted and incarcerated on an unrelated narcotics case.

The Investigative Dilemma

Drug-related homicides are difficult to solve because of the nature of the incident. In most instances, the murder is a premeditated act and the actual motive for the killing is not readily apparent except that criminal enterprise or drugs may be involved.

The exception to the above scenario is sudden and violent confrontations between persons involved with drugs and/or the murder of innocent civilians. Therefore, the police investigation actually becomes a two-pronged inquiry. The police must first investigate the homicide case and then concentrate their investigative efforts on the narcotics aspects of the case. Actually, these types of cases create at least twice the workload of a routine murder investigation and may be further complicated by interjurisdictional considerations.

In addition, drug-related homicide incidents within the United States have significantly increased, which further depletes already strained law enforcement resources. In some jurisdictions, drug-related murders account for 40% to 50% of the homicide investigations.

Jurisdictions that police large urban areas traditionally encounter high levels of violence and drug-related criminal activity. The clearance rate for murder within these jurisdictions has been appalling due to the overwhelming work loads, lack of personnel and the absence of an effective strategy for dealing with drug-related murder investigations.

Investigative Reality

Most drug-related homicides are eventually solved through intelligence and/or informant information. Witnesses in homicide investigations are generally reluctant to get involved. This reluctance oftentimes turns into active resistance during a drug-related murder investigation. The only exception is in the murder of police officers and innocent civilians.

Therefore, police must concentrate their efforts on obtaining information by gathering criminal intelligence. Intelligence information is usually developed through an independent police narcotics operation, which may evolve within the department or through outside agencies such as DEA, ATF, US Customs or the FBI.

Such intelligence may be in the form of court-approved wiretap or electronic eavesdropping warrants employed during a narcotics investigation, the execution of search warrants, or through routine debriefings of information and/or subjects arrested for drug violations.

Informant information is the most valuable source of inside knowledge about any criminal enterprise. It may be motivated by a number of factors including financial reward, fear, revenge, or court consideration in pending criminal action.

The ability of authorities to develop and maintain current intelligence sources and reliable informants is a prerequisite to the successful investigation and/or resolution of a drug-related murder.

Three-Phase Strategy

Practically speaking, authorities should implement an enforcement strategy that addresses three distinct phases of the drug-related murder investigation.

PHASE I - The application of procedural and forensic techniques and investigative resources to the homicide crime scene and murder investigation.

PHASE 2 - The evaluation of intelligence resources with the objective of cultivating reliable sources whose information can be effectively corroborated with the information developed at the homicide crime scene.

PHASE 3 - The implementation of the crime clearance procedures that enable authorities to successfully clear a case without an arrest utilizing exceptional means.

The rationale of a Three-Phase strategy is based upon the premise that most drug-related homicides are the result of ongoing criminal enterprise. The solvability of each case depends on the factual information developed at the time of the event coupled with current information intelligence.

Phase One-The Homicide Crime Scene

Properly processing a homicide crime scene is without a doubt the most important phase of any murder investigation. However, in drug-related homicide investigations, the crime scene process takes on an additional significance. In this phase of the investigation, it is imperative to effectively document every aspect of the event with the objective of establishing a basis for future corroboration.

The investigators must first attempt to establish the facts of the case based upon the dynamics of the event as well as the circumstances under which the person was killed. The investigation usually starts at the point where the body is found. This is the primary crime scene.

This presents two possibilities: Was the deceased killed at the location of discovery? Or was the body dumped at the location?

This is an important consideration because the answer will focus the investigation and determine the scope of the crime scene process. If the homicide is a "dump job," there may be two or more crime scenes; i.e. the location where the actual assault and murder took place and a possible vehicle used to transport the body. Obviously, investigators will not have access to these areas during the initial inquiry. However, as the investigation unfolds, additional scenes may be discovered. These scenes and areas should be processed as soon as possible in order to obtain additional evidence and information.

If the person is killed at the location of discovery, the crime scene process may result in the retrieval of new evidence as well as additional sources of information. Personal papers and effects, telephone records, correspondence, address books, etc., and any property that may aid in the investigation should be seized by detectives for later perusal and disposition. Such information might assist in conducting interviews with family members and friends and may well reveal a possible motive.

Identification and victimology of the deceased becomes an extremely important starting point for the investigation. If the murder took place at the point of discovery, the identification of the victim is usually established early on either due to witness identification or personal papers and information at the crime scene. If the homicide was a "dump-job," then identification may be delayed pending fingerprint analysis or subsequent notification through missing persons reports.

During Phase I of the investigation, authorities should also attempt to ascertain the motive and specific category of the murder: drug-hit, interpersonal drug dispute, murder of innocent bystander, or drug assassination. Each category will suggest an investigative option.

Category	Investigative Options
Drug Hit	Intelligence Information Narcotics Buy Operation Buy and Bust Operation Informant Information
Interpersonal Drug Disputes	Buy and Bust Operation Informant Information Narcotics Buy Operation

Category	Investigative Options
Murder Of Innocent Bystanders	Reward Money Crime Stoppers Program Use of News Media and Press Community Activities Buy and Bust Operation Informant Information
Drug Assassinations	Intelligence Operations Electronic Eavesdropping Narcotics Buy Operations Reward Money--Crime Stoppers Use of News Media and Press

In either event, processing the crime scene should focus on body position, wound structures, ballistics, blood, clothing, trace evidence, and informational resources that represent the tangibles and collectibles in drug-related homicides.

Any subsequent prosecution under state or federal conspiracy laws and/or implementation of exceptional clearance procedures will require the independent corroborative information developed during the Phase I operations.

Phase II-The Application of Drug Intelligence

In this phase of a murder investigation, authorities should direct their resources towards developing intelligence information as it relates to the murder. The objective is to establish the identity of the members and structure of the drug cartel or operation so as to focus on motivations and possible suspects involved.

Drug operations and "key players" within criminal organizations may change. Arrests, prosecutions, murders, and any number of factors may impact on specific individuals or groups; however, the illegal activity remains the same.

Criminal enterprise maintains its continuity through adjusting operations and recruiting the members to engage in criminal conduct on an ongoing basis. This generates a tremendous amount of strategic and tactical intelligence information. This intelligence information, which is utilized by narcotics officers to identify, target, and penetrate drug operations and arrest offenders, can also be utilized by homicide investigators.

Each drug-related homicide should be analyzed and assessed in conjunction with available drug intelligence information for the purposes of identifying and targeting specific offenders involved in the homicide investigation. In fact, in jurisdictions that experience a high percentage of drug-related murders, it is recommended that a homicide division maintain within the command an intelligence operation team consisting of a sufficient number of personnel to effectively engage in reactive and proactive operations.

The mission of this team is to develop pertinent information on the homicide through analysis and assessment. This can be accomplished through debriefings of confidential informants and the exchange of intelligence information with other law enforcement agencies. It requires establishing intelligence liaison with narcotics enforcement units as well as outside agencies involved in the investigation of narcotics violations with the objective of establishing an effective intelligence network.

Many arrested offenders are willing to make deals. They elect to cooperate with authorities to avoid extended jail time. Their willingness to cooperate presents homicide detectives with an effective strategy for developing criminal informants for drug-related homicide investigations.

- Specific offenders who have been identified as witnesses in the drug slaying can be targeted with a "narcotics buy operation" in order to force their cooperation in the case. Or,
- A particular neighborhood can be targeted with a "buy and bust" operation with the objective of snaring potential witnesses to the drug slaying.

In some instances, authorities at a homicide crime scene may be provided with "bonus information" in the form of elaborate records of drug deals. I have been involved in a number of drug-related homicide investigations in which the records and ledgers seized contained code names of dealers and customers, dates and quantities of drugs sold, and financial transactions of specific drug operations. Such information can be provided to narcotics officers to assist in their operations as well as used to target potential witnesses in the drug-related homicide investigation.

The intelligence aspects of a drug-related homicide investigation require mutual cooperation between law enforcement units and agencies involved in narcotics investigations.

Phase III-Crime Clearance Procedures

Homicides are usually considered solved or closed when an offender has been arrested and charged with the murder. However, homicides can also be effectively cleared utilizing Exceptional Clearance.

Exceptional Clearance procedures enable authorities to successfully clear a case without an actual arrest. This method of crime clearance requires an agency to document the following:

- The identity of the offender is known
- The exact location of the offender is known
- There is sufficient information to support and arrest and prosecution

- There is some reason beyond police control that prevents the offender from being arrested

The specific explanation of "beyond police control" must be documented within the report closing the case by Exceptional Means. An example of "beyond police control" in a homicide case would be the verified death of the perpetrator either through an unrelated homicide or by official state execution.

Ironically, drug-related homicides, which are difficult cases to solve, are particularly amenable to Exceptional Means clearance due to the continuity and violent nature of drug criminal enterprise. However, in order to effectively utilize this method of crime clearance, the agency must invest the necessary time and resources into Phase I and Phase II of the drug-related homicide investigation.

The process of classifying each drug-related homicide into one of four categories and then applying the Three-Phase Enforcement Strategy to the investigation enables detectives to establish priorities and maximize their investigative efforts.

Upon the completion of Phase I operations, a homicide investigation can either be inactivated or pursued depending on whether further information can be developed in Phase II operations. This strategy allows investigators to concentrate their efforts on the cases that are most amenable to clearance. However, in order for this strategy to be effective, police agencies must implement a persistent and aggressive law enforcement policy as it relates to narcotics violations.

The strategic and tactical intelligence generated through this continuous narcotics enforcement will provide the informational basis for the successful investigation of drug-related homicides.

AUTOEROTIC FATALITIES



- AUTOEROTIC DEATHS
- ACCIDENT/SUICIDE



Autoerotic Practice

- A solo sexual activity which combines ritual and
- endangerment with erotic gratification through
- fantasy.



"Sex without a partner"

- -Not new-
- 1000 A.D. Mayan Culture
- 1791 Francis Kotzwarra



1791

- First documented case
- of autoerotic death



Terminology for Autoerotic Practice / Varied:

□□□□□□□□ Death has

- Suicide without motivation
- Sex hanging
- Plastic bag asphyxia
- Sexual asphyxia
- Autoerotic death
- Terminal sex
- Kotzwarraism



Autoerotic Activities

- Masturbation
- Voyeurism
- Pornography
- Fantasy
- Cross dressing
- Props



Important Factors to Consider

- Injurious agent
 -
- Escape mechanism
 -
- Victim judgement



Estimates of Cases/Year Vary

- Rosenblum and Faber = @ 250/year



Difficult to Gather Statistics Regarding

□□

Autoerotic Fatalities

- Lack of established criteria to identify and label this type of death
- Problems in categorising the manner of death
- Lack of access to large numbers of these cases in order to study well



Methodological Problems Exist in Researching this Type of Death

- Definitions
- Insufficient number of cases
- Samples unsystematically collected
- Taboo
- Secrecy

📁 FBI (1981) Study of Autoerotic Deaths

- Age range: 9 to 77
- Majority: teens/20's
- @ 45% married
- Most middle class

▣ 63 white males

- 3 black males
- 3 white females
- 1 black female

📁 Asphyxia

- A decrease in the availability of oxygen
- to the tissues of the body, particularly the
- brain (cerebral hypoxia).

📁 Cause of Death

- Neck compression 118
 - Hanging 105
 - Strangulation 13
 -
- Obstruction of airway 2
 - Smothering
 - Choking
 -
- Chest Compression 2
 -
- Exclusion of oxygen 10
 - Plastic bag 5
 - Gas inhalation 5

📁 Cause of Death

- Electrocution 6
-
- Natural 4
-
- Miscellaneous 8

📁 Autoerotic Practices Combine:

📁 Complex Behaviors Include:

- An apparatus which alters the physiological
- state and because of its potential lethality,
- a self-rescue mechanism relying on
- practitioner's judgement.

•

☞ Death During Autoerotic Practice May □□□□□□ Result From:

- Failure with physiological mechanism
- Failure in self-rescue device
- Failure on part of victim's judgement and ability to control a self-endangering fantasy scenario

☞ Five Criteria for Determining Death During Autoerotic Practice

- Evidence of physiological mechanism for obtaining or enhancing sexual arousal and dependent on either a self-rescue mechanism or the victim's judgement to discontinue its use.

☞ Apparatus Altering Physiological Status:

- Used to heighten erotic sensation and/or alter
- stream of consciousness in order to expand the
- sexual fantasy.

☞ Example of Apparatus Altering Physiological Status:

- Neck pressure on carotid arteries or vagus nerve
 - -interferes with blood flow to head creating
 - hypoxia

☞ Identification of Self-rescue Mechanism on the Scene

- Difficulty includes fact that it may simply
- involve standing erect

☞ Mechanism of Death

- Carotid Artery
- Carries oxygenated blood to the brain
- Requires 6.6 lbs. of pressure to restrict the flow
- Jugular Vein
- Requires 4.4 lbs. of pressure to restrict the flow

☞ Five Criteria for Determining Death During Autoerotic Practice

- Evidence of solo-sexual activity
 - Secrecy is important
 - Many move away from residence
 - woods, hotel, locks on doors
- Evidence of sexual fantasy aids
 - FANTASY plays a key role in autoerotic Practice

☞ Three Indicators of Ritualistic Fantasy

- Attire of victim
 - Non-normative attire
 - Women's attire
 - Uniform
 - Costume
 - No attire

☞ Attire can be seen as SYMBOLIC or REPRESENTATIVE of their fantasy

Example:

- Enhanced image: AVIATOR
- Change image: WOMAN (MAN)

☐ Three Indicators of Ritualist Fantasy (cont.)

- Props
 - Help the fantasy
 - Erotic literature
 - Pornography, pictures, films
 - Mirrors
 - Reflections of self
- Bondage
 - Physically or mentally restrained or humiliated

☐ Five Criteria for Determining Death During Autoerotic Practice

- Evidence of solo-sexual activity
 - Secrecy is important
 - Many move away from residence
 - woods, hotel, locks on doors
- Evidence of sexual fantasy aids
 - FANTASY plays a key role in autoerotic Practice
- Evidence of prior dangerous autoerotic Practice

☐ Evidence of Prior Autoerotic Practice

- Neck compression (hanging)
 - Check for abrasions from previous episodes
- Complexity of physiological apparatus
 - More complex suggests prior Practice
- Confirmed victim Practice of autosadistic activities
 - Wife, girlfriend
- Additional fantasy aids located elsewhere
 - car, home, closet

☐ Five Criteria for Determining Death During Autoerotic Practice

- Evidence of solo-sexual activity
 - Secrecy is important
 - Many move away from residence
 - woods, hotel, locks on doors
- Evidence of sexual fantasy aids
 - FANTASY plays a key role in autoerotic Practice
- Evidence of prior dangerous autoerotic Practice
- No apparent suicidal intent

☐ No Apparent Suicidal Intent of Victim

- Everyone is very surprised
- Psychological autopsy suggests no suicidal intention

☐ Medicolegal Problems

- Lack of knowledge
- Misdiagnosed as a suicide, homicide
- Altered death scene
- False or misleading information

☐ IMPORTANT

- The investigator must be able to recognise and discuss professionally with:
 - Public
 - Family
 - Insurance company
 - Others

📁 Questions Most Frequently Asked in Autoerotic Deaths:

- Was there anything I/we could have done?
- Was it my/our fault?
- Was he/she mentally ill?

📁 Who are the Victims?

- White male 139
 - Black male 4
 - White female 4
 - Black female 3
- Age
 - 26.5 average
 - 77 yrs. oldest
 - 9 yrs. youngest
- All but one middle class
- No known history of sexual or mental disorder
- 11 homosexuals (documented)

📁 Who are the Victims?

- All were in good spirits
- All were above average intelligence

📁 How Do They Learn?

- Word of mouth
- Literature
- Experiments
- Accident

📁 American Psychiatric Association DSM-IV

- Sexual Masochism:

📁 American Psychiatric Association DSM-IV

- Hypoxyphilia:

📁 Parahilia:

- Sexual variant in which unusual objects,
- rituals or situations are required for full
- sexual satisfaction to occur.

📁 The Imagery or Acts Tend to be INSISTENTLY and INVOLUNTARILY Repetitive and Involve Either:

- Preference for nonhuman object for sexual arousal.
- Repetitive sexual activity with humans involving real or simulated suffering or humiliation
- Repetitive sexual activity with nonconsenting partners

📁 4 Point Continuum

- Slight sexual arousal toward some particular object/activity
- Stronger arousal toward object/activity but able to perform sexually with member of opposite sex
- No sexual activity or orgasm can occur without the object/activity
- Object/activity is substituted for his/her living sexual partner

☐ Associated Features with Paraphilias

- Impairment in capacity for reciprocal affectionate sexual activity
- Psychosexual dysfunctions are common
- Personality disturbances, especially emotional immaturity, are present

Overview of Autoerotic Activity

Kenneth V. Lanning

Why Autoerotic?

Autoeroticism may be defined as sexual feelings or sexual gratification that is self-induced without having sexual relations with another. It might be asked why someone would choose to have sex without a partner. There are, of course, many possible reasons, some more obvious than others.

One of the more obvious reasons is simply that no sex partner is available when the sexual gratification is needed or wanted. This unavailability may be due to some special circumstances such as separation from a spouse or confinement in an institution. It may also be due to time constraints or limitations that prevent seeking out or meeting with a sex partner.

Another reason for choosing to have sex without a partner might be there is no preference for or desire to have sex with another. This lack of preference for a partner may be due to a variety of personal inadequacies or insecurities. It may also stem from a need to be in total control during sexual activity. This need for control may result in the autoerotic practitioner assuming the dual role of both participants in some sexual fantasy. In other situations, another person may be present during the sex act, but because of these personal inadequacies or needs for total control, this person is used more like a prop than a true sex partner.

In other situations, autoerotic activity may be chosen because of shame or embarrassment over the nature of sexual desires or fantasies. A spouse or lover may be embarrassed to admit that he or she is interested in bondage or sadomasochistic sex acts. Rather than communicate these desires to a partner and risk rejection, alienation, or ridicule, the person may incorporate these interests into autoerotic activity. In the previously mentioned dual role situation, the autoerotic practitioner could assume the role of both the giver and receiver of the pain and suffering associated with such activity.

Another possible reason may stem from moral or religious beliefs. Sex with a partner other than a spouse may be viewed as sinful. Therefore, when that spouse is unavailable for or is uninterested in interpersonal sexual activity, autoerotic activity may be viewed as a more acceptable alternative than adultery. Sexual desires repressed as immoral or sinful may be expressed in rationalized autoerotic activity.

Possibly the most common reason for selecting autoerotic activity, particularly for adolescents, is experimentation. The young teenager attempting to learn about developing sexual desires and body functioning is a likely candidate to explore autoerotic activity.

In the adolescent it is perhaps easier to see the combinations and complexities of motivation that drive any of us to engage in any form of sexual behavior. The adolescent may be experimenting in autoerotic activity because no sex partner is available. This lack of a sex partner may be due in part to personal inadequacies, insecurities, shame, embarrassment, or moral beliefs. Therefore it is possible that anyone's motivations for autoerotic sex may include part of one, one, more than one, or all of the above-mentioned reasons as well as any number of additional individual variations of them.

Variations of Autoerotic Activity

After the choice to engage in autoerotic activity is made, a wide variety of activity is possible, some considered normal, some abnormal.

Probably the most widely practiced and best known form of autoerotic activity is simple masturbation. In its broadest definition, masturbation may be considered synonymous with autoerotic activity. However, a more narrow definition describes masturbation as obtaining sexual satisfaction from manual or mechanical stimulation of the genitals. No effort will be made to discuss whether masturbation is normal or abnormal. Suffice it to say, it is believed to be practiced to some degree by the vast majority of men and women, although some still consider it to be an offense against nature or the law of God. Other common forms of autoerotic activity include viewing pornography or erotic literature and sexual daydreaming or fantasy.

Other types of activity may or may not be considered to be autoerotic depending on definition of terms and opinions concerning the nature of the acts. An individual using an inflatable doll or mannequin (pygmalionism) as a sex partner is in essence an autoerotic practitioner. A solitary voyeur prowling the back alleys at night for sexual stimulation is engaged in essentially autoerotic activity. Even the exhibitionist who uses his victims more like props than partners might be considered an autoerotic practitioner. Depending on how you define "sexual relation with another," the individual engaged in sexual relations with an animal (bestiality) or with a dead body (necrophilia) might also be considered an autoerotic practitioner. It is obvious that deeper and more complex motivations, other than merely the previously mentioned motivations for autoerotic activity, are involved in these more "unusual" forms of autoerotic sexual behavior.

Law enforcement interest in the above autoerotic activities is generally dependent on whether the acts involved are violations of the law. However, other autoerotic activities become of interest to law enforcement merely because of their nature. These activities are referred to as dangerous when there is the possibility of serious bodily injury or death.

Why would someone choose to engage in an autoerotic act that is dangerous? Again there are many possible reasons. One such reason might be the need for risk taking. The prevention of a basic drive such as breathing sometimes causes excitement. Another possible reason might be the need for pain or humiliation. The introduction of pain to sexual activity brings with it a certain potential for injury or death. A third possible reason might be a need for experimentation. Continually trying something new and different may result in

finding something new and dangerous. A fourth possible reason might involve the use of hypoxia to enhance sexual pleasure. For some, the interference with the body's uptake and utilization of oxygen becomes a desired or necessary part of sexual activity in spite of or maybe because of the danger involved. A final reason for engaging in dangerous autoerotic acts might be that the participant is unaware of the danger. The danger or risk may not be desired, wanted, or understood. In one case, a young man died of exposure and exsanguination when he was accidentally trapped naked in the bottom of an outhouse latrine while engaged in autoerotic activities involving coprolagnia. He did not anticipate that the rope he apparently had used many times before to pull himself up would fray and break. In some parts of the country, sadomasochists and bondage practitioners are being instructed on "safe" ways to engage in their potentially dangerous sex practices.

Autoerotic Fatalities

Almost any activity of man has certain possible risks. And so it is always possible that someone engaged in even so-called nondangerous autoerotic practices may meet with unexpected injury or even death. The risk of such injury or death is even greater when dangerous autoerotic practices are involved. The greatest concern of law enforcement is, of course, in those cases where the autoerotic activity results in death. The recognition and investigation of autoerotic fatalities may not be one of the major problems confronting modern law enforcement. However, it is an area where a small amount of training and knowledge can go a long way towards proper identification of a crime scene and the saving of investigative man hours. Although the number of such cases investigated by the police may be relatively small, any situation involving the suspicious death of a human being must be considered a serious matter.

Although the manner of death during autoerotic activity is usually accidental, it can be natural, suicide, or even homicide.

An individual engaged in either nondangerous or dangerous autoerotic practices may die of natural causes such as a heart attack. The autoerotic activity may or may not have been a contributing factor. In any case, the evidence of autoerotic activity (bondage, erotica, fetishism, etc.) might be confusing or misleading to the police investigator in such a case.

It is also possible that a person engaged in autoerotic activity may decide at some point to commit suicide. This point of decision might be prior to engaging in the activity but with the person then deliberately deciding to incorporate his or her autoerotic activity into the suicide or vice versa. This point of decision might also be during the autoerotic activity. In either case, because autoerotic fatalities are typically accidental deaths, determining the manner of death would be extremely difficult. Hopefully, in most cases there will be some behavioral indicators prior to the act that such a suicide was intended. In other cases, a friend or relative may alter the appearance of a true accidental autoerotic death scene to make it look like a suicide.

An individual engaged in autoerotic activity may also become the victim of a homicide. The autoerotic activity may have nothing to do with the homicide. The victim,

for example, coincidentally may be found engaged in autoerotic activity when the killer strikes. The autoerotic activity may also have some bearing on the homicide. In one case, for example, a wife shot and killed her husband in his bed, believing he was in fact her husband's female lover. What she did not know at the time of the shooting was that her husband was a transvestite and had fallen asleep dressed in his female clothing after engaging in autoerotic activity. In other cases, homicide crime scenes may be deliberately staged to appear to be accidental autoerotic deaths. Various items (mirrors, bondage, escape mechanism, etc.) indicating autoerotic sexual activity might be planted at the crime scene to mislead the police investigator.

Typical Autoerotic Fatalities

The manner of death in most autoerotic fatalities is accidental. This is particularly true in dangerous autoerotic practices. Because of the inherent risks in such practices, a variety of things can and do go wrong, which can result in the death of the participant.

The most common form of dangerous autoerotic activity involves the use of some method of asphyxia to achieve a state of euphoria during the sexual activity. Any of the following four methods of asphyxia can and have been selected by the autoerotic practitioner: (1) Neck compression (includes hanging and strangulation), (2) airway obstruction (includes suffocation and choking), (3) chest compression, and (4) oxygen exclusion. If any of these four methods of asphyxia are not terminated in time by the autoerotic practitioner, death will result. Therefore, the most common cause of death in autoerotic fatalities is asphyxiation.

It is important to note the distinction between sexual asphyxia and asphyxial death. One refers to the use of the effects of asphyxia to heighten sexual arousal and the other refers to the cause of death. Although not necessarily always fatal, the practice of sexual asphyxia is clearly a dangerous autoerotic activity. The autoerotic practitioner who dies while engaged in sexual asphyxia typically dies from accidental asphyxiation when for various reasons he is unable to terminate his means of sexual asphyxia. However, it is possible that someone engaged in sexual asphyxia might die a nonasphyxial death (heart attack, exsanguination, etc.) during this activity. Conversely, it is also possible that someone engaged in nonasphyxial autoerotic activity might die an asphyxial death (compression of chest, hyperventilation, etc.).

Atypical Autoerotic Fatalities

As just mentioned, there are other forms of dangerous autoerotic activity that do not involve the use of sexual asphyxia. These activities can involve a wide variety of potentially dangerous practices such as the use of bondage, infibulation with objects and electricity, and life-threatening games. Although it cannot be said with certainty whether these nonasphyxial dangerous practices are more widely practiced than sexual asphyxia, they do appear to be less likely to result in death. Because deaths from such activities are less common, they are referred to as atypical autoerotic fatalities.

These nonasphyxial dangerous practices can result in a wide variety of causes of death as illustrated by the following

examples:

A bondage practitioner dies of exposure when he was unable to remove his bindings and is forced to remain seminude in a cold, remote area.

A man dies of electrocution when the wires he was using to induce electrical current into his genitals becomes short circuited.

A man dies of peritonitis when he failed to seek medical attention after inserting and losing a large soda bottle up his rectum.

A man bleeds to death when he failed to seek medical attention after accidentally stabbing himself while using a knife for autoerotic stimulation.

A man dies of a gunshot wound after he "lost" a game of Russian roulette he was playing with a partially loaded revolver during autoerotic activity.

Equivocal Deaths

The typical autoerotic fatality is an accidental death caused by some form of asphyxiation. However, as this overview of autoerotic activity has illustrated, such fatalities can and do involve any of the four manners of death and any number of varied causes of death.

Of greatest concern to the police investigator is usually whether the death is natural, accidental, suicide, or homicide. Some cases are relatively easy to investigate. All the pieces are there and they all fit together. Many others are not so clear cut.

In the investigation of an equivocal death, the police investigator has two major areas to evaluate: the crime scene and the victim's history.

In order to evaluate the scene of a possible autoerotic fatality, the police investigator should have some knowledge of sexually associated factors such as sadism, masochism, bondage, fetishism, transvestism, ritualism, and fantasy. In addition, the investigator should know what a typical autoerotic death scene looks like, including methods of escape and evidence of prior activity. The investigator should also be aware of the typical victim profile.

In evaluating any crime, the assistance of a good, qualified forensic scientist can be invaluable. This is especially true when evaluating a questionable autoerotic death or one involving an altered or staged crime scene. A forensic scientist who can recognize and evaluate forensic considerations such as petechial hemorrhages, pulmonary edema, hyoid bone fracture, bloody mucous from head orifices, ligature mark locations, absent or

inconsistent lividity, and seminal discharges can make the difference in the proper determination of the manner of death.

The evaluation of the victim's history and background is the other critical area in the investigation of an autoerotic fatality. A good psychological autopsy to determine the victim's state of mind and behavior prior to the incident may be the best way to determine if a death was suicide or an accident. The background investigation should include interviews of friends, relatives, co-workers, etc., to determine these things as well as to determine any indications of prior autoerotic activity. Any diaries, writings, or recordings should be examined and evaluated whenever possible. Any area to which the victim had access or expectation of privacy should be searched in accordance with appropriate legal considerations in an effort to establish victim's state of mind and sexual interests and/or to uncover evidence of prior autoerotic activity.

SUICIDE

Suicide

by Arthur E. Westveer and Dr. A. J. Pinizzotto, Behavioral Science Unit, FBI

- I. Definition: a person's most sincere form of self-analysis and critique. Only solution to whatever bothers that person.

- II. Parasuicide
 - A. Definition: A nonfatal act in which a person deliberately causes self-injury or ingests a substance in excess of any prescribed or generally recognized therapeutic dosage.
 - B. Frequency: Estimate 2-8 times the number of actual suicides
 - C. Suicidal gesture: Self-mutilation for secondary gain (prison)

- III. Society's attitude toward suicide varies from culture to culture
 - A. Roman era: culture viewed suicide as a crime against the state
 - B. Far East
 1. Suicide is accepted
 2. Suicide is considered appropriate under certain conditions, such as if the person has disgraced his/her country

- IV. Statistics
 - A. Ranks ninth among the 144 causes of death in this country
 - B. Estimates indicate that over 200,000 people attempt suicide each year
 - C. 5 million living Americans have made a suicide attempt at some time in their lives
 - D. An average of 35,000+ successful suicides occur in this country yearly
 - E. Suicide is the 3rd leading cause of death among 15-24 years olds and the 5th leading cause of death among 25-44 year olds.
 - F. The most common method of suicide for both men and women is firearms
 - G. The highest suicide rates are for persons over the age of 65

(Statistics from the National Institute of Mental Health, 1993 and the Statistical Abstract of the United States, 1996).

- V. Reasons experts put the number of suicides as at least twice the reported number
 - A. Altered scene
 - B. Inadequate investigation
 - C. Inexperience
 - D. Outside pressure

VI. Why?

- A. Psychiatrists
- B. Psychologists
- C. Sociologists
- D. Theologians
- E. Philosophers
- F. Psychics
- G. Astrologists

VII. Who Commits Suicide?

- A. Men vs. Women
- B. 24-44 is peak age range for attempts
- C. 15-24 greatest increase in rate
 - 1. For Americans 15-24 years of age, suicide was the third leading cause of death behind unintentional injury and homicide
- D. Teenage suicide
 - 1. Tripled in the past 20 years
 - 2. Over 5,000 suicides each year
 - 3. As many as 500,000 attempts each year
- E. Other high risks groups
 - 1. Elderly (white)
Highest rates are in persons 65 years of age and older
 - 2. Alcoholics
 - 3. Ex-mental patients
- F. Recovery phase--increased risk
- G. High risk professions
 - 1. Physicians
 - 2. Dentists
 - 3. Lawyers
 - 4. Psychologists
 - 5. Law Enforcement

VIII. Crime Scene Considerations

- A. Intent/lethality
- B. Overall scene

- C. Weapon/method
- D. Wound(s)
- E. Message(s)

IX. Necessary Elements of Suicide

A. Lethality scale -- assessment of suicide potential

1. Age and sex
2. Symptoms
3. Stress
4. Acute vs. chronic aspects
5. Suicidal plan
6. Resources
7. Prior suicidal behavior
8. Medical status
9. Communication aspects
10. Reaction of significant other

B. Suicidal clues

1. Lethality (seriousness)
2. Intent (chance of rescue)
3. The more precise the death plan, the more lethal the intent

C. Precipitating events

1. Stressors-financial, family, workplace, relationship
2. Situational events-means, opportunity, motive, role of victim, peer influence

D. Warning Signs

1. Change in mood
2. Depression
3. Withdrawal
4. Personal hygiene
5. Loss of interest
6. Loss of energy
7. Threats
8. Loss-family, financial, love interest, social status, incarceration

X. Personality Assessment

- A. Psychological autopsy: post-mortem examination of the victim's behavior. An analytic statement based upon the deceased's thoughts, feelings, and behavior.
- B. Assessment information

1. Birth date & place
2. Family information
3. Personal information about subject (i.e., religious involvement, aspirations, type of friends, etc.)
4. Education
5. Hobbies
6. Physical characteristics
7. Marriage(s)
8. Employment
9. Behavior
10. Health

C. Mental status

1. Difficult for laymen to answer
2. Somatic or physical symptoms may suggest internalized stress and possible depression

D. Key relationship: individual(s) to whom the victim turned for support

E. Description of the deceased: What was he/she like?

F. Period of association

1. When did they first meet?
2. How often did they associate?
3. What was the nature of the association? (friend, co-worker, etc.)

XI. Structured Interview

Interview follows a predetermined structure. All persons interviewed will be asked the same questions.

A. Type of association with the victim

1. How long
2. How often
3. How good

B. Describe the person (behavior)

C. Did you notice any behavioral changes?

1. What type
2. To what do you attribute them

D. Any problems in the person's life?

1. Difficulties
2. Concerns
3. What type
4. When
5. Severity

E. Did he/she make any suicidal statements or was he/she preoccupied with death?

F. What was going on in their life at this time?

1. Major upset
2. Divorce
3. Change in lifestyle
4. Other problems

G. Prior actions and/or events to look for:

1. Precipitating life stressors
2. Absence of emotional expressiveness
3. Extreme preoccupation
4. Socially inappropriate behavior

H. Behavioral/Emotional Changes

1. What change did you notice?
2. When did this occur?

XII. Depression

Mood disorder: Mental disorders characterized by severe disturbances of feeling or affect (depression)

A. Characteristics

1. Demoralization
2. Hopelessness
3. Helplessness-fatalistic
4. Sadness
5. Apathy-"I don't care"
6. Ambivalence
7. Irritability

B. Physical Complaints

1. Pain
2. Tension
3. Fatigue

4. Headache
5. Receive treatment?

C. When describing any physical changes it is important to determine:

1. Frequency
2. Severity
3. Duration

D. Sleep

1. Can't fall asleep
2. Awaken often
3. Awaken early with anxiety
4. Too much sleep

E. Appetite

1. Loss of
2. No taste
3. Indigestion
4. Heartburn
5. Cramps
6. Gas

F. Nausea, Vomiting

1. Bowel disturbances
2. Diarrhea
3. Constipation

G. Libido: decreased or increased sex drive

H. Final Questions

1. Interviewee's explanation of death?
2. Who else would know something about the deceased?
3. Anything else to add?

XIII. Comparison of Suicide Attempters and Completers

Characteristic	Attempters	Completers
Gender	Majority female	Majority male
Age	Predominantly young	Risk increase with age

Method	Low lethality (pills, cutting)	More violent (gun, jumping)
Circumstances	Intervention likely	Precautions against discovery
Common diagnoses	Dysthymic disorder Borderline personality disorder	Major mood disorder Alcoholism Schizophrenia
Dominant affect	Depression with anger	Depression with hopelessness
Motivation	Change in situation Cry for help	Death
Hospital course	Quick recovery from dysphoria	
Attitude toward attempt	Relief to have survived Promise not to repeat	

XIV. Myths

- A. Those that threaten don't kill themselves.
 - 1. 60% direct threats
 - 2. 20% indirect threats
 - 3. 20% little or no warning
- B. People who discuss suicide will not commit the act.
- C. Suicide is committed without warning.
- D. Only people of a certain class commit suicide.
- E. Membership in a particular religious group is a good predictor that a person will not consider suicide.
- F. The motives for suicide are easily established.
- G. All who commit suicide are depressed.
- H. A person with a terminal physical illness is unlikely to commit suicide.
- I. To commit suicide is insane.
- J. A tendency to commit suicide is inherited.

XV. Fact: Few people commit suicide without signaling their intentions to someone.
 Fact: The most common method (male/female) used is a firearm.

XVI. Communication

- A. Direct
- B. Indirect
- C. Cryptic message
- D. Suicide notes
 - 1. 24% left notes
 - 2. Mailed, on or near body

3. Does not determine that suicide has occurred. They give insight into the person's psyche.

XVII. Self-Inflicted Death

Definition: "The act or instance of taking one's own life voluntarily and intentionally"
--Webster's Dictionary

XVIII. Ambivalence

A. "To be or not to be: that is the question."

1. Ambivalent
2. Fatalistic
3. 30%

B. "To Be"

1. Low lethality-low intent
2. Suicidal gesture
3. Cry for help
4. Manipulation for secondary gain
5. 65%

C. "Not To Be"

1. High lethality-high intent
2. Intent on dying
3. Can not stop
4. 3-5%

XIX. An act designed to stop an intolerable existence

- A. "I can not and will not accept or tolerate this world as it is"
"I can not and will not put up with myself as I am"
- B. What is intolerable?--Levels vary from person to person
- C. Psychologically the threshold varies
- D. CRISIS is determined by the person in crisis

XX. Predisposing Factors

- A. Personality traits and characteristics
- B. History
- C. Learning
- D. Biological vulnerability

Investigating A Suicide¹

By Lt. Cmdr. (Ret.) Vernon J. Geberth

The reasons a person kills himself can be as simple or as complex as life itself. The person who commits suicide may accept his action as a solution to a severe physical or psychological problem.

During a police investigation of a suicide, oftentimes a note will be found indicating that the victim had suffered psychological torment or was severely depressed. The note will usually suggest that the person believed suicide was the last resort.

Depression is the primary motive for suicide; however, other factors frequently play a part in the decision. Alcohol, drugs, stress, frustration, fear, anger, hostility, and guilt may lay the groundwork for suicide. Some people may actually take their own life in order to punish their family, fellow worker or society in general for some conceived wrongdoing.

In a particularly bizarre case, the victim planned his death for several months, and actually did it as television camera recorded the event. The victim, a state official who had been found guilty of bribery earlier in the year, had promised reporters that his story would be "the story of the decade." On the day of his death, he called the news conference to resign his public office. As he read his statement, he urged the reporters and camera crews to keep their lenses on him. Then he pulled a .357 magnum from an envelope, placed the barrel of the gun in his mouth, and fired. He effectively blew his brains out for the viewing audience.

Depression does not discriminate. It affects the young and old alike. Teenage suicides have been described as epidemic in proportion to their representation within society. According to a 1987 study conducted by The Center for Disease Control in Atlanta, more than 5,000 people between the ages of 15 and 24 take their own lives every year. This is an invisible problem until it strikes in one's own neighborhood.

Periodically, the nation's newspapers and television networks may cover this phenomenon by reporting a series of events including "teenage suicide pacts." Ironically media attention oftentimes results in further teenage suicides. The course of action would be to seek out professional assistance and create programs within the school system to deal with this problem.

There should be one hard and fast rule in all police departments: **all death investigations should be handled as homicide cases until the facts prove otherwise.** The resolution of the mode of death as suicide is based on a series of factors that eliminate homicide, accident, and natural causes.

¹Adapted from: Geberth, V.J. (1988, Dec.) Investigating a Suicide. Practicle Homicide Investigation: Tactics, Procedures, and Forensic Techniques. Third Edition, 1996.

Suicide cases repeatedly cause more problems for investigators than homicide investigations. It is not surprising to encounter misdirected grief or anger. The surviving family inherits the grief of losing a loved one as well as the psychological uncertainty of whether or not they could have prevented the act.

There is also the possibility that suicide notes may have been taken or destroyed. In addition, the weapon and other evidence may have been removed prior to the arrival of the police.

I experienced a case in which the daughter of an 84-year-old woman notified the police of her mother's death. Unknown to the police, the deceased had suffered from terminal cancer and had been very depressed. When the daughter called her mother at home and did not receive an answer, she went to the woman's house, opened the door with a key and discovered her mother's body. She saw a .32 caliber handgun, which she recognized as an old family heirloom. She looked through her mother's dresser drawers for some personal papers and the codicil to her will, took the gun and left. She went home and called the police to report that she had not been able to get through to her mother. She requested the police meet her at her mother's apartment.

When we arrived we were looking at a burglary-homicide case, not a possible suicide. Later, we were called by the family parish priest who advised us of what had taken place. The case was properly reclassified as a suicide.

Surviving family members often have difficulty accepting that a relative has committed suicide. They have been known to accuse the police of a cover-up, or even petitioning state and federal agencies to review a local investigation with the belief that they can change the outcome.

One of the most bizarre cases of suicide I ever investigated involved the death of a 27-year-old woman. She was discovered in her sister's apartment with a cut throat and three stab wounds in the chest. She had been hiding at the apartment from her boyfriend, who at first was our primary suspect. Upon a thorough investigation, it was discovered that the circumstances of her death, as well as the evidence obtained during the crime scene search indicated the death was a suicide.

The cutting to the throat was superficial, with a stigma of hesitation, and the stabbing to the chest was self-inflicted. The weapon came from the scene and the apartment door was locked from the inside. Her palm prints were found on the blade of the kitchen knife.

A note found at the scene indicated the victim's depression, and a subsequent handwriting analysis revealed that the deceased had written the note. A background check of the deceased indicated drug and alcohol abuse, and interviews of family and friends were conducted. Additional evidence was discovered that indicated the deceased has attempted to kill herself with a rifle found in the apartment. There weren't any signs of struggle and there wasn't any forced entry into the locked apartment. The medical examiner confirmed that the death was a suicide.

However, the next day an associate medical examiner reclassified the case as a homicide. Her rationale was that she had never seen a body with three stab wounds to the chest and a cut throat. She made the determination without consulting the "tour" doctor, who had been on the scene, and she disregarded his official notes. She refused to discuss the case with the detectives and insisted that the case was a homicide.

After investigators conferred with her superiors, the case was properly reclassified as a suicide. But the damage was done. The girl's family is firmly convinced that their daughter was killed by her boyfriend. It is easier for them to believe that than to accept that she killed herself.

Investigators should be aware of three basic considerations that may establish that a death is suicidal in nature.

- The presence of the weapon or means of death at the scene
- Injuries or death wounds that are obviously self-inflicted or could have been inflicted by the deceased
- The existence of a motive or intent on the part of the victim to take his or her own life

A final determination of suicide is made only by a medical examiner/coroner after all the factors are evaluated. However, investigation at the scene and inquiry into the background of the deceased may indicate the presence of life-threatening behavior or activities that suggest suicidal intent. Medical examiners/coroners are supposed to avail themselves of the input of the investigators who were at the scene and conducted the death investigation.

The Weapon

The weapon or means of death should be present in cases of suicide. The absence of a weapon, however, does not necessarily indicate that death was due to a homicide. The weapon could have been stolen or disposed of prior to the arrival of the police.

There are many recorded cases where a suicide victim has arranged to make his death appear to be a homicide. Family members concealing weapons and/or suicide notes in order to avoid the embarrassment of having a suicide in the family or to collect money from the insurance policy is common.

If a weapon is observed in the hands of the deceased, the investigator should examine the hand to see if the weapon is clutched tightly due to cadaveric spasm (instantaneous rigor mortis). It is not uncommon for a person who had a firearm or knife in his or her hand at the time of death to clutch it tightly after death. It is important to note this since, you can be sure that the person held this weapon at the time of his death. A person attempting to place a weapon in the deceased person's hand after death would not be able to recreate the same grasp.

A weapon does not have to be in the deceased person's hand for the death to be a suicide. The survival time factor (time between injury and death), that may have enabled the deceased to perform any number of activities, including disposal of a weapon or leaving the location where he first attempted suicide.

Wounds

Injuries and wounds in suicides may be similar to wounds observed in homicides. Certain observations can be made about whether wounds found on the body are consistent with homicide or suicide. For example, a person found dead from multiple stab wounds of the back would certainly not be considered a victim of suicide.

In suicide cases, there appears to be a preference for certain parts of the body. If the victim uses a knife, the wounds will usually be on the throat or wrists. If the injury is a stab wound, it will generally be through the heart.

Investigators should closely examine any slashing-type wounds for evidence of hesitation marks. They appear as parallel slashes alongside the mortal wound and are indicative of suicide. But do not jump to a fast conclusion based on hesitation marks. An assailant knowledgeable about these factors might leave similar markings to cover up a homicide.

If the victim uses a gun, the most common part of the body affected is the head, followed by the heart. Head shots are usually found in the temple, the forehead or directly into the mouth and are at close range. There should be evidence of powder burns and/or smudging. In some instances, there may even be evidence of hesitation gunshot wounds or evidence of other shots fired prior to the fatal shot. Investigators should examine the hands of the deceased for evidence of any blood or tissue splattering.

An important note: a wound is never too painful if a person is determined to take his life. Deranged people may inflict several extensive wounds on themselves before they collapse and die. Investigators should never presume homicide based upon a casual examination of the extent of the injury.

My experience includes a case in which the deceased had first attempted to commit suicide by hanging himself with an electrical cord, but the cord broke under his weight. He then proceeded to cut open his stomach with an eight-inch knife and systematically began removing his intestines--which he cut into pieces using a pair of tinsnips.

Suicide by fire is extremely rare. A person who has made up his mind to kill himself, however, may utilize any available method. Since gasoline is readily available, it is a convenient weapon. I have found more women resorting to death by fire than men. Perhaps the reason is that men are more likely to obtain firearms.

The manner of death may be important in determining suicidal intent. For example, people who hang themselves or jump to their deaths from buildings have certainly

indicated an intention to take their lives. Similarly, deaths that involve a combination of methods, (poisoning, shooting, slashing, inhaling, gas, etc.) show an extreme desire to die.

There are a number of possible motives to consider in suicide cases. I have found from my own personal experience however, that some motives may never surface. A motive only in the mind of the deceased is a secret well kept.

Some common motives are:

- Depression
- Drugs
- Alcohol
- Frustration
- Fear
- Anger
- Hostility
- Guilt
- Terminal Illness
- Illness in the family
- Severe emotional crisis
- Psychological problems
- Physical Deterioration
- Loss of a loved one
- Death of a child
- Financial problems
- Teenage problems
- Loss of employment
- Despair and general inability to cope with life

In another case I recall, a body was found at the base of a high drop. It was apparent that he had jumped or fallen from the ledge approximately 70 feet above, but there was evidence of some cutting on the wrists. A check of his clothing indicated that his wallet was missing. Further inspection of the area failed to locate the wallet or any type of blade that could have been used to cut his wrists.

Investigation showed that the deceased had been at work the day before and everything seemed fine. There was no indication from friends or family that the deceased was suicidal. Police in a neighboring jurisdiction recovered a wallet belonging to the deceased in a motel room. The room was very bloody and it appeared that there had been an assault. Examination disclosed a suicide note, an empty bottle of pills, and a bloody razor blade.

Apparently the man had gone to the motel room, cut his wrists, and consumed pills. When death did not occur, he got into his car and drove approximately ten miles back to New York City. Then he selected a high building in the area and jumped to his death. The recovered suicide note indicated that he was extremely upset with his life and had planned to kill himself at the motel.

Suicide Notes

A suicide note is certainly indicative of suicide, but investigators should conduct an inquiry to determine if the note is genuine. Was it written by the deceased? Was it written voluntarily? The note should be collected in a manner to preserve any latent fingerprints. Past writings of the deceased should be collected for comparison.

A suicide note is an integral part of a professional investigation and oftentimes provides detectives with a basis of inquiry into the background of the victim for a psychological autopsy.

In order to provide detectives with some insight into a "suicidal mind," I have provided excerpts of suicide notes from cases I have investigated over the years. These notes and brief case histories bring us into the psychology of suicide,

Dearest Mom and Dad, I guess the past ten years escapades have finally paid off--with my Life. . .I'm sorry I'm letting a lot of people down, who had faith in me, but I no longer had any faith in myself. . .

The young man had a serious problem with alcohol. The note was two pages long and contained his telephone number and home address. It was found in his vehicle, which had been left parked on the George Washington Bridge in New York City. The note also contained a drawing indicating that he jumped into the Hudson River. His body was found five days later.

To my family, I just got a little tired. It's not your fault, but I want you to know I love you very much. . .Love always Dad.

This was the suicide note of a police officer I had known for 15 years. I never suspected that he could commit suicide. I interviewed his wife, who said, "This was not the man you or I knew. He changed. There was a drastic change during the week. I think it was the medication he was taking." The officer had a prescription for an infection. It had put him into a deep depression.

Last will and testament, Everything goes to (Jim) with the exception of the things that belong to (John) I love you all.

A young woman, who had moved to New York City from the Midwest, had become depressed with her life. Although she had a good job as a nurse her real goal was to be in the fashion industry. She decided to kill herself in front of her place of work. She probably decided that no one would miss her and she did not want to die alone, so she took her pet dog with her. She hooked up a vacuum cleaner hose to the exhaust pipe of her car, and ran the hose into her vehicle. She was found by her fellow employees the next morning.

Now, (Eva) doesn't have to say Oh she's a pain now I'm dead. Now everybody is happy. I hope I wasn't a problem to nobody but if I was now I am not. . .I hope I didn't cause so much trouble. Tell everybody I say goodbye. Have a Happy Thanksgiving. . .

This sad case involved a 12-year-old girl who took her life rather than being sexually abused further by her father, who had been recently released from prison. Investigation indicated that she had been abused since she was five years old. She shot herself with an unlicensed .38 caliber after swallowing a number of pills.

Brother and sister, we didn't have anything else in this world. Please put our bodies in the same coffin. . .We love you all. . .Don't be sad about us. Everything is in God's hands. . .

This is a classic "Lover's suicide pact." The two bodies were found in bed in a motel room. Both had been shot through the head. The male had the gun in his hand. The note was found on a lamp table next to a Chinese symbol, which meant eternity.

Background Information

A suicide victim may have indicated an intent to commit suicide through activities and statements prior to death. Many suicides are preceded by verbal threats of self-destruction and other indications of despondence.

In some instances these threats are made to people the deceased respects. In other instances a sudden change in behavior is shown by more subtle actions such as increasing life insurance, giving away prized possessions, disregarding a doctor's advice, or abusing alcohol or drugs. Any diaries, unmailed letters, or similar writings should be examined for information that may explain the death.

Obviously, the stated intention of a person to take his or her life and other sudden and unexplained activities are important investigative considerations. I recommend that investigators consider the application of a psychological autopsy.

A psychological autopsy is a collaborative procedure involving law enforcement and mental health experts who attempt to determine the state of mind of a person prior to the fatal act. By examining the victim's life style and interviewing the victim's friends and relatives, they determine whether the death was accidental or involved suicide.

Warning Signs

- A change in sleeping habits; sleeping more than usual or staying up later, followed by sadness

- A lack of interest in sex; loss of sex drive
- A change in eating habits; weight loss or lack of appetite
- A sudden drop in grades or school attendance (young people)
- Loss of work interest (adults)
- Loss of interest in favorite activities, hobbies, or sports
- Loss of interest in friends, family, etc. Isolation.
- A preoccupation with death, or an unusual interest in art or music dealing with death.
Teenagers: heavy metal rock, etc. Adults: preoccupation with death and the afterlife.
- Loss of interest in personal hygiene and appearance
- Involvement with drugs, including abuse of alcohol

Extreme Danger Signs

- Suddenly becoming cheerful or calm after a depression; a sudden euphoria or burst of activity. This could mean that the person has resolved the inner conflict by deciding to take his or her own life. The decision is made.
- Giving away prized possessions.
- Speaking of life in the past tense. For example, saying, "I've loved you," or "You've been a good mother."

Suicide is a tragic ending to a person's life. Things may get bad, but never bad enough to give up your life.

Police officers investigating such tragedies are often reminded of just how precious life is.

Investigative Checklist

Investigative Considerations

* Evaluation of the wounds

- Could the deceased have caused the injuries and death?
- Was the person physically able to accomplish the act?
- Are the wounds within reach of the deceased?
- Are the wounds grouped together?
- Is there more than one cause of death?
- Describe the nature and position of the injuries.
- Are there any hesitation marks?

* Psychological State of the Victim

- Get a background of the victim from family and friends. Include medical as well as social information.
- Were there any recent deaths in the family?
- Were there any warning signs by the victim?
- Get a sample of the victim's handwriting for analysis. This should be done even if a note isn't found-one may show up later.
- Interview any close personal friends as soon as possible.

* Prior Mental Problem or Defect

- Has the deceased been under any professional treatment?
 - Had the deceased ever attempted suicide before?
 - Has anyone in the family ever committed suicide?
 - Was the deceased a heavy drinker?
 - Was the deceased on any medication?
 - Was there a history of drug abuse?
-

Suicide by Environmental Hypoxia (Forced Depletion of Oxygen)

James C. U. Downs, M.D., Sandra E. Conradi, M.D., and Clay A. Nichols, M.D.

Suicidal suffocation by forced oxygen depletion (environmental hypoxia) with carbon dioxide (CO₂) and with propane is discussed in two cases. No toxicologic proof was available with the former and circumstantial evidence weighed heavily. The latter case demonstrated inhaled propane by an on-scene transthoracic aspirate; all other toxicology specimens, including brain, liver, blood, kidney, fat, and vitreous, did not contain hydrocarbons. This second fatality was complicated by multi-agent overdose, including diphenhydramine, fluoxetine (Prozac), and nordiazepam. The designation of these deaths as due to oxygen depletion involved careful scrutiny of the autopsy, toxicologic, and scene findings. Complete analysis of *all* factors surrounding these rarely encountered suffocation deaths is stressed.

Key Words: Suicide—Asphyxia—Suffocation—Carbon dioxide—Dry ice—Propane—Hydrocarbon—Fluoxetine (Prozac).

Suicide by asphyxiation usually results from hanging or drowning. Smothering gases rarely are employed actively to induce asphyxia. Accidental deaths are more frequently encountered and usually are associated with industrial exposure. Carbon dioxide and methane are most often implicated (1-3). The authors are aware of only one report describing suicide by carbon dioxide hypoxia (4); in that case, the immediate cause of death was drowning. Two suicidal asphyxias by suffocation are reported herein, one involving carbon dioxide (CO₂ as dry ice) and the other propane. The value of scene investigation, toxicologic findings, and circumstantial evidence is stressed in cases of this nature. In addition, a technique of on-scene transthoracic aspiration for toxicology samples is described.

CASE HISTORIES

Case 1

The decedent was a 36-year-old white male dairy-plant employee who had failed to show up for work on 2 consecutive days. His supervisor became concerned, went to his apartment, and found the door locked. Police were summoned and forced entry. The studio apartment's ambient temperature was 88°F (31°C) and the officers noted a foul odor. A 2 × 3-foot (60 × 90-cm) poster inside the front door of the squalid, single-bedroom apartment warned of carbon dioxide in the atmosphere of the bathroom (Fig. 1). Three other notations had been made on the poster, presumably by the decedent. Near the poster was a science fiction paperback book that had been taped open to a page revealing an ethereal figure with flowing hair. The text stated, in part, "You have made some wise choices. I congratulate you from all of us here in the future..." An old, empty bottle of nordiazepam and half-full

Received July 1, 1993; accepted September 19, 1993.

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Presented at the 1992 annual meeting of the National Association of Medical Examiners, Milwaukee, Wisconsin, September 19-23, 1992.

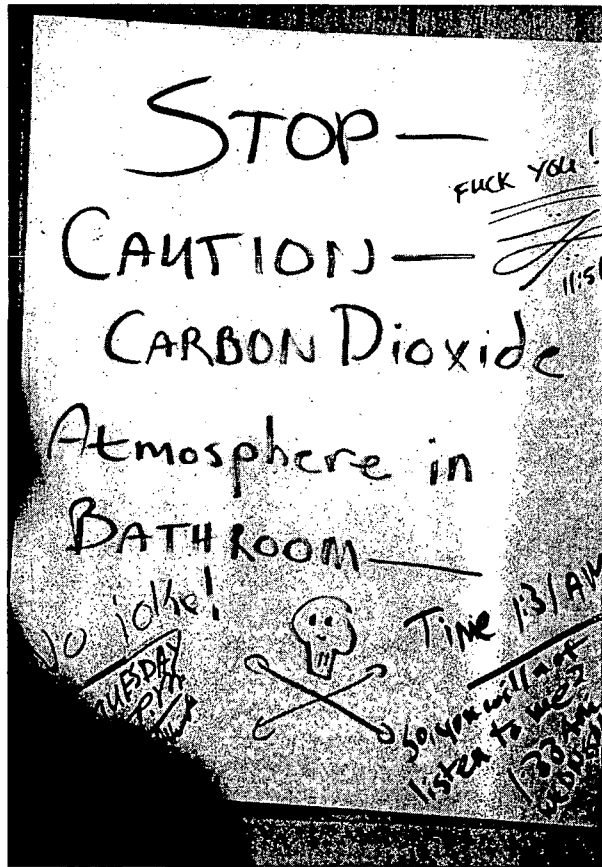


Fig. 1. Poster found on entering the apartment in case 1. Note the warning of carbon dioxide in the atmosphere.

bottles of amoxicillin and terfenadine (Seldane) were noted elsewhere.

The bathroom door was locked from within. The seams around the door edges had been taped shut from within with 2-inch (5-cm)-wide duct tape. Two empty, ~12-inch (30.5-cm)-square milk crates were immediately inside the door, between it and the bathtub (Fig. 2). A phone book containing several circled names and numbers was positioned on the toilet seat. The closed tub shower enclosure doors had been taped shut from inside with duct tape. On the ledge within the tub were a partial roll of duct tape, an empty beer bottle, a clock, and a photograph (Fig. 3). Tape identical to that elsewhere was used to cover both the floor and overflow drains in the tub (Fig. 3), to seal the edges of a 12-inch-square window just above the top of the shower, and to secure numerous photographs to the side of the shower enclosure (Fig. 4). A partially burned candle and a black plastic wristwatch were on a separate ledge, near the front of the enclosure. An ashtray containing a single cigarette butt was on another ledge at the opposite end of the tub. Within the tub was the fully clothed body of a decomposing

white man that was in a semifetal position on its right side. Near the right knee was the body of a calico female cat in a similar state of decomposition. Decomposition fluid had collected in the bottom of the tub. No evidence of animal activity was apparent. The volume of the bathroom was ~8,156 L (289 ft³).

Additional history revealed that the unmarried decedent had had an 8- to 10-year history of apparent paranoid ideation with schizoid behavior. Family and friends described him as "moody," "odd," and "different." He had made a prior suicide attempt ~1 month earlier wherein he superficially slashed his wrists. He was not actively engaged in psychotherapy and was on no recently prescribed antidepressant medication.

Autopsy revealed a moderately decomposed 68-inch (1.72-m), 180-pound (81-kg) white man with no visible recent external trauma. Healed linear scars were on the flexor aspect of each wrist. The autolyzed and putrefied internal organs had no diagnostic gross or histologic lesion. Results of toxicologic analysis of urine by thin-layer chromatography were positive for the bases: caffeine, nicotine, phenethylamine, and doxylamine; acidic and neutral compounds were not detected. The liver ethanol concentration was 46 mg/100 g tissue. The liver doxylamine concentration was 700 ng/g tissue. The environmental atmosphere was not sampled. Death was determined to be due to asphyxiation resulting from environmental hypoxia caused by exogenous carbon dioxide (dry ice) exposure. The manner was designated suicide.

Case 2

The decedent was a 35-year-old white male city police officer who had had no significant past medical history except a 1-week course of fluoxetine (Prozac). He had had a 1-year history of marital difficulties, and his wife had moved in with two sailors ~2 months prior to his death. She reportedly would call up her husband and ridicule him about his lack of sexual prowess in comparison with that of the sailors. One week prior to his death, the deceased convinced his wife to come to their home to discuss their marital situation. When she arrived, he reportedly handcuffed her, bound her with tape, and threatened her with a gun. She convinced him to free her whereupon she notified the city police. He was dismissed from work and admitted to a psychiatric hospital for evaluation. On being discharged from the hospital 1 week later, he was arrested by county sheriff's deputies on kidnapping charges. He subsequently made bail and was not seen alive again.

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Fig. 2. Interior of the bathroom where the decedent's body was found in case 1. Two empty milk crates are immediately inside of the door. Duct tape was present along the seams of the door.

The day after his arrest, he had a noon appointment to see his attorney. When he failed to appear, the lawyer became concerned and called the deceased's best friend, who went to investigate. The friend found the house locked and called the city police. At about 1:30 p.m., he and the responding officer entered through an open second-story window. They noted an odor of "gas" in the house and localized it to the decedent's first-floor bedroom, where the body was located. The medical examiner was dispatched to the scene.

The supine body was on a waterbed and clothed in shorts and a T-shirt but no shoes or socks (Fig. 5). A half-empty sample box of fluoxetine was on a nightstand to his right. A motorcycle helmet on his head had the visor taped closed with transparent tape. A bath towel encircled the neck, forming a partial seal with the helmet. A rubber hose that passed over the towel and into the helmet (Fig. 6) was connected on the opposite end to an almost empty 20-gallon (76-L) liquid-propane gas tank that sat on the floor to his left. A roll of transparent tape

Fig. 3. Bathtub enclosure (case 1). Note the clock, empty beer bottle, and duct tape on the ledge. The seams of the enclosure were covered with tape as seen in Fig. 2. The floor drain and overflow drain (arrow) were also covered by tape.





Fig. 4. Numerous photographs of a former girlfriend and another female friend were secured on the shower wall with duct tape.

was on the adjacent nightstand. The headgear was removed at the scene, revealing vomitus in and about the oral cavity, trickling onto the towel.

At ~2 h postmortem and prior to removing the headgear apparatus, an 18-gauge spinal needle attached to a 20-ml syringe was inserted through the right 6th intercostal space and ~1.5 ml of translucent pink fluid was aspirated. A repeat puncture yielded ~0.5 ml of similar material. Both were placed in appropriately labeled 10-ml red rubber-stoppered glass tubes. A control sample was collected from the gas tank. The environmental atmosphere was not sampled.

The body was immediately transported to the morgue and a complete autopsy was commenced ~4 h after death. The body was that of a 71-inch (1.8-m), 204-pound (91.8-kg) well-developed white man. Bulbar and palpebral conjunctival hemorrhages were absent. Rigor mortis was moderate and easily broken. Livor mortis was dependent and blanchable. The 405-g heart had focal 20–30% atherosclerotic luminal narrowing of the normally distributed coronary arteries. The 410-g right and 395-

g left lungs were acutely congested and mildly edematous. The acutely congested 3,020-g liver had a greasy tan-brown parenchyma. The remaining acutely congested internal organs had no grossly significant pathologic abnormality.

Toxicologic specimens of blood, bilateral lower-lung lobes, right hepatic lobe, bile, right kidney, urine, and ocular fluid were collected immediately on opening the chest and abdomen. The frontal cerebral lobe and cerebellum were collected as soon as possible once the calvarium was opened, ~30 min after commencing the autopsy (4½ h postmortem).

Urine was positive for diphenhydramine, ephedrine, pseudoephedrine, fluoxetine, and norfluoxetine by thin-layer chromatography; acid and neutral compounds were not detected. Benzodiazepines were present by enzyme-multiplied immunoassay technique. Quantitation revealed the following blood levels (ng/ml): diphenhydramine, 2,400; fluoxetine, 550; norfluoxetine, 1,900; and nordiazepam, 204. Samples of lung aspirate, superficial and deep fat, blood, right and left lungs, kidney, vitreous, and brain were injected into 10-ml chambers on a Perkin-Elmer head space gas chromatograph with *n*-propyl alcohol as an internal standard. The sample collected from the liquid-propane tank served as the analytic standard. Analysis was performed by differential columnar retention times. Of the multiple specimens tested, only the first transthoracic aspirate (collected on scene) was positive for propane; all other samples were negative for volatiles.

The cause of death was attributed to suffocation due to environmental hypoxia due to propane gas exposure. Multiple-drug overdose was determined to be contributory. The manner of death was judged suicide.

DISCUSSION

Asphyxiation may be divided into three broad categories: suffocation, strangulation, and chemical (biochemical) (1). Suicidal asphyxia is most often due to hanging or drowning but may occur by other means, including the use of gaseous agents. Death by the latter compounds may fall into the entrapment/environment or the suffocating-gas subdivisions of suffocation (1). Entrapment within a confined space for a period of time results in the victim depleting the available environmental oxygen by consumption. Atmospheric environmental hypoxia may be indicated by an ambient oxygen level of less than the usual 21%. Oxygen levels <19.5% are considered deficient, those of 12–16% ASPHYXIATION - Downs



Fig. 5. Body of the decedent in case 2 as observed on entering the bedroom. Note the motorcycle helmet on the head and the liquid-propane gas tank on floor, adjacent to bed. The seam of the visor was secured by clear tape (arrow).

may pose a serious threat, and those $\leq 5\%$ are potentially rapidly lethal (minutes) (1,5). Suffocating gases, usually carbon dioxide or methane, decrease the oxygen concentration by displacement and have minimal innate toxicity [1,6(pp. 274, 1,239)]. Carbon dioxide concentrations $>10\%$ produce unconsciousness if breathed for even a short period (6, p. 274).

Deaths from exposure to suffocating gases are most frequently accidental; however, suicide has been reported (1-4). The source of accidental contact is usually industrial (1-3,7). This may include exposure in sewers, mines, wells, tunnels, silos, and storage tanks. Another possible route of asphyxiating-gas contact includes inhalation of volatile hydrocarbon gases, usually for desired intoxication or less frequently for deliberate (suicidal) exposure (4,8-14). Unfortunately, the former is increasing in frequency (8,9). All information available concerning a death from suffocating gaseous agents should be scrutinized (1-3,8). In their initial confusion and shock, grieving family members may attempt to obfuscate the cause and manner of death in a suicide or accident by rearranging the scene and/or withholding pertinent information (8,15), particularly if autoerotic activity is involved.

The typical CO_2 -related suicide involves enclosure within a confined space or "chamber" (3). Reports of suicide actively utilizing carbon dioxide are anecdotal. A single previously reported case (4) described a 24-year-old white man who locked himself in a subsequently sealed bathroom and appar-

ently induced environmental hypoxia via two carbon dioxide fire extinguishers, likely rendering him unconscious. He then slipped below the water level in the bathtub, so the immediate cause of death was drowning. The case described herein is the first suicidal exogenous carbon dioxide asphyxiation of which the authors are aware.

Carbon dioxide is a nontoxic colorless gas, normally present in air at a concentration of 0.03%, and has its untoward effect as a result of oxygen displacement from the atmosphere (1,3,5). In a conscious individual, clinically threatening hypoxia may result from an atmospheric carbon dioxide concentration of $\sim 30\%$ (1), although adverse effects may be seen at lesser concentrations when combined with gaseous volatiles (16). Lethal CO_2 gas concentrations may accumulate in preexisting or created "chambers" as in this case when the decedent sealed himself into the tub enclosure with blocks of dry ice that were allowed to sublime to the gas phase.

Postmortem blood gas values are of no use when dealing with carbon dioxide as an asphyxiant, due to its presence as a normal blood constituent (1-3) and to bacterial generation and degradation. The environmental atmosphere should be sampled if possible (3) and, if not, the maximal expected ambient chamber concentration should be calculated. Assuming that two blocks of dry ice (45.5 kg total) were allowed to sublime completely in a closed 8,156-L chamber, the expected gas concentration would be 5.6 g/L (normal, 3.9×10^{-4} g/L) (17). Carbon dioxide, like many other gases, is more

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Fig. 6. Close-up of the decedent's neck area (case 2). The hose from the tank runs over a towel and into the helmet. This apparatus allowed laminar air flow to drive oxygen out of the "chamber."

dense than air (ratio of air density, 1.5 and 1.0, respectively) and will therefore collect near the floor or at the lowest available point (11,14).

Propane is a volatile hydrocarbon used as a gas fuel and as a propellant. In excess of 22 sudden deaths have been ascribed to its use (7,8-14). Aliphatic hydrocarbons classified as simple asphyxiants include acetylene, butane, ethane, ethylene, methane, and propane (5). The toxicities vary: negligible for topical exposure, slight and reversible for inhalation at low concentrations (18), and narcotic with light-plane anesthesia for inhalation at high concentrations [6(p. 1,239),8,18]. Deaths are usually accidental, resulting from industrial exposure or volitional abuse (1,2,9,15); suicide has been described (1,2,11,15).

The mechanism of death by volatile compounds is disputed but may include sudden cardiac arrhythmia or mechanical (rebreathing-induced hypoxia or airway blockage by vomitus) or chronic hepatic dysfunction (2). Of these, arrhythmia occurs most frequently and accounts for over half of all fatalities (2,9). To understand how these agents may induce hypoxia, one should consider that in breathing paraffinic- or oleic-hydrocarbon-containing air, 80% of the total amount to be absorbed will be within 20 min of exposure (19). Absorption during the first

20 min is proportionate to the number of carbon atoms (more hydrophilic, more rapid absorption). After 20 min of exposure, additional absorption occurs very rapidly (19). The molecule is fat soluble to some extent; it has been reported to collect readily in tissues based on differential lipid content: brain > liver > blood > kidney (10).

In case 2, the propane exposure was presumably brief. The three-carbon propane molecule would have been absorbed at relatively slow rate. Had propane been present in a clinically significant quantity, it should have been detected in the quite fresh post-mortem samples. We believe that because of the very small "chamber" created by the combination of helmet and towel, the decedent was able to induce environmental hypoxia quite rapidly. The pressurized propane gas would force the oxygen out by laminar air flow and minimal to no oxygen would be allowed to reenter the helmet. Thus, in contrast to a plastic bag-type apparatus where intoxicant and oxygen are rebreathed until both are absorbed to the point of death, this death demonstrates forced depletion of oxygen with minimal absorption of a relatively short-chain hydrocarbon gas and residual oxygen until suffocation occurred.

Toxicologic analyses are critical in asphyxial gas deaths, not only to determine the presence or absence of a lethal gas, but also to examine possible impact of any other agent(s) (1,7,15,20). These studies should ideally be performed on the environment in question (1,3,7), preferably prior to manipulation of the scene or the body. In the reported carbon dioxide asphyxia (case 1), decomposition rendered environmental study moot because various gases are generated and metabolized during putrefaction. Regrettably, the environment within the motorcycle helmet in the propane death was not sampled; this might prove useful should one encounter a similar case.

To document further the decedent's injury in case 2, a right 6th intercostal space and thoracic aspiration was performed at the scene (twice) 2 h post-mortem with an additional sample obtained just prior to autopsy 2 h later. Of these, only the initial specimen was positive for the presence of propane, confirming that the compound had been inhaled. Tracheal aspirations have been performed at the scene of death or portions of lung collected at autopsy (1,20) for reasons identical to our own. The absence of detectable propane within the multiple specimens in case 2 indicates that a small quantity of propane had been inhaled and/or that the exposure time was brief.

A critical part of toxicologic studies is proper specimen handling. This would include procure-

ment as rapidly as possible. Ideally, specimens should not be placed in a plastic bottle or syringe, nor should they be placed in a rubber-stoppered tube; they should be deposited in glass containers with aluminum-foil or teflon-lined caps or in nylon bags (21). These containers should be sealed airtight, stored at -30°C , and analyzed as soon as possible. Prolonged storage at 4°C is not recommended (11). In the case of liquid-propane exposure, toxicologic specimens were obtained as soon as the autopsy commenced, ~ 4 h after death. All of the specimens—liver, blood, lungs, vitreous, fat, and kidneys—were collected immediately on opening the thoracoabdominal cavities. The brain sample was gathered ~ 30 min later. A toxicology technologist standing by in the autopsy room immediately placed materials in appropriate containers that were then stored overnight in a -30°C freezer prior to analysis the next day. We conclude that the systemic absence of propane at autopsy was real and not artifactual due to improper handling technique.

Of at least equal importance to proper toxicologic specimen collection, handling, and analysis is the scene investigation. In the carbon dioxide death, the scene and circumstances clearly pointed to suicide. Had a cursory analysis been done and/or had the note warning of carbon dioxide not been left, results of toxicologic studies would have been positive only for the antihistamine, doxylamine, in hepatic tissue. There apparently has been only one previous case report with toxicologic results involving hepatic doxylamine (22): that involved a 3-year-old boy who had consumed ~ 100 Bendectine (doxylamine succinate-dicyclomine HCl-pyridoxine HCl) tablets. He died 18 h later and had a liver doxylamine level of 14,000 ng/g tissue. Studies on rabbits and mice have shown a median lethal dose of 250 and 470 mg/kg, respectively (23), which, if comparable to humans, would suggest an oral dose of 17.5–32.9 g in a 70-kg individual. In case 1, the liver doxylamine concentration was only 700 ng/g tissue, which would be insufficient to explain death by an overdose of this agent.

Had the scene in case 2 been rearranged, the examiner might not have suspected propane and might have concluded that this death was due to a multicomponent overdose. The diphenhydramine level was within the toxic range at 2,400 ng/ml (toxic, 2,100 ng/ml; and lethal, $>8,000$ ng/ml), and the nordiazepam level was therapeutic at 204 ng/ml (therapeutic, 100–260 ng/ml) (24). Far greater significance may have been given to the fluoxetine-norfluoxetine level, which was a combined 2,450 ng/ml [fluoxetine therapeutic at 90–400 ng/ml (24),

and combined level toxic at >2000 ng/ml (Meeker JE, et al., unpublished data, 1992)]. The patient's response is also pertinent as he or she may tolerate levels slightly higher than "normal."

These cases reiterate the critical nature of complete investigation of the decedent's remains as well as of events and circumstances leading up to and surrounding death (1–3,8). In the case of the propane death, the decedent was clearly alive in that he inhaled the propane gas and expended some effort in arranging his death. The finding of propane within the specimen from the death scene confirms that he did inhale this gas. The autopsy findings were not specific and included the typical acute visceral congestion and fluid blood.

Classification of the dry-ice death obviously was based on a "negative" autopsy and circumstantial evidence. Six elements are significant: (1) a note specifically citing carbon dioxide, (2) elaborate preparations to seal the "chamber," (3) a partially burned candle, (4) two empty milk crates within the bathroom, (5) the lethal process affected both subjects in the chamber, and (6) the decedent was a dairy employee. The final element is obscure unless one is aware that dairy companies use dry ice (frozen CO_2) in handling their product. The milk crates were apparently used to carry in two blocks of dry ice that produced the carbon dioxide gas. Common experience is that carbon dioxide vapor (dry ice "smoke") collects toward the ground, and the deceased appears to have made use of this property. The candle may have been used as a "marker" to indicate that the oxygen concentration had fallen substantially. The door, tub enclosure, window, and tub drains were sealed to prevent the escape of the vapor. The fact that the cat apparently died at or near the time of this person's death points to an environmental condition that affected both beings—indeed, the feline may have served as a "bell weather" much as a canary in a coal mine.

SUMMARY

Two cases of suicidal asphyxiation due to suffocating gases causing environmental hypoxia are described that are particularly significant in light of the recent upward trend in intoxication and deaths from solvent abuse including volatile hydrocarbons. Case 1 is apparently the first report of pure asphyxiation by smothering with carbon dioxide gas. Suffocating gases usually kill by displacing oxygen from the atmosphere, resulting in cardiac, mechanical, or physical derangement. The typical victim is a young white man who is alone in the bedroom, with or without evidence of autoerotic activity. The

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scene should be scrutinized for evidence of a "chamber" or area for the gas to collect. The evidence from the scene may be altered by family action(s). Circumstantial evidence may be helpful in determining the cause and manner of death. The environment should be evaluated with atmospheric sampling if appropriate. Toxicologic evaluation is critical and proper collection, handling, storage, analysis, and interpretation are essential. A technique of transthoracic aspiration at the scene of death is introduced and may yield pertinent results.

Acknowledgment: We gratefully acknowledge the assistance of Ms. Vicky Seigler in the preparation of the manuscript.

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EQUIVOCAL

DEATHS

Equivocal Death

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Equivocal

Definition: of uncertain nature or classification; unable to determine the manner of death

II. Cause of Death

Reason for death (gunshot wound, heart attack)

III. Manner of Death

- A. Natural
- B. Suicide
- C. Accident
- D. Homicide
- E. Unexplained or undetermined

IV. Deaths where manner can be questionable

- A. Occupational
- B. Fire deaths
- C. Overdose
- D. Firearm
- E. Vehicular
- F. Drownings
- G. Cutting/Stabbing
- H. Falls
- I. Electrical
- J. Etc., etc.

V. Personality Assessment

Definition: used in the investigation of death: a profile of the decedent based upon an in-depth examination and analysis of his thoughts, feelings, and behavior.

VI. Psychological Autopsy

A. Behavioral evaluation of death

Try to form a logical understanding of death from:

1. Evidence
2. Documented life events
3. Intangible emotional factors

B. Case materials

1. Death scene photographs
2. Complete investigative reports
3. Medicolegal reports
4. Photographs of wounds after cleansed
5. Structured interviews conducted
6. **Victimology**

C. Analyst must have working knowledge of

1. Medicolegal terminology
2. Autoerotic fatalities
3. Wound trauma
4. Suicidal behavior
5. Psychological autopsy procedures
6. Scene interpretation

D. Source of information

1. Records--provide documentation
2. Interviews and scene--interviews and the scene provide a variety of information

E. Records

1. Criminal
2. Personnel
3. Medical
4. Credit
5. Bank records
6. Notebooks, writings
7. Diary
8. School
9. Telephone

10. Military
11. Insurance policies
12. Etc., etc.

VII. Interviews

- A. Family
Friends
Associates
Co-workers
Supervisors
Psychiatrists
Doctors
Priests, ministers, etc.
- B. Try to understand the personality of the victim
 1. Key relationships
 2. Compound loss (key relationship)
 3. Documentation
 - a. Obvious stress
 - b. Subtle stress
 - c. Positive stress (Eustress)
 - d. Negative stress (Distress)
- C. Structured to address three questions
 1. What was he/she like?
 2. What occurred in his/her life which could have been stressful?
 3. What were his/her reactions to those stressors?

***CHILD ABUSE /
FORENSIC PEDIATRICS /
SUDDEN INFANT DEATH
SYNDROME***

Forensic Pediatrics

(Deaths in Childhood)

by Arthur E. Westveer, Behavioral Science Unit, FBI

I. Infanticide: the murder of an infant soon after death

A. Elements

1. The infant was born alive
2. Death results from violence or willful act of omission
3. Act or failure to act done with intent to harm

B. Criteria for live-born

1. Air in the lungs: float test of lungs is not reliable
2. Air in the stomach
3. Food in the stomach: presence of food in the stomach is absolute proof of live birth

C. Cause of death

1. Asphyxia (most common)
2. Craniocerebral injury
3. Stab wounds

II. Sudden Infant Death Syndrome (SIDS)

A. Single most common cause of death under one year of age

B. Characteristics of SIDS: In most cases, a well-cared-for infant between one month and six months of age is put to bed and is found, unresponsive, several hours later. The infant may have exhibited mild cold symptoms, but a thorough autopsy reveals no adequate cause of death.

C. Definition (old)

The death of an infant in apparent good health who dies suddenly and unexpectedly and in whose case an autopsy does not reveal a commonly accepted cause of death.

D. Definition (new)

The sudden, unexpected death of an infant under one year of age which remains unexplained after a complete postmortem investigation, including autopsy, examination of the death scene, and review of the case history.

E. SIDS--diagnosis of exclusion

Diagnosis should not be made without a full examination and investigation

F. Frequency

1 per 1,000 live births
11 per 1,000 live births in nonwhites

G. Most Common Social Background

Congested urban areas
Poverty
Illegitimacy
Poor maternal prenatal care

H. Yet, SIDS **does** occur in all socio-economic groups

I. Sex incidence

Male-female ratio = 3:2

J. Age: 85% of cases occur between birth and six months

K. Autopsy results

Nonspecific
petechial hemorrhages
pulmonary congestion

III. Abused Children

A. Battered vs accidental injury

B. General information and statistics

1. Child abuse begins at birth in most cases
2. Abuse can be physical, emotional, or sexual and can include neglect
3. Most deaths occur before the age of 5
4. 80% of all sexually-related attacks on children are by natural parents
5. This year, one million children will be abused in the U.S. Of these, 1,000 will die as a result of the abuse

C. Battered Child: Intentional physical injury inflicted on infants and young children

1. Factors involved in child battering
 - a. parents or caretakers
 - b. child
 - c. environment

2. Common circumstances of child battering
 - a. unexplained illness or injury
 - b. repeated physical abuse
 - c. abuse of parent or caretaker
 - d. delay or failure to report injuries
 - e. misleading statements to medical attendants

3. Morphology of child abuse
 - a. external injuries
burns, abrasions, and bruises of different ages
lacerations of frenulum
bite marks

 - b. internal injuries
head injuries (most common cause of death)
abdominal injuries

 - c. skeletal injuries
avulsion of metaphyses (meat torn from bone)
multiple rib fractures
long bone injuries
skull fractures
when unexplained fractures are found, suspect child abuse

 - d. deprivation of adequate nutrition or environmental needs

SUDDEN INFANT DEATH SYNDROME (SIDS) INFORMATION FOR POLICE OFFICERS

INTRODUCTION

Every night many parents across this country go to bed secure in the knowledge that their babies are resting safely in their cribs, only to discover their infants lifeless in the morning. Why did their healthy infants die? There is no sickness, trauma, or injury to make the death understandable. The families are shocked and confused. An urgent call for help is made, and you are the first responder.

As the first official person on the scene following the discovery of the lifeless baby, your duties in this situation may seem overwhelming. You realize that these parents are clinging to the hope that you can do something to save their infant, though the child is obviously dead. Not only must you try to resuscitate the infant, but you will have to deal with parental reactions ranging from numb silence to violent hysteria. It will soon become obvious to you that there are multiple victims of this tragic disease--the dead infant and the surviving family members.

The first responder must be aware of and sensitive to the traumatic condition of the parents. Life-long feelings of guilt, sibling emotional problems, divorce, and even suicide are all too often the results of this tragic event. SIDS (Sudden Infant Death Syndrome) families must be treated with the same degree of compassion and sympathy as other families who lose a much-loved infant to any other cause. Though you, as the first responder, cannot do anything to alleviate the parents' sorrow, you can provide emotional support and facts about SIDS that may ease their intense guilt feelings. This will be accomplished only when first responders themselves are knowledgeable about SIDS and sensitized to the needs and responses of the SIDS family.

WHAT IS SIDS?

SIDS (Sudden Infant Death Syndrome), commonly known as "crib death" or "cot death," is the number one cause of death in infants between one month and one year of age. About 6,500 babies die of SIDS every year in the United States (two per 1,000 live births). Statistics show that there has not been an increase in the number SIDS cases in recent years, but there is more publicity about them than in the past. SIDS is an extremely widespread condition, occurring in Europe, Australia, Canada, and throughout the U.S. at similar rates. It occurs in both poor and wealthy neighborhoods, in both urban and rural communities.

SIDS is a definite disease that cannot be predicted or prevented, even by a physician. It almost always occurs during periods of sleep. The typical SIDS case involves an apparently healthy infant, usually between the ages of 4 and 7 months, who has suddenly died. No illness has been present; though the baby may have had signs of a slight cold. There is no indication that the infant struggled or cried out while dying. Sometimes, though, the child has obviously changed position at the time of death.

There is evidence that SIDS has been with us since antiquity. In Biblical times it was referred to as "overlaying." Then, as occasionally occurs today, mothers slept with their infants. When a mother woke to find her child dead, it was assumed she had rolled over on him and caused his death.

There is much confusion about SIDS among both the general public and the medical profession. Not until recently has serious medical research on SIDS been conducted. However, doctors are still not certain of its exact causes. One of the hypotheses generally accepted by physicians is that death in SIDS victims occurs as the result of a complete upper airway obstruction. The death, which takes place suddenly, is not believed to cause pain or suffering.

The only way SIDS can be conclusively diagnosed is by an autopsy. Diagnosis is made only after all other causes of death have been ruled out; that is, the autopsy reveals no evidence of a rapidly fatal infectious disease, such as pneumonia or meningitis, or a previously unsuspected abnormality. Knowledge about the cause of death obtained from a thorough autopsy can ease the family's concern and intense guilt feelings.

WHAT SIDS IS NOT

SIDS is not caused by external suffocation.

It is not uncommon for victims to be found wedged into the corner of their cribs or with their heads covered by blankets. Sometimes the face is turned down into the pillow or mattress or is discolored. Under such circumstances, it is natural to assume the baby smothered. However, SIDS also occurs under conditions where there is no possibility of smothering. Investigators have found that even when infants are covered by bedding, the amount of oxygen is not reduced to the point of causing suffocation.

SIDS is not caused by vomiting and choking.

Sometimes milk or even blood-tinged froth is found around the mouth or in the bedding. This has been shown usually to occur after death. Thus it did not block the internal air passages and cause death.

SIDS is not contagious.

SIDS is not contagious. One twin may be taken by SIDS, yet the other remains alive. SIDS is less common after the first year of life, so older children and adults are not at risk. The common viruses that appear to be associated with SIDS do not survive outside living bodies.

SIDS does not cause pain or suffering to the infant.

SIDS can occur within five minutes, and is probably instantaneous. The babies do not cry out and often do not show even the slightest trace of having been disturbed in their sleep.

SIDS cannot be predicted.

At this time there is no known way to predict its occurrence, even if the baby saw a doctor the day of the event. Nothing the parents did or failed to do could have prevented its occurrence.

HOW CAN I TELL IF THE INFANT IS A SIDS VICTIM?

Remember that only an autopsy can determine if a death was due to SIDS. You should make no assumptions about the cause of death. You, as a first responder, can only suspect SIDS as the cause of death. Always give the parents the benefit of the doubt and assume SIDS until an autopsy proves otherwise. However, the fact that a healthy infant is suddenly dead may give rise to suspicions. The general appearance of the child in his crib may be misleading. There have been instances, for example, when a case of SIDS has been mistaken for child abuse. Therefore, it is necessary that you, as the first responder, know some of the identifying features characteristic of the SIDS victim as opposed to the abused child. The following table is a list of the general physical characteristics of each. This table will help you to identify the SIDS baby as well as distinguish him or her from the battered child.

Table 1

SIDS versus Child Abuse and Neglect

SIDS VICTIM	ABUSED AND NEGLECTED CHILD
1. Appears to be sleeping.	1. Adult story does not "sound right" or account for all injuries on baby.
2. May be twisted in the bed clothing.	2. Disfigurements-welts, burns, bruises, etc.- which may be in different stages of healing, or may be scars.
3. Purple mottled markings on head and facial area.	3. Broken bones.
4. Blood-tinged froth around nose and mouth areas.	4. Siblings bearing marks of child abuse.
	5. Physical evidence of general neglect of child (e.g., malnourished).

AS A POLICE OFFICER, WHAT IS MY ROLE IN THE SIDS SITUATION?

When you, the police officer, are the first to arrive at the scene of a possible SIDS death, several tasks must be performed almost simultaneously. You should first initiate resuscitative efforts if the infant is not obviously dead. You must also conduct an "investigation" that will help determine the cause of death. Finally, you must provide leadership and protection to the SIDS family.

It is essential that you begin resuscitative efforts if the infant is not obviously dead. You may save a life. These efforts involve beginning infant Cardiopulmonary Resuscitation (CPR) and continuing it during the transport of the baby to the hospital. CPR is a technique requiring special training and, in some cases, state certification. If you are not trained in this technique, do not perform it. You may do more harm than good--you may kill the one you wish to save. If you are responding with a partner, one of you should assume this duty since it requires your complete attention.

At times, you will find a child displaying the obvious characteristics of death (e.g., rigor mortis and settling of the blood). Under normal circumstances involving a dead baby, you may be legally obligated to leave the body as is and notify the proper authorities, such as the coroner or the medical examiner. SIDS cases, however, are not "normal."

The extreme emotional condition of the parents makes them completely dependent upon you. They are looking to you for help. The best thing you can do for these parents is to make them feel that something is being done. You must understand that often parents cling to the hope that their infant is not dead and can be resuscitated, even when death is apparent. They have expectation that you can save the baby. By starting CPR on the obviously dead baby, you at least allow the family to have the memory (e.g., "If they had only tried, maybe. . ."). These parents will have enough self-imposed guilt and doubt to deal with as the result of SIDS. This does not mean, however, that you are to convey an attitude of false hope. Simply begin resuscitative procedures, inform the parents that everything you can do for the child is being done, and transport the infant to the hospital.

In addition to beginning first-aid procedures on the baby, it is your job to conduct an "investigation" of the scene of the death. This involves observing the scene and making mental notes, which should be written down at the earliest opportunity. Certain questions should be asked of the parents to help clarify matters for you. This should be done as a dialogue, as opposed to an interrogation. Do not pressure the parents for answers. They may really not remember details.

At times, certain items should be preserved for further investigation. This can be done by either taking them with the infant to the hospital or by making sure they remain in their original position until the death scene can be thoroughly investigated. It should be emphasized here that a criminal investigation should be conducted only after the autopsy has shown positive evidence of an unnatural death. There is no need to put these families through the ordeal and overriding implications of an investigation if all indicators point to SIDS. However, you should be aware of what to preserve, should the need arise.

Evidence to Preserve

- Infant's bedding (sheets, blankets, etc.)
- Objects in crib (toys, bottles, etc.)
- Unusual or dangerous items found near death scene (plastic bags, sharp objects, paint chips, etc.)
- Medications - even adult (Note: you may wish to take with you to hospital)

When the time comes to transport the infant to a hospital, you should take charge of the situation. Make sure you tell the parents where you are taking the child. The parents should be allowed to accompany their baby in the police car. If not, give them clear directions regarding where you are taking their baby. Often the parents are in such a state of emotional shock that they are not capable of driving themselves to the hospital. In this case, make other arrangements to get them to the hospital (e.g., taxicab or neighbor). The parents may also need to be reminded to arrange for the care of the siblings. A member of your police team may volunteer to assist in such details.

Once you deliver the baby into the hands of the Emergency Department staff, there is nothing more you can do for him or her. Your attention is now turned to the family of the SIDS victim.

The reactions of family members to the SIDS incident will be as individual as they are. Many factors can affect these reactions: situation of child's death, meaning child had to the individual, marriage relationship, cultural background. You must not misinterpret or read into these reactions. And you, as the first responder, will have to be prepared to deal with them all.

One of the most common immediate reactions to SIDS is shock and disbelief. This may cause family members to become immobilized; incapable of making decisions. Or this may cause them to act as if nothing has really happened. Externally, it may appear as if the parents are cold and unfeeling. It is not that they do not care, but just that they are having a hard time facing reality.

It will be difficult for you to deal with these parents whose reactions are extreme. Some parents may physically act out their emotions, resulting in hysteria, crying or wailing. Parents may be confused and overwhelmed with guilt feelings, unfairly venting their anger and frustration on you. When anger is aimed at you, or perhaps your professional capabilities questioned, your natural tendency is to retaliate with your own angry remarks, which only compounds the problems.

How can the police officer help the SIDS survivors in this difficult situation? First, you, as a professional, must be in command of your own feelings and behavior at all times. Act in a calm, efficient manner, exhibiting kind concern. While in the home, make the parents feel that something is being done. Explain what you are doing and where you

are taking the child. Take command of the situation and try to protect the family from any further stress. At the hospital emergency room, try to keep the parents informed of the child's status. Be careful of what you say to your colleagues at the hospital. Causal comments such as "smothered" or "injured" may be overheard by the family and cause unnecessary emotional distress. Small, often nonverbal, gestures on your part are very important. By simply sitting with the parents, you are showing them that someone cares. Offer to be assistance to them--to make phone calls or to get them coffee. A sympathetic ear may be all these parents need.

Be careful not to "diagnose" the child's problem or to speculate on the outcome. Let all medical information come from the emergency room physician. If you have any questions or comments, or wish confirmation that the child is a SIDS victim, discuss these matters privately with emergency room personnel.

The interview following a sudden infant death will be difficult for both you and the parents. You may already have much of the information you need to complete your report. If SIDS is indicated by the emergency physician as the cause of death, you should explain to them about the disease. Reassure them that they are in no way responsible for the death. If you need additional information, explain that the questioning is routine and necessary to complete your report. The emotional state of the parents may be such that you may wish to postpone the questioning.

The questioning should be done as an interview. Ask open-ended questions such as, "How was the baby yesterday?" Do not ask leading questions or suspicious questions (e.g. "You weren't drunk last night were you?"). Do not ask questions that show you might doubt their capabilities as parents (e.g., "How often did you spank the baby?"). Give your full attention to the parents and listen "actively" to what they are saying.

You will be able to obtain much information if you let the parents tell their story while you actively listen. Encourage them to continue talking by nodding and saying, "Um hm" or "Yes, go on." Try to remain objective--do not express approval/disapproval with any of the actions or facts related. Try not to interrupt except to clarify something they say. If the parents become upset, wait quietly for a minute or two, then encourage them to continue talking by saying something like, "You were saying. . ." At the end of the questioning session, look over your notes to make sure all the necessary information has been obtained.

The time you spend with these families may be brief, but it can have a significant positive impact that influences their recovery from this tragic event.

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PATTERNS OF FATAL CHILD BATTERING

Brian D. Blackbourne, M.D.

Only in the last three decades has the full extent of parental violence upon their children been recognized and medical, social and legal steps been taken to attempt to understand, halt and prevent these tragic events. Prior to 1946 this phenomenon was generally unrecognized aside from infanticide, the killing of a small infant, usually by the mother. IN 1946, Dr. John Caffey¹, a Pittsburgh Radiologist reported his observation of a common association of subdural hematoma and fractures of long bones. Silverman², in 1953 demonstrated by x-ray that previously demonstrated. In 1955 Woolley³ noted that in many cases of long bone fractures in infants and small children, the injuries have been willfully inflicted by parents or siblings. This work laid the foundation for Kempe's paper⁴ in 1962 in which he proposed the name "Battered Child Syndrome". In England the term "Battered Babe Syndrome" is commonly used, and elsewhere it is known by the names of the two men who contributed to its recognition "Caffey-Kempe" syndrome.

The battered child syndrome may be defined as intentionally physical injury inflicted on infants and young children usually by parents or by parents' substitutes. The physical injury is most commonly mechanical force, but may include injury from heat. An associated form of abuse which may or may not accompany battering is emotional or physical neglect.

The term "Battering Child Syndrome" was immediately successful in gaining attention for this neglected clinical and social problem. Almost over night it became the subject of frequent discussions at medical meetings, in courts, social agencies, the press, and on radio and television. Much has been learned, and much has been written in the intervening 12 years. An apparent increase in the number of cases may actually reflect only an increased awareness among medical, law enforcement, and social welfare professionals.

INCIDENCE

The true incidence of the battered child is unknown. From clinical experience, it has been estimated⁵, however, that 15-25,000 infants are significantly injured each year in the United States under circumstances suggesting intentional parental abuse. Between 1969 and 1971 hospital admissions for battered child syndrome represented almost three percent of all pediatric ward admissions to the San Francisco General Hospital⁶. Similarly, variations in death certificate reporting make it difficult to access a nationwide number of fatalities. In 1972 in the District of Columbia, with a population of 750,000, seven battered child deaths were documented, in 1973 five deaths. In a five year study in Philadelphia between 1961 and 1965 Weston⁷ reported 36 infants and children who expired as a result of proven physical injury inflicted by a member of their family, paramour or baby sitter.

FACTORS LEADING TO CHILD BATTERING

Green⁸ has identified three major factors, whose interaction leads to child abuse: the parent's personality characteristics which are incompatible with adequate child

rearing and contribute to their abuse proneness; the characteristics of the child that increase the likelihood of his being abused; and immediate environmental stresses which maximize the burden of child rearing.

The Parent

The family of the battered child frequently falls into the lower socio-economic level. Frequent moving leads to few roots in the community, and separation from other members of their family who may have added significant support to the family and aided in child rearing. It should be stated, however, that the battering parent may be well educated with a stable financial situation and an outwardly stable social background.

The battering parent is more often female than male. Lauer⁶, in a series of battered children compared with a control series of children admitted to hospital for other medical problems, showed that the parents of the battered children were significantly younger than the other parents. 21% of mothers and 9% of fathers were 19 years of age or younger. He concludes that this supports the popular notion that young parents with little child rearing experience, their own adolescent problems, and often an unplanned baby are predisposed to child abuse.

It is repeatedly stated in the literature that many of the battering parents were victims of harsh discipline or of actual physical abuse from their parents during childhood. This pattern of child rearing can thus be carried from one generation to another.

Frequently, one of the adults in the household is not the natural father or mother of the child - as for example in common law, stepfather, stepmother situation or where the boyfriend of the mother resides in the house. Love and compassion for the child may be different, under these circumstances, from that of the natural parent, and the frustration tolerance for the usual childhood annoyances may be less.

Another factor which may play a role is a feeling of competition between the abuse and the child for the love of the mother or father of the child. This competitive resentment may develop into real hostile feelings toward the child.

Emotional immaturity is frequently observed in the battering parent. Actual mental illness may occur. Caffey⁹ concluded that less than 10 percent of battering parents are severely mentally ill. Kempe⁵ reports from his study that in 5 percent of battering families, one parent has a delusional psychosis and in 5 percent one parent appeared to be an aggressive psychopath.

One of the many disturbing and difficult to understand features of repeated child abuse is why the other parent does not intervene, forcibly restrain or report the abusing parent to the authorities. The answer is as complicated and as individual as the psychodynamics of child abuse. In the case of a mother whose child is being beaten by her common law husband or boyfriend it may involve fear for her own safety or threats of physical harm to herself or fear that he will leave her if she interfered, economic dependency upon the abuser, or a passive personality which prevents her from standing up for the child.

The Child

The victim of parental abuse is commonly an infant or small child. Lauer⁵, in a series of 130 hospitalized battered children found 63% under two years of age. One child in a family may be the predominant victim of abuse although Lauer found evidence of abuse or neglect of a sibling in 53% of cases where there were siblings. The child may be the product of an unwanted pregnancy, a pregnancy which began before marriage or which for other reasons was extremely inconvenient.

An area of problem, not yet adequately studied, was described by Caffey in 1972⁹ as the "Provocative Infant". He states that, "an over reactive, demanding, defiant, and exhausting infant may well paralyze the overburdened mother's self control temporarily and release violent impulses to rid herself of him". Some estimate the general incidence of provocative infants in the population to be high as 5 to 10 percent. Adelson¹⁰ in 1961 suggested that, "nine of 44 infants and children studied were killed by their fathers during an emotional outburst triggered by frustration and aggravation from prolonged and repeated crying episodes, defecating in their clothing, persistent harassment, and other temper abrading and eroding activities which goaded the fathers to a point where they resorted to excessive violence either as a disciplinary measure or as an outlet for their explosive anger and sense of futility. In this was even these very young victims of brutal assault may contribute to their subsequent injury".

The Stress

The environmental stress which may precipitate an episode of physical abuse upon a child may not be of profound nature but are rather an accumulation of the frustrations of domestic unhappiness, economic deprivation, social isolation and the 24 hour day care of one or several small children. Elmer¹¹, in a study comparing the families of battered children with a group of control families found that the abusive families lived under constant stress of a kind and degree unknown to the non-abusive (normal) families.

EXTERNAL INJURIES

Some battered children present with such severe cutaneous bruises, periorbital ecchymoses and old scars from lacerations, abrasions and burns that the diagnosis is never in doubt. Others will show such minor external injury, a scabbed abrasion or a small ill-defined bruise on the abdomen or eyelid, that the examining physician or pathologist is surprised to find the multiple healing fractures on x-ray or the profound internal injuries.

Many children have one or two scars from falls, but multiple old or healing scars in a small infant should raise suspicion. Patterned injuries may be recognized by careful examination of cutaneous injuries. Parallel rows of narrow repetitive bruises may indicate blows with a belt. Narrow linear scars or recent abrasions in the shape of a loop may indicate blows with a loop of electrical cord. Small round burns or healing scars may indicate cigarette burns. Larger burns or old burn scars may suggest scalding with hot fluid or contact with a hot object. Deep lacerations are rare and are probably only seen when a blunt object is used to strike the child. Lacerations on the inside of the lips are not

uncommon and can be produced by a hard slap or blow over the mouth with the teeth lacerating the inside of the lips.

One recognized mechanism of producing a burn is to sit a child on a heating appliance in order to dry his wet pants. This may be done by an angered parent attempting to toilet train the child and may result in burns of the buttocks. A very disturbing mechanism of inflicting trauma is the human bite. In this case, the parent actually bites the child and may leave a circular patten of human teeth marks on the skin.

The external examination is also very important to document the child's overall nutrition, height, weight, and state of cleanliness and hydration. These factors all speak to the adequacy of the physical aspects of parental care.

INTERNAL INJURIES

Three main categories of internal injuries are seen in battered children: head injuries, abdominal injuries, and fractures of extremities and ribs.

Head Injury

In two series of hospitalized battered children^{6,12}, 30% and 25% respectively were admitted for head injury, the majority having either a skull fracture or subdural hematoma or both. Head injury was the most common cause of death in hospitalized battered children seen in a medical examiner's office.

The face and scalp may or may not exhibit external evidence of trauma. Extensive hemorrhage may be present beneath the scalp overlying the skull. The skull may exhibit fracture, either a simple straight line fracture or a severe comminuted and depressed skull fracture. Subdural hematomas are relatively common in battered children. They may occur alone or in conjunction with cerebral contusions. All these injuries require moderate to severe mechanical force. The child may be dropped or thrown to the floor, thrown down a flight of stairs, swung by the ankles so the head strikes a wall or other solid object, or repeated blows may be struck to the head by a fist or other blunt object. Caffey¹³ has described another mechanism of injury which may result in subdural hemorrhage and intraocular bleeding in the absence¹¹ of any scalp injury to indicate that the child has struck his head. The mechanism he calls "The Whiplash Shaken Infant Syndrome" results from grabbing an infant by the arms or the thorax and shaking him. It is suggested that permanent brain damage and mental retardation may result.

Abdominal Injury

Due to the fact that the abdominal wall is soft, very severe trauma may be inflicted upon the abdominal organs without significant injury to the skin or the abdomen. One indication of such a condition is a markedly swollen abdomen. Exsanguinating hemorrhage from large lacerations of liver, spleen or small bowel mesentery and peritonitis from lacerated pancreas or ruptured duodenum are all seen in blunt force injuries of the abdomen. Gornall¹⁴ described a two year old who suffered avulsion of the common bile duct

from the duodenum. Any delay in seeking medical attention may contribute greatly to the severity of these injuries or cause death before the child is brought to the hospital. Abdominal injuries are a common cause of death in battered children seen in a medical examiner's office.

Fractures

Skeletal injuries are an integral part of the battered child syndrome and were the first injuries to be documented as being the result of parental abuse.^{1,2,3} Extremity fractures may result from the child being struck, thrown or being grabbed and shaken or the extremity twisted. Fractures of femur and humerus are most common¹². Metaphyseal avulsion and subperiosteal hemorrhages, demonstrated by x-ray in the healing stage, are also induced by shaking an infant¹³.

Rib fractures, frequently multiple and usually posterior, adjacent to their attachment to the vertebra, and relatively common in the battered child syndrome but distinctly uncommon in other forms of trauma in children including falls from heights and automobile crash trauma. The ribs effectively protect the thoracic organs which are infrequently injured in child battering.

Multiple fractures in different stages of healing indicate multiple different episodes of injury. This is a pattern recognized in battered children and thus greatly aids in making the diagnosis. In a series of 110 hospitalized battered children, O'Neil¹² reported 28 long bone fractures, 20 of whom had evidence of old fractures in various stages of healing.

BATTERED CHILD vs. ACCIDENTAL INJURY

Once the external injuries, internal injuries and old and recent fractures have been identified a determination must be made as to whether they represent battered child injuries or whether they can be explained by an accidental event. An inappropriate historical explanation for the injuries sustained is often the first clue to a case of child abuse. These discrepancies may be in the age of the injury, the severity of the injury, when compared to the history, or in the mechanism of injury production.

In a case of repeated old and recent injury with documented old scars, x-ray evidence of old and healing fractures, hospital records of previous injuries and social service records of previous complaints and investigations the patterns of child abuse is quite clear. On the other hand, one encounters cases where only recent injuries are present. Here, especially, one must test the injuries against the history provided by the family. Some injuries are of such severity as to be completely inconsistent with rolling off the bed or falling from a high chair. This degree of suspicion should stimulate a youth division or social service investigation.

NEGLECT

A very distressing phenomenon outside the definition of the Battered Child Syndrome, but within the area of child abuse is neglect, the deprivation of adequate nutrition or

environmental needs. These children, often infants but some up to several years of age are often brought to the hospital dead or moribund weighing little more than their birth weight. They show marked emaciation from malnutrition and dehydration and such poor hygiene that dirt and fecal material may be dried onto the skin. The homes commonly are filthy. Weston⁷ in a study of 24 cases of death from child neglect observed that the neglected child was often the youngest in a large family averaging 3 to 7 children. The average age at death was 5 months. A feature of the investigation is the common disparity between the appearance of the child and the presenting story of the parent who may say that the child would not take is feeding, has mild diarrhea or for one or two days, or had been sick with an upper respiratory infection.

The incidence of death by neglect is not precisely known. Weston reported 24 deaths in Philadelphia between 1961 and 1965. Luke¹⁵ found two such cases in a two year study of all deaths by homicide under 16 years of age in New York City in 1964 to 1965. In the last two years in Washington, D.C. one death by neglect was identified. Weston concluded from the ages of the victims in his study that in an urban environment if a neglected child survives to 1 year and is able to venture out of the home, neighbors or friends will afford necessary care to enable him to survive.

Autopsy examination of these infants must rule out chronic debilitating disease which might explain the child's failure to thrive. Similarly toxicologic examination must be performed to rule out poisoning, overdose of prescribed medication and to eliminate the possibility of lead poisoning.

The fact that these children reach this degree of malnutrition simply by the withholding of food and drink is well shown by those infants who reach the hospital still alive. In the first 24 hours they may gain 5 pounds simply by replacing the fluid their body is lacking from dehydration. In one month in the hospital they may double or triple their admission weight. One such case which was thus rescued from starvation, but released again to the custody of the mother, returned to the hospital dead on arrival, two months later again weighing essentially birth weight.

CONCLUSION

As long as parents, reacting to their own frustration, aggravation and poorly controlled aggression, inflict injury on their defenseless infants and small children the battered child syndrome will remain with us. Society's only hope to reduce this senseless suffering and death is 1) to make the public understand the common reasons for this abuse so that parents who know they are susceptible to this can obtain counselling, and 2) to educate the medical and social welfare professions to recognize the early signs of child abuse so that remedial measures can be taken and further injuries and death can be prevented.

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Sudden Infant Death Syndrome
Pediatrician 15: 191-197 (1988)

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0300-1245/88/0154-0191\$2.75/0

Investigation of Sudden Infant Deaths

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Key Words. Sudden infant death syndrome · Scene investigation · Circumstances of death

Abstract. The diagnosis of SIDS depends on an analysis of information derived from two primary sources: the scene investigation and the autopsy examination. This paper identifies those details that an observer should look for and consider in completing a report of the circumstances of the death.

In order to reach a proper conclusion as to the cause of death of a person who dies suddenly and unexpectedly, a thorough investigation of the circumstances of the death and a complete autopsy examination are necessary. Both components, the investigation and the autopsy, are essential if a reliable conclusion is to be drawn. Omission of one of these elements can place the entire cause of death in question. This fundamental principle of death certification applies to anyone who dies suddenly and unexpectedly regardless of age. However, only during the past two decades has this criteria been applied to cases of sudden and unexpected infant death.

Recent History of Sudden Infant Death Syndrome Investigation

The new focus of infant death investigation was triggered in 1972 by the efforts of concerned professionals, parents and legislators when a joint US Congressional Resolution called upon the National Institute of Child Health and Welfare to make investigations into crib death one of its priorities [1].

Preliminary studies by the Office of Maternal and Child Health (OMCH) identified that the problems fac-

ing SIDS parents were multiple. First of all, there was a prevalent attitude of suspicion held by many law enforcement personnel as well as physicians and the general public regarding the culpability of the SIDS parents in the death of their infant. Secondly, the OMCH identified that death investigation in this country has historically been treated as a state and local responsibility and is governed by a set of inconsistent and often parochial state laws that were often inadequately supported. The initial approach of the OMCH to the problems identified was to commission a study of state death investigation laws [2], to publish Nosology Guidelines for Sudden Infant Death Syndrome [3], to provide uniform guidelines for infant death investigation [4] and to provide follow-up counseling and education to families and those impacted by the infant's death (in 1975, the Office of Maternal and Child Health of the US Department of Health, Education and Welfare awarded 24 community-based SIDS information and counseling grants).

Uniform guidelines for infant death investigation were developed in 1975 in Sante Fe, N. Mex., at a meeting sponsored by OMCH. This meeting was attended by experts in death investigation and infant mortality. A report of the consensus opinion of that group was published in 1976 [5]. As a reaction to the prevalent belief

held by law enforcement and health professionals that many of these deaths were the result of parental neglect, the meeting focused on the importance of the autopsy examination and de-emphasized the role of scene investigation. The consensus of that meeting was that, while an investigation of the circumstances formed an important component of the determination of the cause of death, the investigation should be conducted a minimum of 2 weeks but preferably 1 month after the death by a person 'thoroughly acquainted with all the nuances of SIDS, but not identified with a punitive agency' [5, p. 835]. It was agreed that the appropriate person should be a public health nurse.

A reexamination of this approach to death investigation reveals certain inherent defects. Firstly, the gathering of critical information is delayed and possibly lost forever due to the fact that many families of SIDS victims move during the early days after death. Secondly, accurate documentation of the scene of the infant death is precluded. Environmental conditions can change and cannot be reproduced. Essential details of the sleeping environment can be omitted due to the discarding of cribs, mattresses, covers or pillows. In addition, if the death investigation takes place at some extended time after the death and such an investigation is considered essential to making a proper certification of death, such certification will obviously need to be delayed.

A second inherent defect is that the public health nurse is placed in a conflict of interest situation when she is charged with a dual role of death investigator and grief counselor. What should be the role of the public health nurse when called upon to counsel a family regarding SIDS when she then learns of the existence of a faulty crib in the home and the possible role that it played in the infant's death?

A third problem with the 1975 investigative protocol was that it did not seek certain essential information including the identification and interviewing of the person who first discovered the infant, documentation of where the infant was found and whether his airway had been compromised or obstructed. Neither was there a provision to identify and interview the treating physician to ascertain if the family had a history of questionable child care practices. There was also no provision to contact protective services to determine if the family had an open case file. While the guidelines were presented as being only the minimum data necessary to be obtained prior to autopsy, the emphasis on the nonpunitive approach created certain gaps in the information identified as being relevant.

The importance of contacting the treating physician is illustrated in the following case, investigated by the authors in Wayne County, Mich.

A 4-month-old infant, reported as being in good health, except for prior treatment for a lung infection at 2 months of age, was found dead at home in his crib. The initial investigation revealed that the child had been under the care of a babysitter while the mother worked. There were no external signs of injury. An autopsy was performed and no significant abnormalities were detected except for a slightly reddish-purple zone 1 1/2 inches in diameter on the surface of the cerebral hemispheres, visible beneath the leptomeninges. There was also some flattening of the surface of the brain. Following fixation, this zone was found to represent a cerebral contusion which had most likely resulted from a blow to the top of the head.

A follow-up investigation revealed that the hospitalization of the infant at 2 months of age had been for a superficial skull fracture, rather than a lung infection. The babysitter, when interviewed, revealed that she had not cared for the infant during the several days prior to the initial hospitalization. Neither had she cared for the infant during the 2 weeks prior to his death. The babysitter did state, however, that the infant occasionally would have bruises on his body when he came to her home.

Further investigation revealed that the father had been the primary caretaker of the infant prior to death and a child of his from a previous marriage had died of a subdural hemorrhage. The manner of death had been classified as accidental in that prior case. When the father was interviewed by the police, he admitted that he had struck both infants on their heads with the sole of his shoe because they wouldn't stop crying.

In the 15 years following the US Senate Resolution calling for research into the SIDS, a wealth of information has accumulated in the medical literature regarding the possible causes and mechanisms of death in this group of infants [6]. Valdes-Dapena and Huff [7] have published an excellent manual setting out those procedures necessary for compiling a proper infant autopsy. However, the role of the investigation in the identification of SIDS victims was basically ignored by SIDS researchers. In fact, any detailed investigation conducted by medical examiners and law enforcement individuals was regarded as largely unproductive and potentially damaging to the mental health of the SIDS parents. The authors have observed over the decade following the Resolution, an increasing tendency amongst medical examiners, pathologists and coroners, to accept the autopsy results as the sole requisite of a SIDS diagnosis. The importance of the investigation was largely given lip service. Several dramatic reports in the media of multiple murders of infants by suffocation, jarred the medical community and SIDS families into the harsh realization that when investigations are lacking or inadequate, the

validity of a SIDS diagnosis can be easily discredited [8].

Over an 8-year period in Wayne County, Mich. (Detroit) from 1974 to 1982, the authors investigated approximately 1,100 sudden infant deaths. Approximately 75% of these infants were ultimately classified as SIDS [9]. The remainder were identified as dying as a result of other natural, accidental or homicidal mechanisms. An evaluation of the circumstances surrounding the deaths of most of these infants took place in spite of the fact that approximately 50% of the 1,100 had been transported to emergency rooms by either the parents, police or ambulance.

It is not the purpose of this paper to identify those conditions that may initially appear as a SIDS but are correctly identified at autopsy. These natural disease processes as well as evidence of subtle and obvious signs of child abuse and accidental injury have been adequately documented elsewhere [10].

Rather, the remainder of the paper will focus on the criteria that these authors use in reaching a diagnosis in those difficult cases where there are no demonstrable findings at autopsy and questions of a suspicious or suggestive nature involving the circumstances of the death exist.

Indications for Supplemental Testing, Obtaining Samples for Specialized Testing

It is important to digress slightly at this point to state that the SIDS diagnosis is most appropriately used when a gross autopsy examination is carried out along with auxiliary examination such as histology. It is not the position of the authors that toxicology, virology or bacteriology studies should be carried out on all infants. Rather, such studies should be utilized when the information collected at the scene suggests the presence of a drug or other agent.

In a study of 130 consecutive cases of sudden deaths of infants under 1 year of age in Wayne County in 1978, toxicological studies were carried out looking for substances including alcohol, barbiturates, opiates and organic bases [11]. No instances of drugs causing or contributing to death were identified in the above study, except in those instances where they had been suggested by evidence collected in the course of the investigation. This led to the policy in Wayne County, of conducting toxicological studies where it was warranted by scene investigation or by a parental history of drug use.

On the basis of these criteria, it was determined that at least 1 infant died as a result of methadone intoxication ingested from the breast milk of the mother who was being maintained on methadone. Another infant death caused by methadone intoxication was the result of 2 small siblings feeding their father's weekend bottle of methadone to their infant brother [12]. A recent unpublished case from Wayne County was related to the authors in which cocaine intoxication was the cause of death in a breast-fed infant of a cocaine-addicted mother [personal commun. from Dr. Hareesh Mirchandani, Deputy Chief Medical Examiner, Wayne County, Mich.].

Reports in the literature describe poisonings under 1 year of age from ingestion of a number of noxious agents which include, in part, insecticides by inhalation, oral ingestion of insecticides on nipple of bottle, errors in drop dosage, spider bites and accidental ingestion of drugs, plants and hydrocarbons [13]. This is not to say that large numbers of infants are dying from environmental toxins or medication overdoses. Merritt and Valdes-Dapena [10, p. 204] have stated that it is their belief that such deaths do not commonly masquerade as SIDS. It is also the belief of the authors that when a timely and adequate scene investigation is carried out, the investigator should be able to identify such factors which will lead to the appropriate toxicological tests being ordered.

Other authors have stated that botulism is an occult cause of at least a small percentage of sudden infant deaths and may not be evident from the autopsy alone [14]. A history of the use of honey as a sweetener for the formula or the pacifier may suggest this as a possible factor to consider. In an unpublished study by the authors, no positive cases of botulism were identified in 130 consecutive cases of sudden infant deaths under 1 year in Wayne County in 1978. Microbiological analysis and toxin studies of samples from these victims were carried out in conjunction with the Michigan Department of Health. Control samples had provided positive cultures and toxin tests after transportation to the laboratory in a variety of weather conditions.

Interpretation of Postmortem Changes and Injuries

When infants die in unsanitary environments, the body may be altered by the feeding activity of insects (roaches, ants) or rodents (rats). It is important for investigators to document the presence of such scavengers at

the death scene, since the changes they cause on the body can easily be mistaken as evidence of child abuse [15].

A common finding at the scene of death of a SIDS victim is the intense pulmonary edema evidenced by froth exuding from the nostrils and sometimes the mouth. Occasionally, this froth may be bloody, resulting in prominent staining of the bed linen if the child has been lying on his side or face down. The blood can result from the intense pulmonary capillary congestion that may be secondary to the bradycardia experienced by some of these infants prior to death [personal commun. Dorothy Kelly, Pulmonary Lab, Massachusetts General Hospital, Boston, Mass.].

When circulation ceases, blood will pool by gravity to the lowermost parts of the body. This pooling becomes prominent as a purplish discoloration which can resemble bruising. This discoloration is called livor mortis or lividity. Evaluation of the pattern of lividity present on the body can assist the investigator in determining what the position of the body was at the time of and following death. Knowingly or unintentionally, families may provide inaccurate information as to the location of the body when first observed. One example of the importance of this kind of information is illustrated by the following case history.

An infant was brought to the emergency room with a history of having been found dead in the crib. On external examination, it was observed that the only evidence of lividity present on the body was intense discoloration of both lower legs and feet – similar to that seen in hanging victims. Investigation of the scene and interviewing the family revealed that the infant had been found with his head trapped in a crevice at the top of a crib which had compromised the circulation of blood to the brain. The parents admitted that they had covered up the circumstances of the death because they felt guilty about not having complied with instructions from the crib manufacturer. They had been sent a kit that would have eliminated the dangerous crevice. The kit had arrived 2 days prior to the death but had not been installed. (An infant investigated by the authors who initially presented as a probable SIDS, Wayne County, Mich.)

Another significant scene finding is evidence of regurgitation of formula from the mouth or nostrils of the deceased infant onto the pillow or bedding. This finding is sometimes misinterpreted as an indication that the victim died of aspiration. However, when a person dies and the muscles of the body become flaccid, the sphincters relax resulting in drainage of fluids from body orifices. This represents an agonal or postmortem event. In the case of the infant who dies shortly after a feeding, relaxation of the esophageal sphincter may result in drainage by gravity of fluid from the stomach into the nose and mouth [15, p. 474, 16, 17].

Another physical finding that may mislead the investigator is the postmortem congealing of fat which results in indentations in the skin from tight clothing. When the sleeper is tight at the neck, the resulting mark on the skin can resemble ligature strangulation [15, p. 501].

Identifying Accidental Mechanisms of Death

Since the autopsy alone may be insufficient to differentiate between SIDS and suffocation, or death due to a compromised airway, it is extremely important for the scene investigator to personally interview the individual who was caring for the infant at the time he died and also to interview the first person who discovered the child [15, p. 475]. The authors investigated 16 accidental deaths of infants which occurred as a result of unsafe sleeping environments in Wayne County in 1974–75 [18]. Such unsafe environments can include defective cribs, defective side rails on beds [19], mattresses that are pushed together, mattresses that are too soft, mattresses that are too small for the bed allowing a space between the head or foot boards, and pillows or other objects in the bed that can compromise the infant's ability to maintain an unobstructed airway. All of the above sleeping situations can allow an infant to slip down between mattresses or between the mattress and the side of the bed or a wall and become trapped. Other unsafe sleeping situations include plastic covers in the bed that can become loose and adhere to the face of the infant to block the entrance of air into the nose and mouth, pacifiers that are manufactured in pieces (rather than molded) [20] can come apart and be aspirated by the infant. Cords around the neck can effectively become a ligature for accidental strangulation [19, p. 88]. Other unsafe environments are created when the infant has access to small objects which can become lodged in his airway. Usually such objects can be identified by autopsy. However, on occasion, manipulation of the airway during resuscitation procedures can dislodge the foreign body to another site in the pharynx where it can escape detection if the examination is not extremely thorough [personal obs., 1985].

While it is certainly true that accidental suffocation or strangulation of infants can occur as a result of unsafe sleeping arrangements, it must be emphasized that this information should not be viewed as implying that large numbers of SIDS infants have been dying of suffocation [6, p. 25]. In the experience of the authors and others, the investigation of the scene will reveal whether traumatic

asphyxia was a likely mechanism in the death of the infant [21].

In cases of this type described in the literature, the infants who had been accidentally suffocated were in the younger age group (1 month) [21, p. 485]. This is significant because it has been noted that for some reason, there is a sparing of SIDS infants in the first month of life. Thus, 'the age distribution of SIDS is inconsistent with this hypothesis' [6, p. 25].

Another scene finding that may be mistakenly implicated in the death of the infant is the presence of bed clothing over the face of the child. It has been determined that ordinary, porous materials such as sheets or blankets are probably not capable of producing suffocation [22].

Identification of Cases of Infanticide

Homicidal suffocations are usually perpetrated by a deeply disturbed parent or caretaker. However, the authors are aware of at least one instance when an uneducated parent made a practice of quieting the infant's crying by placing a pillow over the face and pressing softly until the crying ceased. On one occasion when the pillow was removed, the infant was found to have stopped breathing. Other suffocation deaths that can masquerade as SIDS include drowning or blockage of the mouth and nose by plastic 'baggies' or other soft objects [19, personal obs.].

It has been recognized that infant autopsy findings in cases of suffocation can be the same as those found in the infant who dies of SIDS [23]. However, signs of suffocation can be more visible depending on how much force is used. Signs of homicidal suffocation which may be present in a victim include conjunctival petechial hemorrhages, abrasions or scratches in the skin of the nose or mouth, bruises or tears of the mucous membrane of the gums and lips and swelling of the brain (cerebral edema). All or none of these findings may be present in a particular case. However, a careful search must be made if such evidence is to be identified.

There are a number of red flags to alert the investigator of the need for a more intensive investigation. Parents who perpetrate such crimes can sometimes be identified when they give inconsistent stories about the death to other family members, friends, physicians or investigators [24]. Severe depression or mental illness of the mother, father or caretaker, more than one unexplained infant death in the family, a prior history of child abuse

or neglect of the deceased infant or a sibling, prior unexplained collapses of the infant necessitating emergency treatment, or prolonged periods between the collapse and the notification of emergency medical or law enforcement personnel are additional indicators of a possible unnatural event.

A recognized characteristic of abusive parents is their absence from the bedside of their hospitalized child. However, the authors have observed that the immediate grief reactions of parents rarely differed regardless of the final mechanism of death; i.e., parents of abused children were often just as distraught as parents whose children died naturally [18]. It has been reported that parents who suffocate their infant may even engage in prolonged efforts to revive the child [24].

It must be emphasized, however, that the existence of one or more of the above factors does not necessarily imply that the death was a homicide. Reports in the literature describe certain families as experiencing multiple unexplained deaths of infants [25]. There are even instances when twins have died simultaneously [26].

The authors have investigated the deaths of a number of infants in families that have experienced more than one fatality from SIDS. A family who has lost one infant to SIDS is at a slightly increased risk for losing a second infant the same way [6, pp. 14-16]. The authors have investigated the deaths of several infants in one family who had experienced 5 sudden and unexpected infant deaths. The 2 surviving children underwent extensive medical testing [unpubl. account of 5 sudden infant deaths in one family from the Children's Hospital Medical Center, Boston, Mass. and the Michigan Regional SIDS Center]. The surviving 8-year-old girl was identified as having a seizure disorder and the surviving infant had episodes of apnea (30 s). This last infant was maintained on an apnea monitor for the first year of life. The present status of these children is unknown.

In a recent controversial study of death scene investigation of sudden infant deaths in New York, Bass et al. [27] alleged that 26 consecutive cases of sudden infant death were misdiagnosed by the New York City Medical Examiner. In 2 cases, Bass et al. ignored autopsy findings consistent with SIDS and, based on a history of infant shaking, diagnosed 2 deaths as shaken baby syndrome [27, cases No. 13 and 17]. As support for this conclusion, the authors utilized a 1968 article which related spinal injury to SIDS [28]. This article had been refuted in the same journal the following year [29]. The term, shaken baby syndrome, was originally developed to describe 'a clinicopathological entity occurring in infants character-

ized by retinal hemorrhages, subdural and/or subarachnoid hemorrhages and minimal or absent signs of external trauma' [30]. At autopsy, these entities are clearly demonstrable and are certainly not consistent with SIDS. Furthermore, the concept that shaking alone can cause the severe head injury of the type described above has come under recent scientific scrutiny and probably has been repudiated [30].

Identification of Environmental Mechanisms of Death

When the history of the child reveals that he has been lethargic or has vomited prior to death, it is especially important to rule out environmental or infectious causes of death. A 2-week-old infant in Franklin County, Ohio, was diagnosed as dying as a result of chemical toxicity from the fumes produced by a solvent in the stain on his basket crib. The diagnosis was based on toxicological studies which identified significant levels of hydrocarbons in the tissues of the infant [30].

Parents often have questions about the role that insecticides or paint play in their infant's death, especially if the house had recently been fumigated or painted before the child died. If such questions are identified before the autopsy, special toxicological tests can be performed either locally or in special reference labs.

Deaths due to carbon monoxide poisoning produce a characteristic cherry red discoloration of the lividity on a body. Such discoloration is readily apparent to a trained investigator. However, if any question exists regarding a possible source of carbon monoxide in the sleeping environment (such as a portable heater), a small sample of blood can be readily tested to identify the presence or absence of significant levels of carboxyhemoglobin.

Excessive heat has been implicated as a cause or contributory factor in some infant deaths [6, p. 21]. In order for this mechanism to be implicated in the death, proper documentation of the environmental temperature should be obtained. In one case which the authors observed, the intense heat was obvious in the closed room where the infants slept. Both children exhibited obvious signs of dehydration.

Conclusion

In order for the diagnosis of SIDS to withstand possible intense scrutiny, the investigation must be thorough and professional. All concerned in the case study must

recognize that the investigative data is as important as the information gathered at the autopsy and, in some cases, the investigation alone provides the solution to the question of why an infant suddenly died.

Acknowledgment

The authors wish to thank Carol Castellaw for her loyal assistance in the preparation of the manuscript.

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Received: March 16, 1988

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INVESTIGATION OF SUDDEN INFANT DEATHS

1. **IDENTITY:**
NAME _____ DOB _____
AGE/RACE/SEX _____ ADDRESS _____
MOTHER _____ FATHER _____
TELEPHONE # _____

2. **SCENE:**
ADDRESS _____
LAST FEEDING _____ WHAT _____
LAST SEEN ALIVE: By Whom _____ Time _____
Activity _____
FOUND BY _____ RELATIONSHIP _____
CARETAKER Orientation, appropriate responses, medications, intoxication
Day _____ Night _____
Where _____
(Circle) (Describe [eg. Mattress: Firm, soft, very soft])
BEDDING Waterbed Sheepskin BeanBag Wide Side Rails or Slats
Plastic Sheets Lax Bedding Dresser Drawer Artificial Bed
Playpen Parent's Bed Mattress Pillows Blankets

POSITION OF INFANT In relation to mattress, side rails, toys, bedcovers, compression of face, neck, or chest; trapped; prone/supine (sleep/death); overlaying

ENVIRONMENT Clean, order, debris, organization, thermal state, vermin, rodents, food

RESUSCITATION GIVEN Type (CPR, tube, IV);
INITIALLY: By whom? _____
SUBSEQUENTLY: By whom? _____

3. **PREGNANCY:**
PREVIOUS BIRTHS Premature, stillbirths, gravida, parity

COMPLICATIONS Hypertension, infection (type), severe vomiting, ruptured membranes, premature labor, diabetes, anemia, bleeding, medications, illicit drugs, alcohol, smoking (amount)

DELIVERY Gestation; twins/single; vaginal/cesarian (reason); breach; hospital; physician; duration; complications: infection, respiratory distress, birth defects _____

PERINATAL Birth weights; infant response; special care needed; length of stay/treatment.

4. **HOME CARE:**
FORMULA OR BREAST FED Type/amount, other goods, fussy, appetite, last time given

IMMUNIZATIONS DPTX; OPVX; HBVX; HIBX. Last date given: Any fever or seizures? _____

5. **EVIDENCE OF RECENT ILLNESS:** (Type, Duration)
UPPER RESPIRATORY Stuffy nose, wheeze, congestion, cry/type, apnea, monitor, cough, fever [°F] _____

INTESTINAL Vomiting (color, duration) _____
Diarrhea (color, duration) _____
Fever [°F] _____
Appetite _____
Distention of abdomen _____

RASHES When, where, duration _____
ALLERGIES Skin, lungs (wheeze), bowels (diarrhea, vomit) _____

SEIZURES When/type/treatment _____

ANY RECENT MEDICATIONS (Of infant, of caretaker) _____

ANY MEDICAL ATTENTION When, where, physician, diagnosis.
Hospital _____
Surgery _____

ANY RECENT FALLS OR INJURIES _____

EXPOSURES TO INFECTION When/how/who _____

6. **DEVELOPMENT:**
TYPE OF EATER Good, slow, fussy
IRRITABLE
RESPONSES Looks at parents, hold head up, rolls over.

7. **FAMILY HISTORY:**
FATHER Age _____ Health _____
MOTHER Age _____ Health _____
BROTHER(S) Age _____ Health _____
SISTER(S) Age _____ Health _____

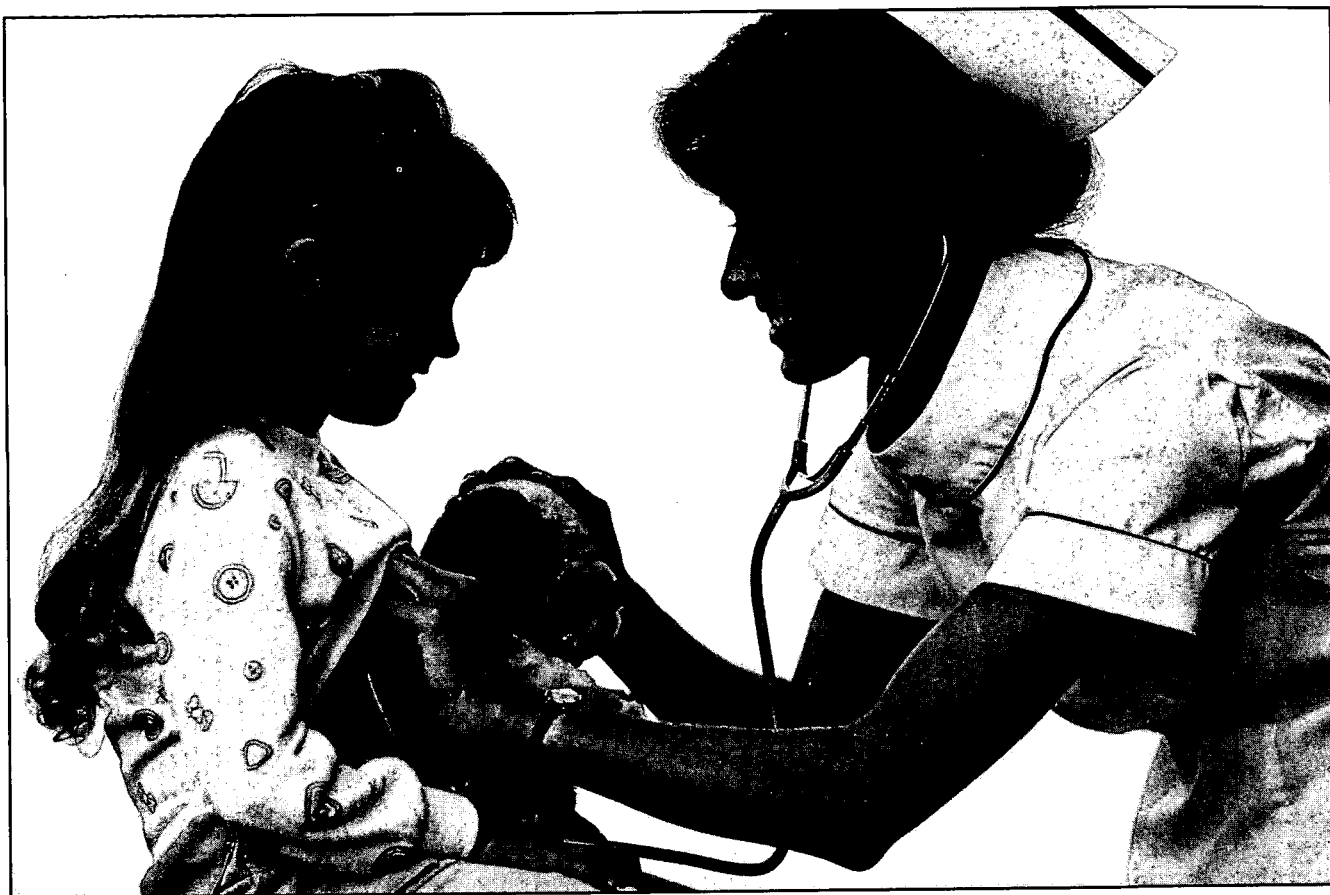
Has any member of family had SIDS or sudden death? _____
When, age, diagnosis, relation _____

Any heart disease, lung disease? _____
Is baby cared for by parent, babysitter, day care center? _____
By whom? Name _____ Age _____
Address _____
Experience _____

8. **PHYSICIAN/INSTITUTION CARE GIVER:**
Physician or clinic
Name _____
Address _____
Phone # _____

9. Compare growth chart (presently) and physician data with information given by child's care giver.
MISCELLANEOUS:

***MUNCHAUSEN
SYNDROME BY PROXY***



Munchausen Syndrome By Proxy

By KATHRYN A. ARTINGSTALL

The dawn of the 1990s brought widespread recognition of a once-obscure criminal act, Munchausen Syndrome by Proxy (MSBP), in which subjects injure or induce illness in children in order to gain attention and sympathy for themselves. Since its recognition by the criminal justice community, MSBP has been identified most closely with mothers who induce in their children breathing difficulties that mimic the symptoms of apnea and sudden infant death syndrome, who poison them, or who fabricate illnesses in their children. These mothers then bask in the attention afforded them by relatives, doctors, and hospital

personnel. However, because the child's illness has no medical cause, doctors have difficulty making a diagnosis.

As the baffling symptoms continue, doctors or hospital administrators may call on law enforcement to investigate the mysterious circumstances surrounding such cases. In fact, as the medical community becomes increasingly familiar with MSBP and its warning signs, doctors and medical staffs seem to be more inclined to request the assistance of local law enforcement agencies.

The growing list of MSBP cases underscores the need for investigators to understand the

various—and often complex—issues related to MSBP. During the past several years, a number of variations to the normal offender patterns have emerged, accompanied by a clearer understanding of how law enforcement should respond to cases believed to involve MSBP. The more investigators know about MSBP, the better able they will be to identify perpetrators, clear innocent suspects, and most important, protect children.

Research on MSBP

Researchers documented the serial nature of MSBP victimization in a study of 5 families with a total of 18 children.¹ In this study,



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“
...a growing list of cases involving Munchausen Syndrome by Proxy confirms that this disorder represents a substantial challenge to the criminal justice system.
”

72 percent of the children were known to be MSBP victims.

In each family, only one child was involved at any given time, and a total of five children seemed to be unaffected. Of those children affected, 31 percent died. In only one instance was there any other form of abuse present.

The characteristics of the maternal perpetrators in this study indicated the following: 80 percent possessed backgrounds in health professions; 80 percent manifested Munchausen Syndrome (self-inflicted injury) themselves; 80 percent received psychiatric treatment prior to diagnosis; and 60 percent of the mothers attempted suicide. Denial persisted in most cases.

The research also shows that individuals who initially engaged in Munchausen Syndrome may eventually practice Munchausen Syndrome by Proxy.² The degree to which the offspring of Munchausen offenders become the subjects of abuse may increase

proportionately with the number and increased severity of incidents of self-inflicted abuse.

MSBP may occur when the perpetrator of Munchausen Syndrome crosses over the threshold of self-inflicted injury into abuse of an unsuspecting child. Oftentimes, the caregivers (offenders) claim that injuries to the child were inflicted by a fictitious bad guy. In some instances, offenders injure themselves in order to substantiate the presence of this unknown perpetrator. Cautious, diligent investigation of these allegations often leads to dead ends based on a series of false crime reports.

Although there seems to be a multigenerational link between Munchausen Syndrome and MSBP, this connection has not been established scientifically to the level that most courts require. The level of understanding that members of the criminal justice system possess regarding Munchausen Syndrome and MSBP makes a crucial difference to the outcome of these

cases. The ever-present possibility of continued victimization of children at the hands of MSBP offenders further underscores the importance of handling these cases expediently.

Establishing MSBP as a possible extension of Munchausen Syndrome will not be an easy task for investigators and prosecutors if the acts have not advanced to the point of physical abuse. Most courts are unwilling to remove a child from a parent's custody without concrete evidence to support charges of child abuse.

Understandably, detectives experience considerable frustration when working on these types of cases. Incidents falsified by offenders and seemingly verified by means of self-mutilation only add to the mystery when a perpetrator cannot be identified.

Perpetrators

In the standard offender-victim relationship, suspicion centers on the biological mother. In fact, the vast majority of MSBP cases resolved through investigation have implicated the victim's mother as the sole offender.³

Investigators should be aware, however, that the MSBP offender profile has widened to include other perpetrators, both within and outside the victim's family structure.⁴ Fathers, grandmothers, aunts, and babysitters have been identified as offenders. Regardless of the relationship to the victim, the offenders all had one thing in common—each acted as the victim's primary caregiver.

In very rare cases, medical professionals also could be included in the list of potential suspects. While it appears that only immediate family members would receive the gratification from attention, increased self-esteem, and false sense of belonging afforded by MSBP, similar motivations lead some health-care workers to cross the line of the Hippocratic Oath into the realm of child abuse. By inflicting MSBP, and then "saving" the child, these offending medical practitioners hope to excel within their fields and win acceptance by their peers.

Fortunately, the frequency of cases involving health-care workers has been relatively low thus far. The possibility exists, though, that a medical professional's actions might indicate MSBP in certain circumstances.

Investigations of this type are highly sensitive. Often, medical personnel are wrongly accused by actual offenders who perceive that they have come under suspicion. Still, an investigator's decision to suspect or accuse medical professionals of MSBP should be based on the same standard of investigation used for other suspects. However, the primary caregiver status inherent in the most common offender profiles continues to place mothers at the height of suspicion.

Investigative Guidelines

The methods by which investigators approach suspected MSBP offenders are the keys to resolving such cases. During interviews, investigators should not express open disbelief in their accounts of

criminal incidents. Rather, investigators need to convey to the suspect that they are keeping an open mind regarding the case. Investigators can expect sound rationalization on the part of such offenders, as well as a series of open-ended allegations that cannot be substantiated.

Investigators should make every effort to segregate other family members from suspects during the

interview process because relatives probably will voice support and belief in the allegations if the suspect is present. In those cases where obvious inconsistencies exist, family members might view facts differently when questioned away from the suspect.

With further investigation, identified MSBP offenders might be linked to the deaths of their other

Profile of MSBP Offenders

- Are most often biological mothers of the victims, but potential offenders are not limited to this group; fathers and persons outside the family also have been identified
- Are often upper class, well-educated persons
- Remain uncharacteristically calm in view of the victim's perplexing medical symptoms
- Welcome medical tests that are painful to the child
- Praise medical staffs excessively
- Appear to be very knowledgeable about the victim's illness
- Have some medical education—either formal or through self-initiated study/experience
- Might have a history of the same illness as the victim
- Typically shelter victim from outside activities, such as school or play with other children
- Allow only selected persons close to their children
- Maintain a high degree of attentiveness to the victim
- Seem to find emotional satisfaction when the child is hospitalized because of the staff's praise of their apparent ability to be a superior caregiver.

children. Often, the original medical examiners incorrectly identified these deaths as resulting from sudden infant death syndrome.

If the deceased child or children have not been cremated, then exhuming their bodies for forensic testing might be appropriate. When advised of previously identified causes of death within a family, forensic pathologists or medical examiners might be able to uncover particular toxins or evidence pointing to homicide.

Questioning Victims

Whether the child actually knows that the offender has induced the illness depends on the child's physical age and the offender's covert skills. Certainly, the longer the abuse continues and the older a child grows, the more likely it becomes that the victim will understand the offender's actions.

If the abuse has been present throughout the life of the child, then the victim might believe that whatever action is being done to cause the illness is normal. Because of this misunderstanding of normal behavior and the attention that the offender lavishes, the child might not view the offender as anything less than an ideal caregiver, even if the abuse is blatant.

Law enforcement officers generally should refrain from interviewing the victim for two reasons. First, even if a victim is old enough to talk, the child probably will not be able to assist officers verbally in the

investigation. Second, officers must consider the potentially traumatic consequences should the child be told that a trusted caregiver is in fact an abuser. For these reasons, it would be wise to elicit the help of professionals when dealing with this



aspect of the investigation to lessen the possibility of further traumatizing the victim.

Victim Safety

In MSBP-related cases, investigators face additional concerns for the safety of the child involved. Suspected offenders might react in a number of ways when confronted by the police.

Generally, offenders deny the allegations and blame the child's apparent illness on unknown causes. Often, an upsurge in the severity of the victim's symptoms follows as the offender attempts to prove the presence of the illness. Unfortunately, the child might not be able to withstand the escalating abuse or the increased treatments prescribed to address the symptoms.

In order to reduce the possibility of further abuse to the child, investigators must work toward a swift conclusion to the case once they have confronted the suspected offender. Accordingly, case parameters and guidelines regarding evidence collected should be established *prior* to informing the subject of the investigation. Careful planning and caution in this area can be critical; research indicates that from 9 to 31 percent of all MSBP victims die at the hands of their perpetrators.⁵

Some confronted offenders might react more passively by relocating with the victim and other family members. If the courts do not enact protective measures to preclude a suspect from relocating with the child, the cycle of MSBP probably will continue in a new locale.

To avoid this scenario, investigators should ensure that adequate measures to protect the victim are in place via social services or judicial avenues before informing subjects that they are under suspicion. These measures should remain in place until the case is concluded.

If not arrested, offenders who believe they are under suspicion might become more cautious, but only temporarily. The child's apparent illness might subside until the offender believes it is safe to resume the abuse. Offenders also may wait until a reasonable time elapses and then re-admit the child into the hospital.

In either case, it appears that as offenders continue their abuse, the danger to the child increases. The needs-oriented behavior of such offenders has been compared to that of drug addicts. Through cycles of abuse and nurturing, MSBP offenders seek to satisfy an ever-increasing need for attention and self-validation. However, some experts believe that—unlike most drug addicts—MSBP offenders cannot be rehabilitated.⁶

False Allegations

Despite seemingly strong circumstantial evidence present in some cases of apparent MSBP abuse, law enforcement officers must make every effort to refrain from making false allegations. Accusations based on insufficient investigation and absent forensic analysis can have disastrous consequences.

In one such case, a mother in Missouri was falsely accused of the death of her infant son. The child died as a result of apparent ethylene glycol poisoning. However, upon the birth of a second baby, doctors found that the infant had a rare disease, methylmalonic acidemia, which in fact, had caused the death of the first child. The mother subsequently

initiated legal action against the State.

Such cases reinforce the need for investigators to explore all avenues when suspicion of MSBP arises. The importance of medical evaluation cannot be overstated. In fact, without properly collected medical documentation to support the thesis of MSBP abuse, it is unlikely that prosecutors can establish probable cause to support custodial arrest.

Child Custody Cases

The manner in which charges of MSBP originate must be considered in the total course of an investigation. Highly disputed child custody cases often generate charges of child abuse. Sometimes, MSBP offenders accuse the other parent of abuse in order to mask their own wrongdoing and to keep custody of the child.

In cases where an estranged parent involved in a custody dispute reports illnesses or accuses the other

Motivational Factors

One or more of the following motivational factors might be present in MSBP cases:

- Most offenders crave the attention gleaned from hospital staffs, doctors, and family members
- Offenders become more aggressive as time passes
- Some offenders in theory might receive gratification as they fool the doctors. They derive enjoyment from knowing what is wrong with the child while medical experts remain baffled
- Some offenders may fear going home or adjusting to a normal daily routine without being the center of attention
- A relatively minor crisis—such as the fear of being left alone or of the child's being released from the hospital—could trigger an attack on a victim
- An offender who is praised as a hero for saving a child might elect to re-create that euphoria by fabricating subsequent incidents of abuse and revival of the victim.

parent of child abuse, investigators should explore all potential motivations for such accusations. Falsified

reports for custodial purposes could be a valid concern. Any investigator assigned to a potential MSBP case

needs to ensure that the agency is not being used as a tool for secondary gain by the accusing parent.

In cases where reports of abuse emanate from a noncustodial or estranged parent, the question of accuser/inflictor role reversal should be considered as an alternate cause of the child's ailments. This type of issue often arises in contested divorce situations involving minor children and also might be linked to parental kidnaping by noncustodial parents.

When custody has been denied to an offending parent, and the victimized child has been placed with the other parent, the offender might go to great lengths to regain custody. Accusations of sexual abuse, especially if the custodial parent is the father, might be made by offenders as they attempt to disguise their responsibility for the child's abuse.

The underlying rationalization for the actions of MSBP offenders stems from their desire to regain lost custody through outward expressions of love. It appears that the longer offenders are separated from victims, the more desperate and determined they become to regain custody.

Domestic Violence Shelters

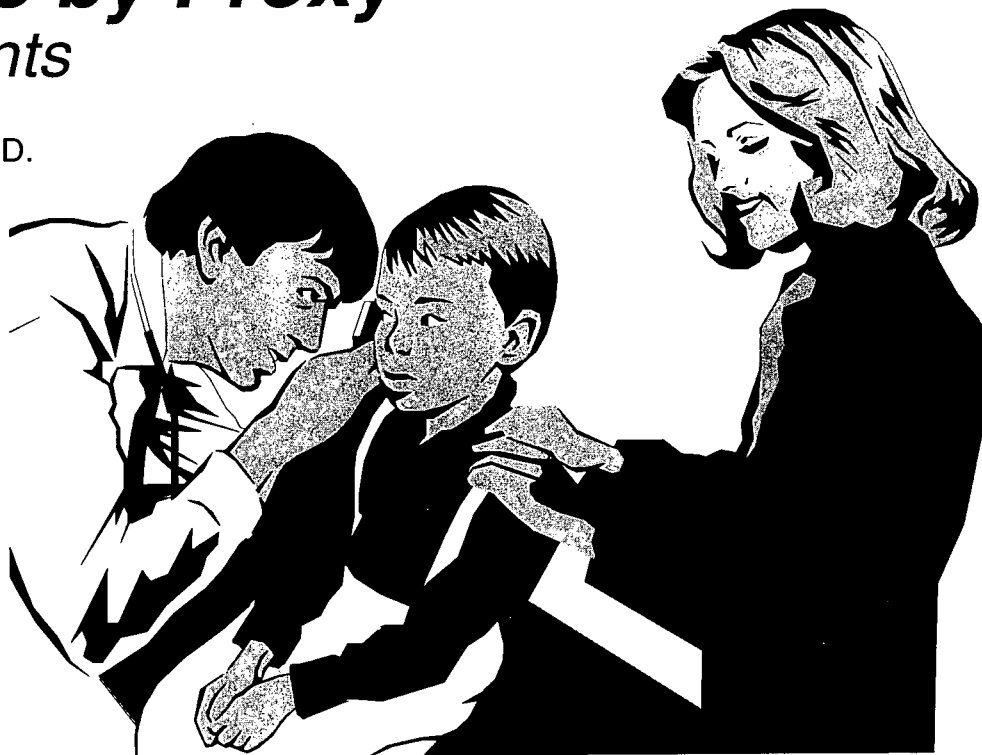
Suspected MSBP offenders who believe that they are being watched, have been accused of MSBP abuse, or sense the need for self-vindication might seek assistance by accessing public shelters provided for victims of domestic violence. In such cases, offenders rely on their highly developed skills of deception.

MSBP Warning Signs

- Unexplained and prolonged illness that puzzles experienced doctors who may state that they have "never seen anything like it before"
- Repeated hospitalizations and extensive medical tests that fail to produce a diagnosis
- Symptoms that do not make medical sense
- Persistent failure of the victim to respond to therapy
- Signs and symptoms that dissipate when the victim is removed from the suspected offender's presence
- Mothers who do not seem worried about their child's illness but are constantly at the child's side while in the hospital
- Mothers who have an unusually close relationship with the hospital's medical staff
- A family history of sudden infant death syndrome
- Mothers with previous medical or health-care experience who have a history of the same type of illness as their child
- A parent who welcomes medical testing of the child, even if painful
- Attempts to convince the staff that the child is still ill when advised that the child will be released from the hospital
- A model family that normally would be above suspicion
- A caregiver with a previous history of Munchausen Syndrome
- A caregiver who adamantly refuses to accept the suggestion that the diagnosis is nonmedical.

Munchausen Syndrome by Proxy Case Accounts

By
STEPHEN J. BOROS, M.D.
and
LARRY C. BRUBAKER



Hieronymous Karl Fredrich von Munchausen was an 18th century German baron and mercenary officer in the Russian cavalry. On his return from the Russo-Turkish wars, the baron entertained friends and neighbors with stories of his many exploits. Over time, his stories grew more and more expansive, and finally, quite outlandish. Munchausen became somewhat famous after a collection of his tales was published.¹

In 1794, at the age of 74, Munchausen married Bernhardine Brun, then 17 years old. It is said that on their wedding night, the

baron retired early, and his bride spent the night dancing with another. In 1795, Bernhardine gave birth to a son. Following the birth of this child, it was whispered that "the life of the Munchausen child will likely be short." The boy, named Polle, died at approximately 1 year of age under suspicious circumstances.²

Almost a century later, an unusual behavior pattern among young men gained recognition in the writings of Charcot. In 1877, he described adults, who through self-inflicted injuries or bogus medical documents, attempted to gain hospitalization and treatment. Charcot

called this condition "mania operativa passiva."³

Seventy-four years later, in 1951, Asher described a similar pattern of self-abuse, where individuals fabricated histories of illness. These fabrications invariably led to complex medical investigations, hospitalizations, and at times, needless surgery. Remembering Baron von Munchausen and his apocryphal tales, Asher named this condition Munchausen's Syndrome.⁴

Today, Munchausen's Syndrome is a recognized psychiatric disorder. The American Psychiatric Association's *Diagnostic and Statistical Manual of Disorders*

(DSM III-R) describes it as the "intentional production of physical symptoms."

MUNCHAUSEN SYNDROME BY PROXY

The term "Munchausen Syndrome by Proxy" (MSBP) was coined in a 1976 report describing four children who were so severely abused they were dwarfed.⁵ In 1977, Meadow described a somewhat less extreme form of child abuse in which mothers deliberately induced or falsely reported illnesses in their children. He also referred to this behavior as MSBP.⁶

Over the years, alternate terms, such as "Polle's syndrome" and "Meadow's syndrome," have been suggested; however, these terms never gained popularity. In contrast to its adult namesake, the American Psychiatric Association's DSM III-R does not consider Munchausen Syndrome by Proxy a psychiatric disorder.

Tragically, MSBP victims are usually children, and the perpetrators are almost always parents or parent substitutes. If and when victims are hospitalized, they may be subjected to multiple, and at times, dangerous diagnostic procedures that invariably produce negative or confounding results. When the victim and abuser are separated, however, the victim's symptoms cease. When confronted, the abuser characteristically denies any knowledge of how the child's illness occurred.

CASE REPORTS

In recent years, medical personnel at Children's Hospital in St. Paul, Minnesota, and local law en-

forcement agencies encountered several MSBP cases, three of which are outlined here. Two of the cases were presented with apnea, a condition where breathing temporarily stops. The third case was presented with recurrent infections masquerading as an immune deficiency.

Case #1

Victim

MA, a 9-month-old boy, was repeatedly admitted to Children's Hospital because of recurrent life-threatening apnea. At 7 weeks of age, he experienced his first apneic event, and his mother administered mouth-to-mouth ventilation. Spontaneous respiration returned, and MA was hospitalized, treated, and discharged with a home monitor.

During the next 9 months, MA experienced 10 similar events and 7 more hospitalizations. Eight of the events required mouth-to-mouth ventilation. All of these episodes occurred while mother and child were alone, and only MA's mother

witnessed the actual events. Two episodes occurred in the hospital.

Unfortunately, despite many tests and surgical procedures, MA's apnea persisted, and his growth slowed. Because of his persistent apnea and failure to thrive, MA received home nursing care. During these home visits, several nurses observed that MA would refuse to eat in his mother's presence. If she left the room, however, he would eat.

In time, both medical and nursing staffs became increasingly suspicious that Mrs. A was somehow responsible for her child's apnea. To better observe mother-child interaction, MA was moved to a hospital room equipped for covert audio-visual surveillance.⁷

On the sixth day, the video clearly recorded Mrs. A bringing on the apnea by forcing the child into her chest, which caused him to lose consciousness. MA became limp and experienced a falling heart rate. Mrs. A then placed the baby back on the bed, called for



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Special Agent Brubaker is assigned to the FBI's Minneapolis Division.

help, and began mouth-to-mouth resuscitation.

The hospital immediately informed child protection services and police authorities, who reviewed the recording. Shortly thereafter, a team consisting of a physician, nurse, social worker, and police officer confronted the parents. At first, Mrs. A expressed disbelief at the suggestion that she smothered MA, but when she was informed of the video, she made no comment. She was then arrested.

Family History

Mrs. A was a 36-year-old occupational therapist and the mother of

three boys. Late into her pregnancy with MA, she worked in an early intervention program for developmentally delayed children. During many of MA's hospitalizations, she appeared caring and concerned, but emotionally distant. Clearly, Mrs. A was the dominant parent, who made all decisions regarding medical treatment.

Followup

Mrs. A subsequently pled guilty to felonious, third-degree assault. At the time, she stated: "The only time I ever caused MA to stop breathing was in the hospital." She received 3 years' probation during

which she was to receive psychotherapy. If she successfully completed psychotherapy, the felony charge would be reduced to a misdemeanor. She also had to live apart from her children and could only visit them in the presence of two adults.

MA had no further apnea, and at 24 months of age, he appeared vigorous, healthy, and normal. Eventually, the family was reunited.

Case #2

Victim

CB, a 10-month-old girl, was admitted to a hospital because of recurrent life-threatening apnea. CB was born in another State and was sexually assaulted at the age of 3 months by an acquaintance of her father. After the assault, local child protection services closely monitored the family.

At 6 months of age, CB experienced her first apneic episode. Her father shook her vigorously, then administered mouth-to-mouth ventilation. She was subsequently admitted to a local hospital. After examination and treatment, she was discharged with a home monitor. During the next 2 months, CB experienced six apneic events and three hospitalizations. The family then moved to Minnesota.

During her first month in Minnesota, CB experienced four apneic episodes and three more hospitalizations. All required vigorous stimulations to restore spontaneous breathing. Other family members observed the child immediately following the events. However, only CB's father ever witnessed all of the

Help for Investigators

Investigators assigned to work child abuse cases should investigate cases of MSBP as they do similar cases of abuse. In general, however, when confronted with possible cases of MSBP, investigators should:

- Review the victim's medical records to determine condition and illness
- Determine from contact with medical personnel the reporting parent's concerns and reactions to the child's medical treatment
- Compile a complete history of the family to determine previous involvement with law enforcement agencies, medical facilities, and social and child protection services
- Compile a detailed social history of the family, including deaths, injuries, and illnesses
- Interview family members, neighbors, and babysitters
- Use video surveillance in the hospital in accordance with State law, and
- Use a search warrant for the family's residence when collecting evidence of the assaults.

actual events. CB was eventually referred to Children's Hospital.

While in the hospital, CB had no clinical apnea or monitor alarms. And, most of the time, she appeared happy and playful. However, when anyone attempted to touch her face, she became hysterical and combative. Over time, both the medical and nursing staffs began to suspect that CB's parents were responsible for her apnea.

Local police and child protection services were notified, and CB was placed in a room with covert audio-visual surveillance.⁸ On the third day of video monitoring, the video recording clearly showed CB's father producing an apneic event by smothering her. Mr. B was viewed picking up the sleeping child, placing her prone on the bed, and forcing her face into the mattress. CB awoke and struggled to escape, wildly kicking her legs. Mr. B continued until CB's struggling stopped and she appeared limp and unconscious. Then, he repositioned her on the bed and called for help. A nurse entered the room, stimulated her, and administered supplemental oxygen.

CB's parents were confronted by a physician, nurse, and police officer. Mr. B adamantly denied smothering CB. He was subsequently arrested and removed from the hospital.

Family History

Mr. B. was a 27-year-old, unemployed, semi-literate laborer in good health. He was actively involved in CB's day-to-day medical care and was clearly the dominant parent. He also became very knowl-

edgeable of the mechanics of the various county and hospital welfare systems. Officials described him as "demanding and manipulative." During CB's hospitalizations, the family lived in a hotel adjacent to the hospital with room, board, and radio pagers provided by the hospital. Throughout CB's hospitalization, Mrs. B was passive and deferred all medical decisions to her husband.

“...MSBP victims are usually children, and the perpetrators are almost always parents or parent substitutes.”

When they first arrived in Minnesota, the family received emergency financial assistance and was closely monitored by local social service agencies. Four years earlier, Mrs. B was allegedly assaulted and raped. Two months prior to CB's monitored episode, Mrs. B was evaluated at a local emergency room for a "hysterical conversion reaction."

Followup

Following the incident at Children's Hospital, Mr. B was taken to the county jail, and upon viewing the video, he admitted to smothering CB. He also was charged with felonious, third-degree assault. The judge ordered a psychiatric examination. Mr. B also received a 10-month sentence in a

local workhouse and 5 years' probation. Also, he is to have no contact with his daughter or unsupervised contact with any child in the future.

Case #3

Victim

JC, a 2 1/2-year-old boy suffered from asthma, severe pneumonia, mysterious infections, and sudden fevers. He was hospitalized 20 times during an 18-month period. Doctors were even concerned that he may have AIDS. However, they soon began to suspect that the mother may have caused the child's problems. Finally, when the boy complained to his mother's friend that his thigh was sore because "Mommy gave me shots," the authorities were called.

Upon searching the residence, investigators seized medical charts and information and hypodermic needles. It was also believed that material also entered the boy through a catheter doctors surgically inserted in the arteries near his heart to give him constant medication.

Family History

JC's mother was a 24-year-old homemaker and part-time fast-food restaurant worker. When the mother was 7 years old, an older sister died of a brain tumor at Children's Hospital. During her sister's prolonged illness, JC's mother, by necessity, spent long periods of time at the hospital. Although this occurred long ago, JC's mother remembered the experience vividly.

During JC's many hospitalizations, the mother seemed almost

MSBP Warning Signs

- Unexplained, prolonged illness that is so extraordinary that it prompts medical professionals to remark that they've "Never seen anything like it before."
- Repeat hospitalizations and medical evaluations without definitive diagnosis.
- Inappropriate or incongruous symptoms and/or signs that don't make medical sense.
- Persistent failure of a child to tolerate or respond to medical therapy without clear cause.
- Signs and symptoms that disappear when away from the parent.
- A differential diagnosis consisting of disorders less common than MSBP.
- Mothers who are not as concerned by their child's illness as the medical staff, who are constantly with their ill child in the hospital, who are at ease on the children's ward, and who form unusually close relationships with the medical staff.
- Families in which sudden, unexplained infant deaths have occurred and that have several members alleged to have serious medical disorders.
- Mothers with previous medical experience and who often give a medical history similar to the child's.
- Parent who welcomes medical tests of the child, even if painful.
- Increased parental uneasiness as child "recovers" or approaches discharge.
- Parental attempts to convince the staff that the child is more ill than what is apparent.

obsessively involved in medical matters and hospital routines. She spent hours in the hospital library reading medical texts. She had few friends outside the hospital, and the medical and nursing staff described her as an isolated person.

JC's father was a 24-year-old church janitor, afflicted with many health problems—the most notable being severe insulin-dependent diabetes. During JC's many hospitalizations, his father appeared distant and only marginally involved. JC's 7-year-old sister was in good health and was named after her mother's deceased sister.

Followup

Since JC was removed from his home, he has been healthy. As in previous cases, only Mrs. C was present when the boy became ill, and until investigators showed

evidence linking her to her child's illnesses, she denied any wrongdoing. Assault charges were filed, and Mrs. C's case is pending.

CONCLUSION

Today, the consensus is that MSBP is not rare, is notoriously resistant to parental psychotherapy, and carries a very grim prognosis. Approximately 10 percent of MSBP victims die.

Unfortunately, more police agencies and medical professionals will be confronted with this form of abuse in the future. Hopefully, the information discussed here will alert law enforcement officers, especially those who deal with cases of abuse, to the warning signs of MSBP and will assist them in identifying the perpetrators and helping the victims. ♦

Endnotes

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***THE INVESTIGATION OF
SEX-RELATED HOMICIDES***

The Investigation Of Sex-Related Homicides¹

By Lt. Cmdr. (Ret.) Vernon J. Geberth

Investigation of sex-related homicides involves the basic procedures employed in other death investigation cases; however, a number of additional investigative considerations must be explored.

These depend upon the circumstances of the incident as well as the type of activities observed at the crime scene. For example in sex-related death investigations, the reason for the killing may not always be as clear as in a robbery case or organized crime "hit" type of homicide.

Experienced homicide investigators are aware that a sex-related homicide may involve homosexual as well as heterosexual victims, and that children as well as adults may be involved, both as victims and as perpetrators. Also, motives may include a number of possibilities that range from interpersonal violence and rape-murder to sexual perversion and serial murder.

A homicide is classified as "sex-related" when there is evidence of sexual activity observed in the crime scene or upon the body of the victim. This includes the type of, or lack of, attire on the victim; evidence of seminal fluid on, near, or in the body; evidence of sexual injury; sexualized positioning of the body; evidence of substitute sexual activity, such as masturbation, fantasy, or ritualism. Multiple stabbings and cuttings to the body, as well as slicing wounds across the abdomen of the victim are also suggestive of a sexual motivation.

The presence of seminal fluid in the vagina, mouth, or rectum as well as any semen discovered on the outside of the body or upon the clothing is an important consideration in determining the type of sexual activity that has taken place.

A careful search should always be conducted within the surrounding area for evidence of sexual activity or sadomasochistic fantasies. Such evidence may appear in the form of pornographic books, videos, magazines, or photographs found at the crime scene depicting the victim involved in sexual activity; or writings or messages left by the perpetrator (either at the scene or upon the body of the victim); bondage paraphernalia, masks, ropes, chains, or tape; sex toys, props, lubricants, and other items that are commonly associated with sexual activity.

The homicide could have sexual implications even without an overt sex act or observable sexual activity, as in psychotic killings where the motive is not readily discernable. If the body is that of a female or a young child nude or partially clothed, investigators should consider it as a possible "sex crime."

Adapted from: Geberth, Vernon, "The Investigation of Sex-Related Homicides," Practicle Homicide Investigation: Tactics, Procedures and Forensic Techniques. Used with permission of author. Third Edition, 1996.

Crime Scene Investigation

A trained homicide investigator will examine the crime scene with a twofold purpose. The first objective is the complete documentation of events through photographs (both black and white and color), and/or videotape, along with crime scene sketches. The second objective is to assure that there has been a careful and complete search for any other items that may provide a clue to the identity of the murderer, as well as any other items that may provide some information about the crime (see Table 1).

Table 1
Evidence Collection

- Physical Evidence in the form of seminal fluid must be collected as soon as possible before it is lost or destroyed. Bloodstains, spittle and hair (including pubic combings) should be obtained at the scene; properly packaged and forwarded to the lab.
 - Trace evidence found on the victim and/or upon the victim's clothing should be collected.
 - Bruises and marks on the victim, including the presence of sadistic injuries, should be recorded.
 - The body should be examined for the presence of Bite-marks. Collect and record:
 - a) Saliva washing of the Bite-mark area for a blood grouping. Use 100% cotton dampened in distilled water. Important: Get a control sample from another area of the body.
 - b) Photograph the Bite-mark. Use a 1x1 camera (Fingerprint model) and get black and white photos as well as color. Use a rule of measure in photograph and obtain an anatomical landmark.
 - c) Casting (if possible) using dental materials.
 - The scene should be examined for evidence of a struggle. The presence of torn clothing, missing buttons, ripped textiles, marks on the ground or floor and blood splatters must all be photographed, documented and collected as evidence.
 - The investigator should confer with the Medical Examiner and assure that specimens are taken from the body (e.g. hair from various area of the body). In addition, vaginal washing, as well as anal, nasal, and oral swabs should be requested from the pathologist for serological evaluation and examination.
 - Fingernail scrapings should also be obtained for an analysis of any blood, skin, or hair from the perpetrator.
 - If a suspect has been taken into custody, his or her clothing should be taken and an examination made for any physical evidence. Each piece of evidence should be packaged in a separate container. The suspect's body should be examined for any fingernail scratches, bite marks, or other indications of a violent struggle. In addition, hair and blood samples should be obtained. (Assure that these items are obtained legally.)
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In sex-related cases, basic evidence collection procedures take on additional importance. Certain human behavior patterns and psychosexual activities become additional factors to consider in determining the reason and motive for the killing.

An understanding of human behavior and the nature of human sexuality is an important prerequisite for a homicide investigator to develop. This, in conjunction with practical experiences, ensures that a proper analysis of a sex-related homicide can be intelligently pursued.

Components of the sex drive are basically divided into three segments: biological (instinctive), physiological (functional), and emotional (mental). The emotional or mental component is the strongest of the three subdivisions. It would be a logical assumption that "The mind controls the act," in that the mind directs what is and what is not sexually arousing to an individual. This can be an important consideration when analyzing "What took place?" in a sex-related crime scene.

Sex is also a sensory act, involving the five senses of touch, sight, sound, smell, and taste. Each sense is employed to a different degree by individuals, who attach a sexually significant message to a particular sensor. For example, the sight of a scantily clothed woman might be sexually arousing for some, or smell as it relates to a particularly pleasing perfume might be the stimulus that affects another person's arousal. These are perfectly appropriate responses as they relate human sexuality when the mind is stimulated by significant sensor information.

However, when the stimulation is taken to the extreme and an individual becomes obsessed with the sensory "turn-on," a deviance begins to emerge. This unhealthy attraction may result in an appropriate acting out of a fantasy, including murder.

Also, people who are inhibited sexually may develop unconventional forms of sexual expression, which may be harmful. These responses are known as paraphilias; an attraction to deviance.

Examples of unconventional forms of sexual activity are; voyeurism, exhibitionism, transvestism, and fetishism, which are generally considered harmless. Examples of paraphilias, considered harmful are; sadism, masochism, sadomasochism, pedophilia, and necrophilia. Whether an activity is considered harmless or harmful, substitute sexual activity and activities of a psychosexual nature may evidence themselves in certain sex-related crime scenes and should be considered in determining motivation.

Determining Motivation

An extremely important aspect of a homicide investigation is to determine the reason for the killing.

Sex-related homicides include rape-murder and killings that involve both anal and oral sodomy, as well as other acts of sexual perversion. The victims are usually females and young children, and the killer is usually a male.

Homosexual homicides are quite common and may involve male victims killed by other males, or female victims involved in some sort of lesbian relationship and killed by other females. Oftentimes these cases involve bizarre and sadistic methodologies.

There are certain preliminary questions an investigator should ask when examining a crime scene: "What took place?" "Why did it occur?" and "Who could have done it?"

Examining a crime scene with the purpose of identifying and interpreting certain items that may serve as clues to the type of personality involved is an excellent technique of developing a mental picture of the TYPE of person who may have committed the crime. There are certain common denominators between the psychological make-up of the criminal and the psychological clues the crime scene reveals.

Research by the FBI's Behavioral Science Unit into sex-related homicides has disclosed a remarkable consistency in the type of person who commits certain acts. Although there are a wide range of differences among offenders who commit similar offenses, these offenders also share similarities and common traits.

Organized and Disorganized Offenders

The organized and disorganized dichotomy devised by the FBI's Behavioral Science Unit is a description of criminal offender typologies. Information presented here as it relates to the phenomena of organized and disorganized offenders is based upon studies and research of the Behavioral Science Unit, personal interviews with Supervisory Special Agent Robert K. Ressler (retired) and others involved in this project, as well as the personal experiences of the author as a homicide practitioner.

The Organized Offender

The organized offender is usually above average in intelligence. He is methodical, cunning, and his crime is well thought out and carefully planned. He is likely to have his own car, which is likely to be in good condition. The crime is usually committed out of his area of residence or work. He is mobile and travels many more miles than the average person.

Fantasy and ritual are important to the organized type personality. The victims are people he considers the "right" type, whom he can control (either through manipulation or strength), usually strangers, and share some common traits.

He is considered socially adept and uses his verbal abilities to manipulate his victims and gain control over them. He is fully cognizant of the criminality of his act and takes pride in his ability to thwart the police investigation. He is likely to follow news reports of the event and will oftentimes take a personal item from his victim, which he may use to relive the event or continue the fantasy.

The body is most often removed from the crime scene. He may do this to cause the body to be found so he can "taunt" the police or to prevent its discovery by transporting it to a location where it will be well hidden.

The Disorganized Offender

The disorganized offender usually below average intelligence, a loner, who is usually not married, living either alone or with a relative in close proximity to the crime scene. He experiences difficulty in negotiating interpersonal relationships and is described as socially inadequate.

He acts impulsively under stress and will usually select a victim from his own geographic area. He doesn't own a vehicle and avoids people in general. He is usually described as a sexually incompetent and has no meaningful sexual relationships. The crime scene will be disorganized.

He uses a "blitz" style of attack, which catches the victim off-guard. This spontaneous action, in which the offender suddenly acts out his fantasy has no specific "game plan" or thought about being detected.

The disorganized offender usually depersonalizes the victim by facial destruction or overkill type wounds. Any sexually sadistic acts are performed postmortem. Mutilation to the genitals, rectum, breasts of females, neck, throat and buttocks are performed because these parts contain a strong sexual significance to him. There may be evidence of disembowelment, amputation, and/or vampirism.

The death scene and the crime scene are generally in the same location and there is usually no attempt to conceal the body. If the body has been mutilated, he may position it in a special manner that has significance to him. The murder weapon, usually obtained from the scene, is oftentimes left behind.

Human behavior, although unpredictable, is oftentimes repetitive. Certain actions engaged in at the crime scene by certain types of personalities will repeat themselves in other homicide investigations.

A criminal investigative analysis can prove to be a good investigative strategy in cases that reveal some sort of personality aberration. The National Center For The Analysis Of Violent Crime, based at the FBI Academy in Quantico, Virginia, can provide law enforcement authorities such an analysis or other services that can be useful in certain types of crimes. (See Law and Order, January, 1986, Mass, Serial and Sensational Homicide: The Investigative Perspective.)

A homicide investigator, through experience and review of similar types of cases, must develop a base of knowledge that he can apply to each investigation. The nature of the act and the type of person who would commit a specific type of act are important considerations in the "Who Could Have Done It?" scenario. However, keep in mind that, "things are not always as they appear to be."

The motivation behind the act is an important consideration. Was it a lovers' quarrel? Or is the offender psychotic, in which case the crime sometimes appears to be motiveless or bizarre? Or is the homicide the work of a psychopath, with sadistic or impulsive implications?

No one acts without motivation. According to the late Dr. James Brussel, a criminal psychiatrist, "Even the acts of a madman possess a certain type of logic. There is a method to their madness. A logic and even a rationale hidden behind what he does and how he does it, however wildly bizarre and completely without reason it appears to be . . ."

The investigative challenge is to discover this perverse or seemingly irrational logic and then apply this information to the case.

The identification of the victim is a crucial consideration in determining the victimization. "Who is the deceased?"

Investigation into the victim's background, lifestyle, and associations many times will reveal the possible motivation of the killer. An examination of any relationships, acquaintances, and risk factors may provide a clue to the "Who could have done it?" scenario.

For example: Who does the victim live with? Who was the victim with last? Does it appear that the victim knew the assailant? What is the victim's current social status? Why was this particular victim selected? Does the crime appear to be a "stranger-homicide"? Was the deceased in a high-risk occupation (call girl or prostitute)? Was the victim a runaway or hitchhiker? Or, was the victim a late hours worker e.g. waitress, or a service worker, who had to travel alone at night?

Any number of similar questions must be asked and answered depending upon the scenario presented in the crime scene. Keep an open mind; don't jump to any conclusions, especially as they relate to human behavior and human sexuality.

Table 2
Profile Characteristics of Organized and Disorganized Murders

ORGANIZED

Average to above-average intelligence
 Socially competent
 Skilled work preferred
 Sexually competent
 High birth order status
 Father's work stable
 Inconsistent childhood discipline
 Controlled mood during crime
 Use of alcohol with crime
 Precipitating situational stress
 Living with partner
 Mobility with car in good cond.
 Follows crime in media
 May change jobs or leave town

DISORGANIZED

Below-average intelligence
 Socially inadequate
 Unskilled work
 Sexually incompetent
 Low birth order status
 Father's work unstable
 Harsh discipline as child
 Anxious mood during crime
 Minimal use of alcohol
 Minimal situational stress
 Living alone
 Lives/works near crime scene
 Minimal interest in news media
 Significant behavior change
 (drug/alcohol abuse, religiosity, etc.)

Reprinted from the FBI Law Enforcement Bulletin, August 1985.

Table 3
Crime Scene Differences Between Organized and Disorganized Murderers

ORGANIZED

Planned offense
 Victim a targeted stranger
 Personalizes victim
 Controlled conversation
 Crime scene reflects overall control
 Demands submissive victim
 Restraints used
 Aggressive acts prior to death
 Body hidden
 Weapon/evidence absent
 Transports victim or body

DISORGANIZED

Spontaneous offense
 Victim/location known
 Depersonalizes victim
 Minimal conversation
 Crime scene random and sloppy
 Sudden violence to victim
 Minimal use of restraints
 Sexual acts after death
 Body left in view
 Evidence/weapon often present
 Body left at death scene

Reprinted from the F.B.I. Law Enforcement Bulletin, August, 1985.

Classifications

Based upon my experience as a homicide detective, sex-related homicides can be divided into four distinct categories:

- Interpersonal violence oriented disputes and assaults
- Rape and/or sodomy oriented assault
- Deviant oriented assault/the lust murder
- Serial murder

Interpersonal Violence

The most common type of sex-related homicide is one that originates from interpersonal violence. These include disputes involving husbands/wives, men/women, boyfriends/girlfriends, girlfriends/girlfriends, boyfriends/boyfriends, and even siblings. They may also involve third party relationships such as jilted lovers.

The death may not appear to be sexually motivated, but upon examination into the circumstances, the elements of rage, hate, anger, or revenge may reveal the true motivation. For example, police may be called to a location where a male or female is found fully clothed and shot in the head "execution-style." At first, this death will appear to be other than sex related. Upon checking into the background and relationships of the victim, a new possibility may present itself.

Many times a simple solution or motivation is clouded by what was done to the body or how the crime scene was changed. What may appear to be the work of a sexual psychopath often turns out to be an enraged lover or spouse who under emotional circumstances attempted to destroy the victim by depersonalization of the body, facial destruction, and/or multiple cuttings and stabbings, some of which may be postmortem.

Rape and/or Sodomy Assault

Such a sex-related homicide may be directed in overcoming the victim and/or furthering the sexual assault. It may be heterosexual or homosexual and the intent may be forcible rape or forcible sodomy. The intent of the perpetrator is sexual assault and not homicide.

These cases may be extremely brutal; death usually results from the assailant overcoming the resistance of the victim to rape, sodomy, or homosexual assault. The victim may be choked or strangled into submission or the mouth and nose may be held tightly in order to stifle the victim's screams, causing asphyxia.

Blunt force injuries may be present when the killer has attempted to beat the victim into submission. In addition to the brutality of the attack a victim may also die of shock or other trauma. This is especially evident in young children or older persons.

In some instances the death may be intentional. This is especially true in cases where the killer is known to the victim.

These types of cases usually have been preceded either by some nuisance type offenses (voyeurism, exhibitionism, telephone scatologia) or other sexual offenses including rapes or sodomies where the victim was not killed. The investigative approach should be to first ascertain whether or not other cases involving similar M.O. have taken place. Action should concentrate on this avenue of inquiry and on research of records for similar offenses committed in the past by someone, recently released from prison.

Deviant Oriented Assault

The lust murderer oriented towards deviant and sadistic assault, is distinguished from other sex-related homicide offenders by the involvement of mutilation. Most such murderers, according to studies conducted by the FBI, will not participate in sexual activity with their victims e.g. penis penetration. Instead, they may masturbate upon their victims and engage in postmortem mutilation, such as displacement of the breasts of females, postmortem attack of the genitalia (male and female); insert objects into the body cavities of their victims; and possibly engage in anthropophagy, which is consumption of human flesh.

This killer, who usually acts on the spur of the moment, is obsessed with some sort of perverse fantasy. In his own mind he has planned this event and he has "complete control." However, when the opportunity presents itself, the killer, who is generally a disorganized personality, either panics or becomes so involved in his fantasy that he is totally oblivious to the fact that he is leaving evidence behind. For example, the body is usually left at the location of assault, there may be evidence of blood smearing on the body (which means there might be blood on the killer), evidence of masturbation (which may provide blood type of suspect), tire marks or footprints, personal items of the killer left behind, and maybe even the suspect's fingerprints left at the scene.

Many times he will take a "souvenir" from his victim, usually some personal item, or even a body part that has some sexual significance to him, such as a breast. Many times he will return to the crime scene, either to relive the event or engage in further mutilation of the corpse.

The Serial Murderer

Serial murder is the killing of separate victims with time breaks, from days to weeks or months, between victims. These time breaks between killings are referred to as "cooling-off" periods.

There has been much interest in the phenomenon of serial murder, and a number of articles and books on the subject are now available. The recent NBC mini-series "The Deliberate Stranger" was based upon the deviant exploits of Ted Bundy, a convicted serial killer, who received a judicial execution by electrocution on January 24, 1989, in the Florida State Prison, Florida.

In psychiatric terminology, a serial killer may be classified as either psychotic or psychopathic depending on the information examined as well as the facts of the crime. In the experience of the author, however, serial killers are rarely psychotic. They are usually sexual psychopaths who have a profound criminality and are definitely in touch with reality.

In the case of a psychotic killer, one could propose that he killed because his psychosis drove him to kill. In the case of a psychopathic killer, especially a serial murderer, I would suggest, based on the studies of the FBI and personal experience, that he kills because he likes to kill.

Serial killers have been described as intelligent, charismatic, street-wise, charming, and generally good looking. They are mobile individuals, capable of traveling miles in search of the "right" victim someone who is vulnerable and easy to control. Their victims may be females, children, vagrants, homosexuals, or prostitutes.

Serial killers are extremely manipulative and are oftentimes able to "talk" their victims into what has been described as a "comfort zone": a location where they can control their victims. Many times they use a ruse (cast on arm--Bundy) to get their victims alone. They are continually perfecting their ruse and have an uncanny knack for recognizing potential victims.

Many serial killers have a fascination for police procedure; some have even worked as police officers or security guards and use this experience to avoid detection. They have been known to frequent police hangouts and eavesdrop on police conversations during a case. Some have even interjected themselves into the investigation.

Some serial killers have returned to the scene of the crime or the location where the body was discovered, either to assess the investigation or to taunt the police with additional clues.

A serial killer, despite his outward facade, is a very insecure individual. He is without any power until he has a victim under his control. He feels secure in this temporary superiority.

They enjoy the publicity of their crimes for the same reason. They are likely to follow events in the news very closely and gain satisfaction in the knowledge that they have defeated the police.

Serial killings are considered by some psychologists to represent the ultimate extension of violence. From a rational standpoint, serial killings are completely senseless acts. However, the serial killer experiences great pleasure in exerting power and control over victims, including the power of life and death. The sex act is secondary. He is excited by the cruelty of his act and will oftentimes torture his victim to death.

He may even resort to tape recording his victim's screams of pain, which he can use to enhance his fantasies when he doesn't have a victim to "play with." He may even use this

recording to terrorize future victims. Any mutilation of the victim will have been done either to shock the authorities or to render the remains unidentifiable.

Although many serial killers were known to engage in normal sexual relations with a primary female in their lives, they really do not have any type of satisfactory relationship with anyone. They are into self-gratification to a point where nothing else matters. Most serial killers report that they were victims of child abuse, usually at the hands of a female parent or parent figure. Many offenders were reportedly under the influence of alcohol or drugs, at the time of their crime, which tended to exacerbate their sadistic fantasies.

A serial killer's homicides tend to increase towards the end of their course of conduct. It appears that they have to kill more often in order to enjoy the "high" they get from the act. Most serial killers have been caught by accident, as they became bolder in their pursuits and disregarded the risks. This type of killer never stops killing until caught and put in prison or until he dies. There is no known cure for a sadistic sexual psychopath who has become a serial killer.

Criminal investigators confronted with a sex-related homicide should first address the basic crime scene techniques of documentation and preservation before delving into the more intricate possibilities that each case presents. Remember, there are four distinct categories of sex related homicides: (1) interpersonal violence related disputes and assaults, (2) rape and/or sodomy oriented assault, (3) lust murderers, and (4) serial murder. Each has specific law enforcement strategies and present a number of investigative practicalities.

All four are amenable to standard investigative techniques, including profiles and computer analysis of similar offenses. However, within each of these categories there exists the elements of human sexuality and sexual deviance. The goal is to identify the motivation and then pursue the investigation utilizing every tool available. This could range from a sophisticated criminal investigative analysis provided through the National Center For The Analysis of Violent Crimes or a simple re-canvass of the neighborhood where the crime took place.

In any event, there are no simple solutions, nor standard procedures or explanations to account for the reasoning of a person who commits a sex-related homicide.

SEXUAL HOMICIDE

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DETECTION - suspicion is a prerequisite

POSSIBLE INDICATORS (features often seen in sex-related deaths):

manual (ligature) strangulation

close, personal forms of violence

(blunt force, sharp force (stab/cut), or combinations) - hand to hand activities

sharp force - cut / stab

blunt force - contusion / abrasion / laceration

defense wounds - may be on arms or legs (extremity used to ward off blows)

sexually significant areas injured

breasts / penis / genitalia / buttocks / etc.

post-mortem mutilation

often opening of abdomen with or without evisceration

bite marks

overkill - excessive number of wounds

ligature - victim immobilized with binding ties

torture - burn / electrocution / sadistic wounds / repetitive wounds

clothing - disrobed / torn / disheveled

*concordance or lack thereof of body wounds to clothing defect(s)

toxicology - both victim & offender

cocaine / alcohol common (also opiates)

any agent possible ("date rape" sedative hypnotics)

location

custody / prison / hospital

male or female assailant or victim

ex: male guards may assault female inmates

remote / isolated (residence or outdoors)

weak victim (child or elderly adult) - especially if other elements above are present

"Whenever a female is found murdered by stabbing, strangulation, bludgeoning, or other manual means, a 'rape workup' is necessary." - C.V. Wetli, V.J. Rao, & R.E. Mittleman 1988

GENERAL CONSIDERATIONS WHEN DEALING WITH A SEXUAL HOMICIDE

high profile crime

- shock & outrage community
- offend public sensibilities
- require diligence by investigators
- case & evidence potentially open to intense scrutiny

clues to the nature of the crime may be suggested by:

- scene - environment / clothing
- history - area / victim profile
 - sexual homicide often pure stranger-on-stranger crime
- body - injuries / positioning

- *collect appropriate samples to include / exclude sexual element(s) if reasonable suspicion
 - “You only get one chance to do it right the first time.”
 - “Evidence not collected is evidence lost.”

- *work-up begins as soon as the body is discovered
 - every reasonable effort should be made to preserve available evidence
 - minimize potential contamination and preserve evidence
 - place body in clean sheet / body bag
 - paper bags on hands

EVIDENCE - the scene is not the place to collect evidence items from the body which would be better assessed in the morgue

GENERAL CONSIDERATIONS

- ***ideal procedures may not be available or practical in the real world***
- a picture is worth a thousand words
 - the only truly permanent and infallible part of the case file are the photos
 - scales with case number are critical
 - color standards may be necessary if attempting to date bruises/injuries
- chain of custody must be maintained at every step
 - if the chain is altered by EMS / ER handling - retain the chain subsequently (do the best you can with what you have)
- air dry wet items as soon as possible - esp. those soiled with blood / biological fluids
- bag items in clean paper bags (*never plastic*)
- avoid transfer / cross contamination of items (individual bagging may be necessary)
- retain all clothing items as potential evidence, even if no further forensic work needed
 - clothing often turned over to the family at the scene or emergency room
 - try to collect items as evidence as soon after the fact as is possible
- clean paper with a druggist's fold may be used

1	1	
2	EVIDENCE	
2		

TRACE EVIDENCE:

PRINCIPLE: contact between one person & an item or person results in transfer of trace materials

presence or absence of evidence may be important in confirming the sequence of events

fingernails

- bag hands at scene (clean paper bags / envelopes)
- preferably clipped
 - possible physical match to broken-off fragment
 - if nails extremely short - scrape nails with clean wooden stick
- note & photograph any defects, tears, or missing nails
- possible DNA evidence if later recovered

pubic hair

- pubic combing with clean plastic comb - submit both hair & comb
- pubic hairs (pulled) should be collected and retained for later analysis if needed
 - 25-50 individual hairs with roots attached (DNA)

scalp hair

- scalp hairs (pulled) should be collected and retained for later analysis if needed
 - 25-50 individual hairs with roots attached (DNA)

clothing

- see above

- stains - soil / grass / blood / biological fluids
 - foreign material - grass / hairs / fibers / other
 - physical state - defects caused by weapon(s) or struggle
 - drainage of ejaculate from vagina / anus may soil undergarment

proffered (suspect) weapon(s)

- blood / biological material may be present
 - even small quantities can be used for DNA analysis (PCR)
- pattern wound(s) may be present
 - see "BLUNT FORCE INJURY" chapter

fingerprints

- body surface (especially legs) may have latent prints on skin
- iodine fuming / other techniques may allow visualization of latent prints

SEROLOGY EVIDENCE:

I. SEXUAL INTERCOURSE

evidence collection

use multiple (≥ 4 cotton tipped swabs)

collect samples as soon as possible with body *in morgue*

proteins degrade with time and temperature

bacteria may accelerate normal degradation

sperm evidence

best results from cervical canal (may take from any site within vagina)

prepare slides to examine under microscope

washings / other sample examined for motile sperm with short interval

typically sperm motility lasts an average of 3 to 4 hours

range between 1 to 6 hours

extremes $\frac{1}{2}$ to 60 hours

may be affected by post-mortem environment or circumstances

anal samples potentially could be contaminated from leakage from vagina

A. EJACULATE

1) *acid phosphatase*

enzyme secretion from normal tissues - elevated in seminal fluid (ejaculate)

life span in vagina: 14 hours (range 8-24 hours)

cut-off level - above this level, ejaculate present (below level - unable to say)

even with ejaculation may not necessarily be above level for (+)

level varies with post-mortem interval (proteins degrade with time)

even without (vasectomy) or low (alcoholic) sperm, AP positive

concentration falls with time

level may suggest general idea of time when intercourse occurred

initial level unknown - exercise caution to avoid over-interpretation

remains elevated up to 8 (range 18-24, up to 72) hours in vagina

highest levels during first 12 hours post coitus

subsequently level falls in vagina over next 12 hours

longer duration if area dries (i.e. stain on clothing / body surface)

2) *p30 glycoprotein*

component of semen produced by prostate gland - specific for male

may be present even if sperm absent

more specific for semen than other tests

may be positive even with negative acid phosphatase / sperm

$\frac{1}{4}$ of cases p30 positive with negative acid phosphatase (Graves et al., 1985)

life span in vagina: 27 hours (range 13-47 hours)

3) spermatozoa

life span varies with time & site

cervical mucus - longer life span for sperm

non-motile but intact sperm may last up to 72 hours

vaginal pool preferred

living victim (Willott & Allard, 1982)

intact motile sperm (with tail)

a) vagina

up to 6 hours

occasionally 12 hours

rarely to 24 hours (cervical mucus)

b) oral

up to 3 hours

c) anorectal

rare, especially >6 hours

non-motile sperm (heads)

a) vagina

up to 26 hours (with tail)

up to 5 days (head)

up to 7 ½ days (cervical mucus)

b) oral

up to 6 hours

c) anorectal

anal - 45 hours

rectal - 65 hours

deceased victim

sperm degrade by decomposition

longer life span

up to 2 weeks post-mortem

indefinite in dried stains

refrigeration & embalming delay breakdown

use clean microscopic slides and slide holders (boxes)

smears from swabs - mark site of origin (“O”ral / “V”aginal / “A”nal)

air dry specimens (both slides & swabs)

areas to collect samples

ANAL / RECTAL

VAGINAL

ORAL

OTHER - may be on body surface / clothing rather than within

ideally collection by trained scientist from source evidence

an ultraviolet light may assist in identification of suspect areas

B. TRACE EVIDENCE

1) skin cells - from underneath victim’s fingernails

2) hair fibers

from pubic combing

from trace hairs found on body surface

II. ORAL CONTACT

A. *salivary amylase* - normal enzyme secreted by many tissues (mainly pancreas & saliva)
easily tested as a qualitative assay (positive or negative)

any site contacted by saliva is a potential positive

sexually significant areas: neck / breasts / genitalia / buttocks

extremities - offensive / defensive wounds

bite marks

consult forensic odontologist / dentist

collection

saline moistened gauze / swab(s) → dry gauze / swab(s)

sites to collect suspected saliva

bite mark(s)

sexually significant areas (breast, etc.) - depends on case analysis

uninvolved area - negative control

victim mouth (buccal mucosa) - positive control

B. DNA

****due to the nature of DNA evidence clean gloves & care should be used at all steps**

cells from offender's mouth mucosa are sloughed off into the saliva

even with small amount of DNA is present, newer techniques (PCR) may allow ID

collection:

saline moistened gauze / swabs (1-4) → dry gauze / swabs (1-4)

control sample - gauze / swabs (1-4) of inside victim's mouth

III. CONVENTIONAL SEROLOGY ("blood type")

A. SECRETORS

80% of the population secrete blood group (A/B/O) into their biological fluids

ejaculate / saliva would give suspect's blood type

20% do not secrete their blood type into their biological fluids

B. BLOOD

blood at scene or on the body surface may originate from victim *or assailant*

suspect offender contributed sample

obvious offender injury at scene

spatter patterns at scene suggest victim did not contribute sample

collection

saline moistened gauze / swabs (x4) followed by dry gauze / swabs (x4)

blood spatter on body - collect as for other blood samples above

C. OTHER

small items left at scene may provide a wealth of data

cigarette butts

tissues

drinking glasses

partially consumed food items

D. CONTROL SAMPLES - knowns from victim (& assailant if available)

red top (unmodified) or purple-top tube (anticoagulant added)

blood stain card (air dried)

INJURIES

**** *most forcible sexual assault victims survive the event***

the case is handled in a way similar to that described below for fatal cases
additional medical & therapeutic steps are necessary due to the nature of attack

both fatal & non-fatal sex-related assaults, the historical information helps direct work-up

**** specific detailed description of presence or absence of injuries important**

DOCUMENTATION:

diagrams

overlays

tracings may help recognition of pattern wounds (see blunt force injuries)

photographs

experienced photographer preferable

scale

case number

standards - color / 18% gray content

locating (establishing shots)

multiple pictures - *film is cheap*

living hospitalized victim (patient may or may not die - evidence is evidence)

as soon as feasible

sequential photos over time

same steps as above

microscopic sections (if age of wounds a potential issue)

AUTOPSY:

****general principle: one must be alive to bleed (internal or external bruise)**

1) NECK

manual or ligature strangulation often correlated with sexual homicide

fingernail marks - curvilinear (crescentic) abrasions on neck

horizontal - may be victim attempting to remove assailant's hand

vertical - may be assailant's hand in act of strangulation

layered dissection - see "ASPHYXIATION" chapter

even if strangulation not suspected or death by other means

the neck examination should be the final aspect of the complete autopsy

(*all* other organs, including brain, should have been removed first)

photographic & microscopic documentation of injuries or absence optimal

medical examiner may potentially age hemorrhage within neck muscles

question is was this peri-mortem (around time of death) or earlier

2) EYES

petechial (pin-point) hemorrhage on conjunctivae suggest strangulation

see above

3) GENITALIA

remove & document (diagram & photograph) injuries

special considerations

elderly have atrophied skin & mucosae

prone to injury / bleed with less force

young / sexually immature

prone to acute trauma injury - unprepared for penetration

hymenal ring should be examined to note injuries

may be recent or old wounds

may have resulted from same or other assailant

may be from penile or other penetration

injuries arise from force

forcible sexual intercourse / penetration

forcible foreign body penetration

timing of when injuries occurred (true for *all* injuries)

bleeding into wound in general indicates a premortem wound

if bleeding absent from wound(s)

post-mortem - wound appears yellow

agonal - injury occurred as the person was dying

low blood pressure from shock or bleeding

insufficient pressure or blood to bleed into tissue

direct wounds to genitalia may extend within body

foreign bodies may be inserted in anus / vagina → abdominal cavity

4) BITE MARKS

potentially highly incriminating evidence

- may place suspect's mouth on the victim's body at the time of attack
- does not prove suspect committed the remainder of the attack
 - other assailant(s) may have acted in concert or subsequently
- level of certainty of identification - to reasonable degree dental certainty
 - definite - to the exclusion of all others (i.e. only suspect)
 - consistent - no features to exclude suspect
 - possible - due to nature of injury unable to
 - exclusionary - definitely not suspect

values of bite marks

- pattern of teeth represented in mark may be unique
- saliva may be deposited on skin
 - DNA - see above
 - blood group antigens - see above

cautions

- older / subacute bite marks may or may not be from same suspect
- interposed target may alter mark
 - finger
 - clothing
 - object
- sufficient detail may not be preserved in wound to use for identity
- although bite marks are fairly distinct, a few mimics do exist
- an experienced forensic odontologist (dentist) is critical
 - testimony & evidence can be highly contentious
 - even experts may disagree about degree of certainty of ID
 - ideally odontologist on-call to examine body at scene / in morgue

processing bite mark

*****recognition of bite mark as such is essential***

- if not recognized & processed properly, critical evidence is lost
- when the victim survives to the hospital - preserve evidence
- food items at scene (apple/candy bar/etc.) may have bite marks

patterns of bite marks

- bite ring - complete oval (upper & lower teeth)
- half ring - semicircle (only upper or lower teeth represented)
- partial - few teeth or single tooth

bite mark evidence collection - sequence critical in bite case

a) saliva evidence

recognition at scene

samples may be collected at scene

consider repeat collection at morgue

preserve surface with clean paper taped over mark

tape edges of paper away from mark

inform pathologist of suspected bite mark

avoid contamination with other biological fluids

b) photographs

must use 2 perpendicular rulers adjacent to wound

preferably ABFO #2 ruler

take initial photo without ruler at site (can be adjacent)

take localizing overall photo first

close up at site

close up photos

preferably 1:1 size

subsequent examinations require 1:1 prints

multiple photos crucial

may use close to 1 roll per bite mark

take photos from different angles

ruler should always be perpendicular to plane of film

consider using ≥ 2 cameras

standard color / gray scale cards may be helpful

retain ruler / standard cards used for later comparison purposes

c) preserve bite mark

useful if skin surface has retained any impression(s) from teeth
techniques

prepare dental cast - by forensic odontologist / pathologist

lift with fingerprint powder - newer technique

d) excise bite mark

only if mark is in an unexposed area

should be performed by experienced pathologist / odontologist

retain skin with bite mark as evidence

formaldehyde may cause shrinkage

ideally secure skin to an area of known size and freeze

take microscopic sections from underneath bite to age wound

SPECIAL CONSIDERATIONS: PEDIATRIC SEXUAL ABUSE

motive for crime may be important in determining whom to suspect
chronic - part of a repetitive pattern by assailant known to child
acute - assailant may or may not be known to victim
entire scenario of crime must be analyzed

usually the victim of any sexual child abuse is female (fatal or non-fatal)
rape (lethal or non-lethal)
over 1/2 occur in children (≤ 18 years old)
~1/3 of cases occur in adolescents

lethal child intercourse

assailant motivation varies
maintain secrecy
sexual sadist
serial killer

child homicide may be concealed as sex motivated by post-mortem instrumentation
assailant attempts to deceive the investigating agency
consider suspect(s) able to perpetrate such an act
access
motive

INJURIES

- 1) acute - as for adult
- 2) chronic
 - introitus - dilated
 - hymen
 - healed or healing tears / disruptions
 - dilated
 - infection
 - pus discharge
 - sexually transmitted diseases
 - venereal warts

SIGNIFICANCE OF EVIDENCE:

*****RAPE - a legal term, not a medical term***

rape requires three elements:

- 1) penetration
 slightest violation of the area(s) in question - may include foreign bodies)
- 2) use of force
 may be actual or threatened physical or mental
- 3) lack of consent
 may be due to age / mental incapacitation / lack of volition

*****a medical examiner is unable to state whether or not rape occurred***

penetration may occur without evidence thereof
force includes coercion which may leave no marks
force may be used for pleasure (sado-masochistic sexual practices)
consent is a mental process which leaves no anatomic indicators

“The physical and laboratory examination of a rape victim may be entirely negative....”

W.U. Spitz, 1993, in Medicolegal Investigation Of Death

DOCUMENTED FINDINGS IN NON-FATAL RAPE CASES (Stone, in DiMaio, Forensic Pathology)

- 1) Trauma
 1/3 with visible trauma (any site)
 < 20% with visible genital trauma
- 2) Sperm
 <20% with motile sperm
 ~1/2 to ~2/3 victims with sperm
 (2/3 with crime laboratory analysis of evidence)
 1/3 negative

SPERM / EJACULATE ABSENT

possibilities

- no ejaculation occurred

 - no sexual act took place

 - offender did not ejaculate (~ 1/3 of rapists do not ejaculate)

- ejaculation occurred

 - aspermic (no sperm) offender

 - offender with vasectomy

 - ejaculated but not into body

 - condom

 - onto body surface

 - into area around body

 - into tissue, etc. and discarded

 - cleaned orifice

 - attempt to conceal evidence speaks to intent

 - even if it appears the body has been cleaned, collect samples

 - delayed intercourse to death interval

 - decomposition - sperm rapidly degrade with time

 - both post-intercourse & post-death intervals

still a good idea to check - "You only get one chance to do it right the first time."

DOWNS' LAW:

If you think of it, do it; someone else will think of it later and ask why you didn't.

Results of analysis

- positive sample may be significant

 - it still does not prove rape

 - suspect faces must explain why his DNA (sperm) is in / on decedent's body

- negative sample is equivocal

other evidence may be crucial in proving case

 - type & nature of injuries suggests use of force & lack of consent

 - genital injuries suggest forcible intercourse

 - trace evidence (i.e. pubic hairs) may suggest genital contact

 - saliva on sexually significant areas suggests contact with area

 - clothing - disarray / damage / absence suggests force / intercourse

** none of these in & of themselves may be critical

 - the totality of the evidence may speak volumes

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***CRIMINAL INVESTIGATIVE
ANALYSIS***

CRIMINAL INVESTIGATIVE ANALYSIS

I. Homicide Classification

- A. Single
 - 1. One victim
- B. Double
 - 1. Two victims
 - 2. Same location
 - 3. Single event
 - 4. Victims usually related or socially/vocationally acquainted
- C. Triple
 - 1. Three victims
 - 2. Same location
 - 3. Single event
 - 4. Victims usually related or socially/vocationally acquainted
- D. Mass
 - 1. Four or more victims
 - 2. Same location
 - 3. Single event
 - 4. Offender
 - a. Often located on site
 - b. May surrender, commit suicide, or cause others to bring about his or her own death
- E. Serial (Spree)
 - 1. Victims at two or more locations
 - 2. No cooling-off period between homicides
 - 3. Time interval between homicides can be minutes or days
 - 4. Offender characterized by ongoing high excitation level
 - 5. Often involves fugitive situation
- F. Serial (Classic)
 - 1. Two or more victims
 - 2. Separate events
 - 3. Usually one offender, acting alone
 - 4. Homicides committed over a period of time ranging from hours to years
 - 5. Frequently the method is predatory/stalking, with a psychological motive
 - 6. Offender's behavior and physical evidence at scenes will likely reflect sadistic sexual overtones

II. Criminal Investigative Analysis

- A. Services offered to law enforcement
 - 1. Crime analysis
 - 2. Description of offender characteristics in unknown offender cases (profiles)
 - 3. Investigation strategy
 - 4. Interviewing techniques
 - 5. Search warrant information
 - 6. Prosecutive strategy
 - 7. Expert witness testimony
- B. NCAVC Coordinator-At least one is assigned to every FBI field office
 - 1. Profile coordinator
 - 2. NCAVC- National Center for the Analysis of Violent Crime
- C. Criminal Personality Type
 - 1. Method and manner in which a crime is carried out relates directly to the criminal's personality type.
- D. Criminal Investigative Analysis
 - 1. Paradigm?
 - 2. A model
 - 3. CIA
- E. Perception is not logic. Perception is experience.
- F. Finished files
 - 1. The result of years of scientific study combined with the experience of years.
 - 2. Seville Der Dago Toussen Buzzes Inaroe No Choe Demes Troux Summitt Couzen Summitt Daux
 - 3. Seeing vs. Observing
 - 4. Behavioral examination of the offender's territory
- G. Criminal Investigative Analysis Process
 - 1. See
 - 2. Observe
 - 3. Analyze
 - 4. Interpret
- H. Three portions of a persons life
 - 1. Public
 - 2. Private
 - 3. Secret
 - a. CIA is the study and analysis of the secret life.

III. Characteristics Identified in a Personality Assessment

- A. Age
- B. Sex
- C. Race
- D. Marital status/adjustment
- E. Intelligence
- F. School achievement/adjustment
- G. Lifestyle
- H. Rearing environment
- I. Social adjustment
- J. Personality style/characteristics
- K. Demeanor
- L. Appearance/grooming
- M. Emotional adjustment
- N. Evidence of mental decomposition
- O. Pathological behavior characteristics
- P. Employment/occupational history and adjustment
- Q. Work habits
- R. Residency in relation to crime scene
- S. Socioeconomic status
- T. Sexual activity (including perversions or disorders)
- U. Motive

IV. CIA Objective

- A. Provide investigator with a behavioral composite of the most probable offender
- B. Reduces the number of most probable suspects
- C. Refocuses the investigation
- D. Reduces investigative work hours

V. General Population Percentages

- A. Sex: 50% Male - 50% Female
- B. Race: 60% White - 40% non-white
- C. Marital status: 75% married - 25% single
- D. Employment status: 85% employed - 15% unemployed
- E. Previous mental/criminal record: 90% No - 10% Yes
- F. Residence close to crime scene:
99.9999% No - 0.0001% Yes

VI. Investigative Approach to Profiling

- A. Presentation of the crime scene
 - 1. Sometimes tainted by ambulance personnel, fire department, rescue squad, etc.
- B. Photographs
 - 1. Color photographs of victim
 - 2. Larger=better; Focus on extent of wounds
 - 3. Photograph position of body from different angles
 - 4. If indoors, photograph other rooms-include sketch or floorplan of building
 - 5. Photograph of exterior to include aerial shot to show relationship of body placement to surrounding area
- C. Neighboring and surrounding area
 - 1. Racial, ethnic, and social data
- D. Victimology: The Key to Crime Analysis
 - 1. Age
 - 2. Sex
 - 3. Race
 - 4. Marital status/adjustment
 - 5. Intelligence
 - 6. School achievement/adjustment
 - 7. Lifestyle
 - 8. Personality style/characteristics
 - 9. Demeanor
 - 10. Residence in relation to crime scene
 - 11. Sexual adjustment
 - 12. Victim assessment
 - a. Why was the victim selected?
 - b. Why was the victim attracted by that method?
 - c. What feeling was the victim experiencing and expressing before and after the assault?
 - 13. Medical Examiner's report
 - a. Photos to show full extent of damage to the body
 - i. Stabbing and cutting (number)
 - ii. Gunshot(s) (number)
 - iii. Bruises
 - iv. Lividity
 - v. Toxicological reports (drugs and alcohol; sperm present)
 - vi. Wounds: pre- or post-mortem
 - vii. Opinion of the Medical Examiner which is not committed to report
 - 14. Map of victim's travels/activities prior to death
 - a. Where employed

- b. Residence
- c. Where last seen
- d. Location of crime scene

VII. Offender Profile Analysis

- A. What method did the offender use to assault the victim?
- B. Why was that particular victim selected?
- C. What were the feelings of the offender before and during the attack?
- D. Why did the offender make the decision to allow the victim to live or die?

VIII. Crime Analysis

A. Organized

1. Organized Crime Scene

a. Location

- i. Kills at one location and may move the body to another location (mobility and adaptability)
- ii. Blatantly displays the body or makes a concentrated effort to conceal it.
- iii. Scene is close to the killer's residence or place of employment during early stages.

b. Weapon

- i. Typically one of choice
- ii. Brings it to and takes it away from the scene

c. Souvenir (trophy)

- i. Psychologically relives the crime
- ii. May give the item to a significant person in his life

iii. Item often has intangible value

d. Amputation- to delay identification of the victim

e. Clothing removed and taken

- i. Delay identification
- ii. Trophy

f. Penis penetration - sexual experimentation

g. Torture prior to death

- i. Psychological
- ii. Physical

h. Leaves little or no evidence

2. Development

- a. Internalized hurt, anger and fear (aggressive, senseless acts)

- b. Superiority attitude (overcompensation)
- c. Described as a troublemaker
- d. Angry with himself, family, and society in general
- e. Acts out anger (late teens - early twenties)
- f. Cruelty to animals
- g. Arson
- h. Selects victims that he can manipulate, dominate and control

3. Characteristics

- a. Indifference to welfare of society
- b. Irresponsible and self-centered
- c. "Chameleon" personality
- d. Manipulate people
- e. Methodical and cunning
- f. Cruises for victims
- g. Lives some distance from crime scene
- h. Fits well into given society - contemporary style
- i. Victims are chosen randomly

B. Disorganized

1. Disorganized crime scene

- a. Location
 - i. Victim is killed and left at same location
 - ii. Scene may be isolated, but no real effort to conceal body
 - iii. Scene close to offender's residence or place of employment
- b. Weapon
 - i. Typically weapon of opportunity (from victim or crime scene)
 - ii. Often left at or near the scene
 - iii. Cause of death often strangulation or physical (blunt) trauma
 - iv. Mutilation with sharp weapon following death
- c. Souvenir
 - i. Usually an object or article of clothing
 - ii. Taken as a remembrance (fantasy)
- d. Uncontrolled stabbing or slashing
- e. Bite marks - breasts, buttocks, neck, thighs, abdomen (post-mortem/frenzied)
- f. Dissection of body - exploratory examination after death or when victim is unconscious
- g. Blood smearing - on self, victim, or other surface
- h. Anthropophagy
 - i. Cannibalism
 - ii. Vampirism
- i. Insertion of foreign objects (curiosity)
 - i. In anal or vaginal cavity
 - ii. Probing
 - iii. Penis penetration unusual

- j. Likely to leave physical evidence
 - k. Ritualism
 - i. Crime follows fantasy
 - ii. Body or items may be left in a symbolic way
- C. Any one crime scene may reveal characteristics of both the organized and disorganized personalities (mixed)
- D. Organization to Disorganization
 - 1. Causal factors
 - a. Youthfulness of the offenders
 - b. Ingestion of alcohol
 - c. Ingestion of drugs
 - d. Lack of criminal experience
 - e. Multiple offenders
 - f. Decompensation
 - g. Any and/or all of the above
 - 2. Generally a crime may transform from organized to disorganized. The reverse is rarely observed.
- E. Lust murder
 - 1. Male or female victims
 - 2. Mutilation or removal of the genitals, breasts, and/or rectum
- F. Development
 - 1. Internalizes hurt, anger and fear
 - 2. Becomes secluded and isolated (withdrawal)
 - 3. Rejects society, which he feels has rejected him
 - 4. Poor self-image - inadequacies, physical ailments or disability
 - 5. Underachiever
 - 6. Substitute sex (voyeurism, panty theft, fantasy drawings and writings)
 - 7. Frequently described as nice, quiet, shy, cooperative, strange
 - 8. Crime against weak and helpless (e.g. young, elderly, animals)
 - 9. Arson
- G. Characteristics
 - 1. Social aversion
 - 2. Feels rejected and lonely
 - 3. Finds interpersonal relationships difficult
 - 4. Lacks cunning
 - 5. Commits crime in a frenzy
 - 6. Kills in close proximity to residence (security)
 - 7. Strange in appearance and behavior (outcast)

Forensic Psychology: Criminal Personality Profiling

Anthony J. Pinizzotto

During the decade of the 1950s, New York City was engaged in a massive manhunt. The city was under a constant threat of explosive devices being triggered at any moment. These intermittent detonations were the cause of constant fear and anxiety for citizens, law enforcement personnel, and firefighters.

During an 8-year period, 32 devices were triggered by an individual who had become known as "The Mad Bomber." Conventional investigative techniques had failed to offer substantive leads. Police and fire investigators reached a blind alley.

It was at this point that the police requested the aid of a New York City psychiatrist. The services of Dr. James A. Brussel had been engaged in order to construct a personality profile of the "type of person" who would be capable of performing these "mad bombings."

After analyzing the data given to him by authorities, Dr. Brussel determined the following: the "Mad Bomber," when apprehended, will be found to be between the ages of 40 and 50 and of Eastern European stock; he is currently living in Connecticut with either his sister or a maiden aunt; during his childhood, his relationship with his father was negative, though he loved his mother and got along well with her. Diagnosed as a paranoid personality, the "Mad Bomber" would be apt to pay great attention to details: when apprehended Dr. Brussel not only suggested that the "Mad Bomber" would be dressed in a double-breasted suit—but that all the buttons would be buttoned (Brussel 1968).

Within the same year that Dr. Brussel completed his psychological profile of "The Mad Bomber," the New York City police arrested and charged George

Metesky for the bombings. George Metesky, Slavic by birth, at the time of his arrest was in his early 50s, single, living in Connecticut with his two unmarried sisters, and wearing a double-breasted suit with virtually all the buttons buttoned.

Was this accuracy coincidental? Was Dr. Brussel's ability a singular act? What was the doctor's process of inference, and can this process become objectified?

This investigative procedure is not as singular—or as mystical—as it may at first appear. In fact, psychological profiling has been used in a large number of cases within the last 20 years. Some of the more celebrated cases are: the Boston Strangler, Charles Manson, Son of Sam, Richard Speck, and the Yorkshire Ripper (Douglas, in press; Marks 1981).

The actual origins of criminal profiling are obscure (Ault and Reese 1980; Douglas, in press). For centuries there have been attempts to describe physical and/or psychological attributes that would clearly indicate potential and actual criminal types. Even such literary works as Shakespeare's *Julius Caesar* and E. A. Poe's "The Murders in the Rue Morgue" exhibit examples of attempts to profile certain behaviors by means of physical attributes (McPoyle 1981).

A less celebrated, but no doubt important use of psychological profiling took place during World War II. William Langer, a psychiatrist, was employed by the Office of Strategic Services (OSS) to profile the personality of Adolph Hitler. The material assembled by Langer included a psychological description of Hitler's personality, a diagnosis of his condition, and a predictive statement suggesting how Hitler would react to defeat (Ault and Reese 1980; Langer 1972).

How does one develop such a profile? What materi-

als are the necessary ingredients of profiling? What kinds of crimes are more appropriately profiled? The balance of this paper will deal with answers to these basic questions.

Let us begin by defining the process of psychological profiling. A psychological profile focuses attention on individuals with personality traits that parallel traits of others who have committed very similar offenses (Geberth 1983). It is through close examination of the crime scene that one is able to extrapolate certain relevant psychological material that leads to a profile. A forensic pathologist will allow the corpse to "tell how it was murdered" by bruises, marks, and chemical analyses. The forensic investigator will let the entire crime scene, including the victim, tell "what KIND of person committed this act."

Not all crime scenes are appropriate for profiling, however. Only where psychopathology is evidenced will the scene lend itself to being profiled. Common burglaries, "smoking-gun" crimes where a victim is simply shot in the commission of a robbery, and most property destruction cases are among the kinds of crimes which are not suitable for profiling (Hazelwood 1983). Another area of crime not apropos for profiling is the drug induced crime. Because drugs are mind altering substances, the personality is in an altered state during the commission of the crime. It becomes increasingly difficult to determine which traits are nondrug induced (personality traits) and which traits are the effect of the drugs (Hazelwood 1983).

For any crime where there is some indication of psychological dysfunction, a profile can be attempted. Certain crimes are most appropriate (Douglas, in press): sadistic torture in sexual assaults; evisceration; post mortem slashings and cuttings; post mortem explorations; motiveless firesettings; lust and mutilation murders; ritualistic crimes; and rapes.

Once it is determined that a crime scene exhibits evidence of a mental or personality aberration and profiling is requested, what steps are required to conduct such a forensic investigation? This process involves five steps (Douglas, in press):

1. a comprehensive study of the nature of the criminal act and the types of persons who have committed this offense
2. a thorough analysis of the specific crime scene involved in the case
3. an in-depth examination of the background and activities of the victim(s) and any known suspect(s)
4. a formulation of the probable motivating

factors of all parties involved

5. the development of a description of the perpetrator based upon the overt characteristics associated with his probable psychological make-up.

The factors frequently assessed and described in a psychological profile of a perpetrator are: the sex and age range; marital status; education level; general employment; reaction to police questioning; degree of sexual maturity; whether the individual might strike again; the possibility that he has committed a similar offense in the past; and whether he possibly has a police record (Ault and Reese 1980; Geberth 1983).

As previously stated, the profile is developed from material collected from the crime scene; hence, the crime scene material must be as complete as possible. Necessary information required in order to develop a complete profile includes (Ault and Reese 1980; Douglas, in press; Geberth 1983):

1. Photographs of the crime scene.
This includes color photos of the victim, enlarged photos of the wounds on the victim's body, various angles and positions of the victim, and complete photos of the entire area of the crime.
2. Neighborhood and Complex.
This includes racial, ethnic, and social data.
3. Medical Examiner's Report.
This includes photos depicting the full extent of damage to the body, toxicology reports, report on presence of any semen and post mortem wounds.
4. Map of the victim's travels prior to death.
This includes place employed, residence, and where last seen before the crime scene location.
5. Complete investigative report of the incident.
This includes standard report of date, time, location, etc.; weapon, if known; investigative officer's reconstruction of the sequence of events; and detailed interview of witnesses.
6. Background on the victim.
This includes age; sex; race; physical description including dress at the time of the incident; marital status/adjustment; intelligence, scholastic achievement, and adjustment; life style and recent changes in life style; personality style and characteristics; demeanor; residency, former and present,

and its relation to the crime scene; sexual adjustment; occupation, former and present; reputation at home and at work; medical history, physical and mental; fears; personal habits, such as the use of alcohol or drugs; social habits; hobbies; friends and enemies; and recent court action.

Once the above listed material has been collected (referred to as the "WHAT" of the crime), the profiler attempts to determine the "WHY" of the crime, that is, the motivation to commit such a crime. A basic premise of profiling (Hazelwood 1983) is that if the WHAT and the WHY of the crime can be determined, the WHO will follow.

Let us now view this material in relation to an actual case (Hazelwood 1983). The following incident occurred in a white, upper-class neighborhood during the summer months of school recess. The victim was a 12-year-old male.

Routinely, the victim would go fishing in a pond (see figure 1) located approximately $\frac{3}{8}$ of a mile from his home during the afternoon. The victim's father, a physician, knew his son would return from the pond and be ready for dinner by five o'clock in the evening.

FIGURE 1
RELATIVE LOCATIONS OF THE BUSH
AND POND IN CRIME SCENE

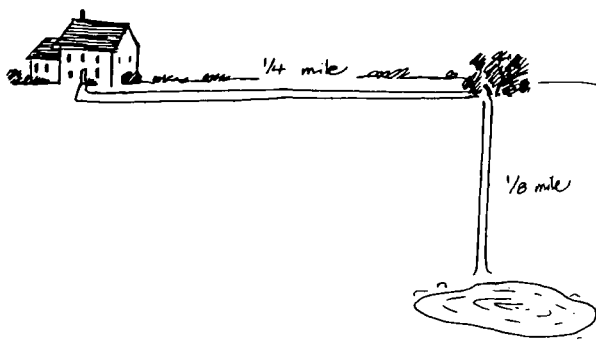
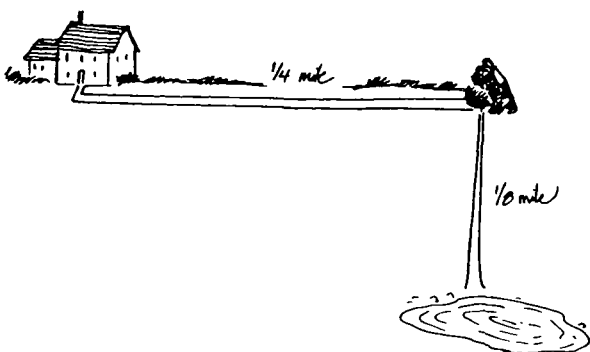


FIGURE 2
BODY OF VICTIM LOCATED ON BUSH



On a particular day the child did not return in time for dinner. After waiting a short time, the father followed the walking path through the wooded area to the pond. However, before reaching the pond he discovered the body of his son lying exposed on the top of a large bush (see figure 2). Realizing his son was dead, he immediately notified the police.

The crime scene photographs, police incident report, maps of the location, and the coroner's reports afforded the investigators with the necessary WHAT of the crime—the details of the crime. They can be outlined as follows:

1. Body shot in the back with a .22 caliber firearm from a distance of 18" from the body.
2. Post mortem stab wound located in the upper torso of the body.
3. Post mortem anal assault was evidenced.
4. Body was washed in the pond after death was effected.
5. Body was redressed with a new T-shirt. The shirt was the victim's correct size, but it was NOT owned by the victim.
6. Body was moved from the pond where the murder took place and was displayed on the top of a large bush.
7. Boy's pants were up and zipped.

Having assembled the facts of the case, the profiler is now able to ask questions concerning motivational intent, that is, the WHY of the crime.

Let us examine each of the facts of the crime in an attempt to determine the possible reasons an individual would commit each of these acts. A word of caution: in attempting to understand the reason for an action, always view the act from the perspective of the perpetrator (Hazelwood 1983); otherwise, any explanation falls very short of comprehension.

An examination of the crime scene suggests the following. It would appear that the victim and the actor were acquainted. Further, it can be suggested that the actor felt some degree of affinity for the victim. This is neither to suggest the actor was related to the victim nor that they were very close in friendship; however, they did know one another.

This acquaintance is suggested for the following reasons. The victim was shot at a close range, only 18" from the gun muzzle. An even stronger reason to suggest that they knew one another, though distantly, is due to the fact the boy was dressed in a new T-shirt, one that though it was his exact size, was not owned by the boy. The actor must have known the boy beforehand to have known the correct size. (This appar-

ent premeditation will tell us more information about the actor later as well.)

Having placed the body on a bush in plain view suggests that the actor wanted the body discovered. There are three ways of disposing a body (Hazelwood 1983): dump, conceal, and display. In "dumping" a body, there is no concerted effort to conceal the act or the victim. Generally, the actor is disorganized, experiencing a panic reaction state, and is only concerned with "getting rid of the body."

"Concealing" the body suggests some organization and possibly suggests premeditation. The body may be burned, cut up into unrecognizable parts, or buried in a deep grave. "Displaying" the body suggests the actor wished that the body be found. There are two reasons to want the body found: (1) concern for the victim and/or the family, and (2) in order to taunt the family, friends, police, and/or the community. The way in which the body is "displayed" will indicate whether the desire is to taunt or whether the desire is to have the body found out of concern.

In this present case, given the additional facts that the body was washed and dressed subsequent to the killing, it would appear that the perpetrator acted out of a morbid sense of concern for the child and/or his family in displaying the body.

"Undoing" is a psychological process where an individual attempts, through some ritualistic behavior, to "undo" the event which he caused. In other words, it is an attempt to atone for and so counteract some immoral act or desire (Coleman 1980). A clear example from literature is Pontius Pilate's washing of his hands in the Bible as an attempt to display his innocence of the blood of Jesus. A more poignant example is found in Shakespeare's *Macbeth*. Lady Macbeth, after her involvement in the death of Duncan, developed a handwashing obsession, a clear, albeit unconscious, attempt to wash away her guilt. In the present case, by washing the body of his victim, this actor was seemingly both cleansing the body in preparation for its display as well as attempting to "undo" his actions.

The post-mortem anal assault suggests two possible interpretations. The first explanation relates to the same reason for displaying the body in the "wake-like" position (cleansed and dressed), namely, out of concern for the victim. By assaulting the child post-mortem, the actor avoided inflicting further physical harm on the victim. (Remember, these explanations and reasons must be seen from the perspective of the actor of the crime.) Second, the post-mortem assault further suggests a tremendous amount of sexual inadequacy on the part of the offender.

The post-mortem stabbing in the upper torso is an example of a psychological perversion called piquerism (deRiver 1958; Morneau and Rockwell 1980). Piquerism is a perversion wherein one derives sexual gratification by piercing or stabbing his victim.

A typical case of piquer was a young man in his early twenties who operated and performed his perverted sexual aggressive activities only at night or in crowds. He did not wait to see how much destruction his actions reaped, but quickly disappeared into the crowds or into the blackness of the night. All of his victims were of the same age group, all were apparently unknown to him, none of them ever saw his face. He inserted his sharp instrument (an ice pick) into the thigh or breast of his female victim with such rapidity that she hardly knew what had happened. (deRiver 1958, p. 46).

Often, when mutilation, maiming, and cutting occur, they are delivered after the assailant murders his victim (deRiver 1950b; Reinhardt 1957). In this present case, perhaps one can again see a morbid sense of concern for the boy, not stabbing him until after he had already delivered the death shot from behind.

Analyzing the details (WHAT) of the crime and then suggesting reasons (WHY) for these actions, one can now ask what type (WHO) of person is likely to kill a 12-year-old boy in this manner?

Many of the answers listed below are the result of statistics. In other words, given many incidents of a similar nature, the investigators have discovered that the individuals who often committed "this particular type of offense" displayed certain specific characteristics or traits.

Let us begin now to draw a picture, using statistics of similar cases as well as psychological explanations of aberrant behavior.

The first and major recognition is that we are dealing with a pedophile, an adult individual who chooses a child or an adolescent as one's sexual object (deRiver 1958; Hazelwood and Douglas 1980; Mohr, Turner, and Jerry 1964). Pedophiles are classified into two groups, with classification made on the following bases (Bartol 1980; Burgess, et al. 1978; deYoung 1982): if the adult has been involved in this kind of activity since adolescence, he is considered a fixated pedophile; if, on the other hand, the individual's involvement constitutes a recent change in sexual activity, he is a regressed pedophile. This is an exceptionally important point because the regressed pedophile will *act* and *react* quite differently from the

fixated pedophile, as they are quite distinct types. The regressed pedophile

is a person who originally preferred peers or adult partners for sexual gratifications. However, when these adult relationships became conflictual in some important respect, the adult became replaced by the child as the focus of this person's sexual interests and desires. . . . The situational crises may be physical, social, sexual, marital, financial, vocational, etc.—or a combination of such factors—but it precipitates the sexual involvement with a child. His offense is an impulsive and desperate act that is symptomatic of a failure to cope adaptively with specific life stresses. . . . Typically this offender is married and a situation develops that threatens this relationship. . . . Quite often he is distressed by this behavior. . . . At the time of the sexual activity, this offender is usually in a state of depression, . . . he suspends his usual values, his controls are weak . . . (Burgess, et al. 1978, pp. 8-9).

This is contrasted with the fixated pedophile

who has, from adolescence, been sexually attracted primarily or exclusively to significantly younger people, and this attraction has persisted throughout his life, regardless of what other sexual experiences he has had. As a teenager this offender tends to avoid the usual pattern of socialization with age-mates typical of adolescence, such as dating and competitive sports. . . . The fixated pedophile may respond to sexual invitations or demands from age-mates, but generally does not initiate or actively pursue them. . . . For the most part, these pedophile desires are not disturbing to the fixated offender; that is, he is comfortable and satisfied with such activity and experiences no intense feelings of guilt, shame, or remorse in this regard. . . . Sexual thoughts and fantasies about children or young adolescents preoccupy the offender, and interest in them often reaches the level of an obsession. The offender appears sexually "addicted" to children. . . . He appears to be a marginal or inadequate individual who is somewhat overwhelmed by the ordinary demands of life. He feels compelled to interact sexually with children, and he finds or creates opportunities to be in their company (Burgess, et al. 1978, pp. 6-7).

Consequently, we can derive the following major

differences between the regressed and the fixated pedophile:

Regressed Pedophile:

- a. Psychosexual development was normal beyond the adolescent stage.
- b. He regresses when feelings of inadequacy intrude.
- c. The crime scene is disorganized; it evidences little or no plan.
- d. If he kills his victim, it is out of fear and panic.
- e. Disposal of the body will be accomplished by "dumping" it in some fashion. This is a result of his lack of organization as well as a reaction to his fear, guilt, and panic.

Fixated Pedophile:

- a. He has been directed to younger objects sexually since adolescence.
- b. He has not experienced a "normal" sex life, nor has he been married.
- c. His job and/or recreational activities place him in situations where he must deal with children.
- d. Statistically (Hazelwood 1983), when a fixated pedophile murders, he is in the 45-55 age bracket.

There are several other facts that can be drawn from statistical knowledge of crimes of a similar nature. Based on the fact that most pedophiles are caucasian and the fact that this crime occurred in a segregated, white, upper-class neighborhood during the daylight hours, the chances are more than significantly high that the offender will be a 45-55-year-old white male. He is probably of average to better than average intelligence. This is both a statistical finding as well as a recognition of the details of the crime and the crime scene. Given his intelligence and abilities, he may well have attended college and is now employed in a white-collar job which brings him in contact with children.

Our profile indicates that the offender is single and sexually inadequate (as indicated from the classification as a fixated pedophile). One can also suggest, given his long standing proclivity toward children, that he has an extensive record for child molesting.

It is known from the crime scene that this offender is well organized and does not generally act on impulse. It is then reasonable to suggest that the offender does *not* live in proximity to the crime. He is too organized to commit such an act "in his own back yard."

Considering the year of the crime (early 1970s) and the probable age of the offender (45-55), it is reasonable, then, to assume that he is a military veteran. He more than likely would have been drafted than voluntarily chosen the military service as a vocation.

Finally, the vehicle this individual operates would be one of three: a station wagon, a four-door sedan, or a van. Since he is often with children—either for work or for recreation—he needs a large vehicle to transport the children. Given his probable age and socioeconomic status, the vehicle will be two- to five-years old, well maintained, and painted a conservative color.

The individual who was eventually apprehended and charged with the murder was a 50-year-old, single, white male who was employed in a white-collar job. The defendant was in the area of the murder several days before the incident in connection with his employment. It was during this time he engaged the youth in conversation and the two became acquainted.

He had been drafted in the military service, is now a veteran, tests above average in intelligence, and attended college. He did not live in the general area of the crime but commuted in his four-door sedan—well maintained, dark in color, and 4-years old.

The above case, profiled by the Federal Bureau of Investigation's Behavioral Science Unit at Quantico, Virginia, is one of hundreds correctly detailed. Basing its decisions on a combination of common sense, logic, intuition, and experience, this unit claims an accuracy rate in excess of 80 percent in its profiling abilities (Hazelwood 1983). Utilizing an understanding of the principles of psychopathology, as well as statistics from similar crimes across the nation, the unit is able to hone in on the most salient aspects of the crime scene in developing its cases.

The psychological profile was first used by the Bureau in 1971 (Douglas, *in press*) when it afforded assistance to local law enforcement authorities in solving a murder case. In 1981, a study was conducted by the FBI in order to analyze the effects of the Behavioral Science Unit in psychological profiling. Several questions were examined by the Bureau in its analyses. What follows are several of those questions and the results of an internal examination by the Bureau (Douglas, *in press*).

In 1981, as part of regular management practices, the Institutional Research and Development Unit of the FBI Training Division was asked to initiate a cost-benefit study to determine the extent of the value the service has had to its users. Specifically, the analysis was un-

dertaken to examine two questions: (1) what was the nature and extent of any assistance provided by psychological profiling; and (2) what were the actual results of utilizing a psychological profile in terms of offender identification and/or savings in investigative mandays (sic)? A review of the material submitted by the various field divisions for analysis revealed that requests had originated with the jurisdictional areas of 54 field offices and 2 local attaches. While the majority of these submissions were from city police (52 percent), requests came from all levels of law enforcement services including county police or sheriff (32 percent); FBI (8 percent); state police (7 percent); state investigators (5 percent); and state highway patrol (1 percent) (see table 1).

TABLE 1
AGENCIES REQUESTING PROFILES

Agency	Number	Percent
City	100	52.0
County Police or Sheriff	45	23.4
FBI	16	8.3
State Police	13	6.7
State Investigators	10	5.2
State Highway Patrol	2	1.0
Not Given	6	3.13

As might be suspected, most of the requests for psychological profiling were submitted in an effort to identify the individual(s) responsible for one or more murders (65 percent). The second highest offense requested was for rape (35 percent) with other offenses including kidnapping, extortion, threat/obscene communication, child molestation, hostage situations, accidental death, suicide, and others (see table 2). Most of the cases submitted involved a sin-

TABLE 2
TYPES OF OFFENSES IN WHICH
PSYCHOLOGICAL PROFILING WAS REQUESTED

Crime	Number	Percent
Homicide	126	65.0
Rape	68	35.0
Kidnapping	15	7.8
Extortion	8	4.2
Threat/Obscene Communication	7	3.6
Child Molesting	3	1.5
Hostage Situation	3	1.5
Accidental Death	2	1.0
Suicide	1	.5
Other	14	7.2

gle victim (61 percent) although 10 percent involved at least two, and 17 percent contained six or more victims.

Based on the total requests ($N = 192$), the suspect(s) were identified (*as a result of profiling*) in a total of 88 or 46 percent of the cases. In these cases, responding agencies indicated that psychological profiling was useful in the following ways: (1) focused the investigation properly; (2) helped locate possible suspects; (3) identified suspects; (4) assisted in the prosecution of suspect(s). Only in 15 cases was profiling stated to be of no assistance (see table 3; italics added).

TABLE 3
TYPES OF ASSISTANCE PROVIDED
BY PROFILING IN CASES WHERE SUSPECT(S)
WAS (WERE) IDENTIFIED

Type	Number	Percent*
Focused the Investigation Properly	68	77.2
Helped Locate Possible Suspect(s)	18	20.4
Identified Suspect(s)	15	17.0
Assisted in the Prosecution of Suspect(s)	5	5.6
Was of No Assistance	15	17.0

*Totals do not equal 100 percent since more than one type of assistance may be rendered in a single case.

Psychological profiling is one investigative tool among many tools. It is not a magical solution nor is it a "substitute for a thorough and well-planned investigation" (Douglas, in press). Rather, it is an attempt to utilize behavioral and psychodynamic principles of psychology in an applied setting.

Given the above data in regard to the interaction of psychodynamic and behavioral principles with the investigative tools of law enforcement, certain questions remain. What will future applications look like? And what place will research play in establishing validity and reliability?

Certainly, in today's age of the computer, a recurrent question that is asked of the FBI is "Couldn't this entire procedure be placed within a computerized framework?" In other words, facts from a crime scene can be punched into a terminal and a computerized profile will appear on the screen. Such a system is being developed by the FBI. Eventually, it is hoped that any law enforcement officer from any jurisdiction will have such capabilities at his disposal. The officer will be able to enter data from a crime scene which occurred in this jurisdiction through a computerized cross-reference system which will analyze similar

crimes from across the nation. A profile will be drawn as to such characteristics as sex, age, race, and probable residence in relation to the crime scene. These characteristics will be weighted numerically, depending on the frequency with which they appear in similar crimes in the past (Porter 1983). The *possible* shortcoming of this computer technology lies in the combination of factors that are orchestrated to produce a profile, namely, common sense, logic, intuition, and experience, both street and academic (Hazelwood 1983). Until this process is underway, it remains a question: "Will the computer programmer be able to factor in such ingredients as common sense, intuition, and street experience?" Once underway, the "sign vs. seer" approach or the "sign vs. seer plus sign" approach can be empirically tested in either real or simulated ways.

Before moving to a specific research question, there is one related area that should be addressed: the "proactive" use of psychological profiling. This proactive use of profiling is applied in two areas: (1) bringing an unknown suspect to reveal himself, and (2) causing a known suspect to "break down" and reveal his guilt.

Through media presentations one can create anxiety within certain offender types who listen to and read media reports. The degree of anxiety may be enough to cause a precipitous move on his part, thus calling attention to himself (Porter 1983).

The second area where proactive profiling is applicable is within the court proceeding. With a knowledge of the emotional and psychological profile of an offender, one is able to assist the prosecutor in courtroom examination and cross-examination. This was clearly seen in the case of Wayne Williams, tried and convicted of murder in the Atlanta slayings:

... the problem, from the prosecutor's point of view, was that in the beginning, Williams appeared too cool and composed—hardly the picture of a man capable of murderous outbursts. "We were concerned," Douglas recalls, "that the jury was seeing him as a creditable type of person." Douglas therefore advised Mallard (Assistant District Attorney) to keep Williams on the stand as long as possible and to rattle him with detailed questions about the killings. "It's difficult for him here in the courtroom where he's not in control and where all the flaws in his personality are coming out. The longer you can keep him up there, the more he'll become agitated and the greater the chance that he'll create an outburst." Douglas said (Porter 1983, p. 52).

An interesting research question also surfaces which deals primarily with regard to the reliability of the process of psychological profiling. The following research proposals are designed to analyze the variance within groups of profilers and between groups of profilers with reference to their reliability in profiling accuracy.

The question can be formed as follows: Are the predictive statements of professional profilers statistically higher than chance, and are they statistically higher than the predictive statements of forensic psychologists/psychiatrists and of the general public? In order to test this question, crime scene data from three actual cases will be presented to each individual of the three groups. In each of the presenting cases, the actor of the crime will have been arrested, tried, and convicted of the crime. Consequently, both reliability and validity of the predictions can be tested with reference to the actual offender.

It is hypothesized that the forensic psychologist/psychiatrist's accuracy will exceed that of the lay person. However, the professional profiler's accuracy will be greater than either of the other two groups.

One might expect the forensic psychologist/psychiatrist's ability to exceed the lay person's ability, based upon the psychologist/psychiatrist's educational background in psychopathology. However, a major element is missing in the background of the "typical" forensic psychologist/psychiatrist: crime scene experience and investigative expertise. One of the major ingredients of profiling is intuition. A large part of intuition results from actually having been involved in processing crime scene investigations. Though some forensic psychologists/psychiatrists do, in fact, "develop" this intuition, the incidence of this occurring remains seemingly low.

A subsequent study analyzing within group reliability could then be made with data from the above study. It would be reasonable to expect some variance in the accuracy within each of the three groups. Of greater interest would be the variance within the group of professional profilers.

Where differences in ratings are found, several questions would follow. Are the differences a result of unclear directions; ambiguous definitions; profiler's academic background and understanding of principles of psychopathology, especially due to approach (for example, psychoanalytic or behavioral); profiler's experience with actual crime scenes; and profiler's investigative experience.

Currently, the Behavioral Science Unit of the Federal Bureau of Investigation is developing a variety

of research methods to statistically test for reliability and validity. Some of their methods will incorporate parts of the above described techniques; other forms of analyzing the data are presently in the planning stages (Hazelwood 1983b).

As Bruce Porter stated in his article "Mind Hunters" (1983):

. . . the day does not seem far off when the police will be able to identify a criminal by the psychic loops and whorls he left at the scene, just as quickly and as surely as if he had covered the wall with fingerprints.

But getting to "that day" is going to require the empirical support that researchers, particularly researchers in psychology and the behavioral sciences, can provide.

ACKNOWLEDGMENT

This author wishes to gratefully acknowledge the cooperation of the Behavioral Science Unit of the Federal Bureau of Investigation, Quantico, Virginia. Particular gratitude is expressed to Special Agent Robert R. Hazelwood for his assistance and keen insight in the preparation of this article as well as to Professor Norman Finkel of Georgetown University for his assistance and editorial comments.

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Criminal Personality Profiling

An Outcome and Process Study*

Anthony J. Pinizzotto† and Norman J. Finkel†

In this work we examine outcome and process differences in criminal personality profiling among groups of profilers, detectives, psychologists, and students, using closed police cases—one sex offense and one homicide. Two major questions guide this research: (1) Are professional profilers more accurate than nonprofilers in generating personality profiles and correctly identifying offender features from crime scene details? and (2) Is the process that the profilers use qualitatively different from that of the nonprofilers? In the written profile task, the task that is most representative of what profilers actually do, profilers write richer, more detailed, and more valid profiles than the nonprofilers for both the sex offense case and homicide case. An analysis of correct responses concerning the known offender for the sex offense case revealed that the profilers scored significantly better than the other three groups in a variety of measures; similar results were not revealed for the homicide case. Profilers, however, do not appear to process this material in a way qualitatively different from any other group.

Criminal personality profiling—formerly the stock-in-trade of whodunit writers, whose fictional detectives transformed crime scene facts into a portrait of the perpetrator—has itself been transformed in the last 20 years from fiction to fact. As the use of criminal personality profiling increases, empirical questions con-

* This article is based in part on the doctoral dissertation of the first author. We gratefully acknowledge the suggestions and comments of John Monahan, Bruce Sales, Daniel Robinson, Darlene Howard, and James Lamiell. A special note of gratitude is given to those law enforcement agencies and individuals who participated in this study but need to remain anonymous; without their participation, this research could not have been completed. A note of thanks is given also to SSA Roger Depue and SSA Roy Hazelwood of the Federal Bureau of Investigation for their valued assistance. Requests for reprints should be sent to Anthony J. Pinizzotto, Department of Psychology, Georgetown University, Washington, D.C., 20057.

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cerning its validity and reliability, and legal questions regarding its applicability, arise. Already one court has allowed partial reading of a personality profile to be introduced into testimony (*Kentucky v. Gowin*, 1986).

The actual origins of criminal profiling are obscure (Ault & Reese, 1980). During World War II, the Office of Strategic Services (OSS) employed William Langer, a psychiatrist, to profile the personality of Adolf Hitler; Langer described Hitler's personality, diagnosed his condition, and accurately predicted how Hitler would react to defeat (Langer, 1972). Psychological profiling was first used by the Federal Bureau of Investigation in 1971 (Ressler, Burgess, Hartman, Douglas, & McCormack, 1986). In relatively short order, the early and isolated efforts have given way to the current era, where "professional criminal personality profilers" are trained (typically at the Behavioral Science Unit of the F.B.I. in Quantico, Virginia) and are then called upon with increasing frequency to assist in ongoing criminal investigations.

Largely through the F.B.I.'s continued and increasing use of profiling, along with the training of profilers, the topic has become defined, its areas of applicability delimited, its procedural steps outlined, and its conceptual underpinnings articulated. A psychological profile (Geberth, 1983) focuses attention on individuals with personality traits that parallel traits of others who have committed similar offenses. Through close examination of the crime scene one is able to extrapolate certain relevant psychological material that leads to a profile; said another way, the forensic investigator will let the entire crime scene, including the victim, tell, in effect, what *kind* of person committed this act (Pinizzotto, 1984).

Once it is determined that a crime exhibits evidence of a mental or personality aberration and profiling is requested, a five-step procedure typically follows (Ault & Reese, 1980; Douglas & Burgess, 1986; Geberth, 1983; Vorpapel, 1972): (a) a comprehensive study of the nature of the criminal act and the types of persons who have committed this offense; (b) a thorough analysis of the specific crime scene involved in the case; (c) an in-depth examination of the background and activities of the victim(s) and any known suspect(s); (d) a formulation of the probable motivating factors of all parties involved; and (e) the development of a description of the perpetrator based upon the overt characteristics associated with the person's probable psychological make-up.

Once the material has been collected, referred to as the "WHAT" of the crime, the profiler attempts to determine the "WHY" of the crime: that is, the motivation for each crime scene detail and for the crime itself. A basic premise of profiling is that if the WHAT and the WHY of the crime can be determined, the WHO will follow (R. R. Hazelwood, personal communication, January 8, 1983). Thus, using behavioral, correlational, and psychodynamic principles of psychology, the profiler proceeds from the WHAT to the WHY to the WHO. Factors frequently assessed in a psychological profile of a perpetrator are: sex, age range, marital status, education level, general employment, reaction to police questioning, degree of sexual maturity, whether the individual might strike again, the possibility that this person has committed a similar offense in the past, and whether the perpetrator has a police record (Ault & Reese, 1980; Geberth, 1983).

The Conceptual Underpinnings of Profiling

The WHAT-to-WHY-to-WHO model, beyond providing a very general conceptual-sequential framework, lacks specificity on two counts: for one, it does not tell us precisely how (i.e., by what rules of thumb) the profiler gets from the WHAT to the WHY, or from the WHY to the WHO; and for another, it does not specify which behavioral, correlational, or psychodynamic principles are being invoked for making predictions from which type of crime facts, or how these various principles and predictions are interrelated.

Various conceptual models (Dietz, 1985; Douglas, Ressler, Burgess, & Hartman, 1986; Rossi, 1982) have attempted to describe the theoretical process profilers use, with the recent attempts focusing on psychological constructs and trait theory (Ellerby, 1986). To mainstream psychologists, the use of trait theory (Allport, 1967) may seem dated, if not questionable, given the situational emphasis (Mischel, 1979) and idiothetic thrust (Lamiell, 1987) of personality researchers and theorists today. However, trait theory has its defenders when it comes to criminal personality profiling, because the "person variable" repeatedly shows a greater consistency and weight when we move from normal to pathological populations (Alker, 1972; Ellerby, 1986; Ender, 1973; Ender & Okada, 1975; Moos, 1968, 1969). Regarding the realm of applied forensic psychology, criminal personality profiling appears to benefit from this trait theory approach particularly when examining scenes that exhibit significant degrees of psychopathology.

Rationale for this Study

Given the growing use of the personality profile and the fact that this growing use is largely supported by testimonials and accuracy figures that were not obtained through controlled studies, this research was undertaken to provide more precise answers to both *outcome* and *process* questions.

Regarding outcome, is the profiling of the experts accurate, and to what degree? Said another way, can the professional profilers' claim of expertise in criminal personality profiling be substantiated, when compared against control groups of experienced detectives, clinical psychologists, and college students? This outcome question will be tested using a homicide case (Burgess et al., 1986; Ellerby, 1986) and a sex offense case (Ressler et al., 1986; Scolatti, 1986).

The second major question concerns the *process* of criminal personality profiling. That is, how do profilers and nonprofilers organize and recall knowledge related to crime scene investigations? Like the master chess player (Chase & Simon, 1973), mathematician (Larkin, McDermott, Simon, & Simon, 1980; Schoenfeld, 1980; Simon & Simon, 1978, 1979), and physicist (Larkin, 1979, 1980), experienced profilers may be able to give meaning to what might appear to the nonfiler as random, inconsequential, or illogical. It is assumed here that because of this imposed meaning, the expert will organize and recall the details of the crime differently from the novice. In short, both qualitative and quantitative process differences should emerge between profilers and nonprofilers.

The specific research hypotheses include the following:

1. Profilers will write more detailed, informative profiles than any other group.
2. Detectives, who are trained to look at and examine every detail on a crime scene, will recall a greater number of details than any other group.
3. Profilers, who are trained to discriminate relevant from extraneous details, will recall a greater number of details that are necessary and important to writing a profile.
4. Profilers will describe more accurately the suspect in the sex offense than in the homicide offense. In the sex offense case, the profilers are supplied with a victim statement that generally gives a narrative of the crime as it occurred, but in the homicide case, no such witness statement is typically available.
5. In the professional groups (profilers, detectives, and psychologists), (a) profilers will examine each detail of a crime scene, attempting to give reason for each detail—as well as the motivation for the overall act; (b) detectives will look more to the motivation of the act (crime) itself without looking at the individual reasons for each detail on the crime scene; and (c) psychologists will examine some individual details and attempt to determine motivation, but they will remain unclear as to which details are of significance.

METHOD

Subjects

Of the 28 subjects used in this study, four (Group A, Expert/Teacher) were profiling experts who train police detectives in profiling at the F.B.I. Academy in Quantico, Virginia. Each of these subjects is or was an agent with the Federal Bureau of Investigation. They share a combined total of 42 years of profiling, with a range of 4–17 years experience. The authors were unable to locate sufficient numbers of expert/teachers who were both actively engaged in profiling and willing to cooperate in this study. Two of the four designated expert/teachers used in the study are no longer involved in profiling.

Six subjects were police detectives from different police agencies across the country who have been specially trained in personality profiling (Group B, Profilers). The course of studies involved 1 year at the Behavioral Science Unit of the Federal Bureau of Investigation in Quantico. These six profilers have a combined total of 65 years as detectives in law enforcement (range = 7–15), and 14 years of combined experience in profiling (range = 1–6).

Six detectives (Group C, Detectives) from a large metropolitan city police department made up another subject group. Though these detectives have no training in personality profiling, they are experienced police investigators in both homicide and sex offenses. They share a combined total of 93 years in the police

department and a combined total of 57 years experience in criminal investigations (range = 6–15).

Six clinical psychologists (Group D, Psychologists), naive to both criminal profiling and criminal investigations, were used. The psychologists share a combined total of 85 years as practicing clinicians (range = 7–24). For all of the subjects in Groups A, B, C, and D, participation was voluntary and no remuneration was received.

Six undergraduate students (Group E, Students) from a large metropolitan university naive to both personality profiling and criminal investigations were used. These students were drawn from several general psychology classes. The average age of the students was 19. For the students, participation in this study was voluntary, and each was given \$10 for participation in this study. All of the subjects were treated in accordance with APA's Ethical Standards.

Materials

Two crime scene investigations of "closed cases" were used: these cases involve actual crimes that have been solved (an individual has been arrested, charged, and convicted of the crime). One case involved a homicide and the other involved a sex offense.

The materials in the homicide case included:

1. Fourteen black-and-white crime scene photographs.
2. Information concerning the victim of the crime (victimology report). This material was compiled from statements given by relatives and friends as found in the police reports. The victim data included race, age, education, residence, physical disabilities, drug and alcohol use, and reputation, according to friends.
3. Autopsy and toxicology reports. These reports were provided by the medical examiner's office, and included the cause, manner, and mode of death. The toxicological examination of body fluids and organs is performed in order to determine if any chemical agents were present in the victim's system that would be related to his or her death.
4. Crime scene reports. These included the report of the first uniformed officer on the scene, the detectives' reports, and the follow-up investigative reports as provided by the police department. These reports included date and time the body was discovered, and by whom, the area where the body was found, and the condition and arrangement of the body.

The materials in the sex offense case included:

1. Detailed victim statement. The victim's statement of what happened and what the offender did and said, as she relayed it to the investigative detectives, was combined with the crime scene reports. The crime scene reports included the reports of the first uniformed officer on the scene, the detectives' reports, and the follow-up investigative reports as provided by the police department. Included in the report were the date and area of the

sexual offense, the race, age, and occupation of the victim, as well as the events that led up to the rape, the rape itself, and the events that followed the rape.

2. **Victimology.** This comprised information concerning the victim of the crime. This material was offered by the victim herself as found in the initial police report. This information included the race, age, and occupation of the victim. Her physical appearance and personality as described by her friends as well as by the detectives who interviewed her were also given. A history of the victim's alcohol and drug use was included.

For both cases, the materials were sanitized to protect the identities of both parties involved in the crime, as well as the police agencies. This unavoidable necessity meant that some material ordinarily available to profilers (e.g., maps of geographical area and neighborhood) was absent here. Prior to final selection of the cases, a search of newspaper and magazines from the areas in which the subjects resided was made. This search revealed no major news coverage of either case. As a check on "prior familiarity," all subjects were instructed (on the Information Sheet each completed) as follows: "During any part of this experiment, if you feel you are at all familiar with either of these cases, please inform the experimenter immediately."

Procedure

The study was administered in six stages.

1. All members of each group (A, B, C, D, E) were given either the homicide or the sex offense case to read. The cases were given in a balanced order. The subjects were told to read all the information concerning the particular case before them, and that after they completed the reading, they would be asked some questions concerning the materials.
2. Next, each subject was asked to cover all the material and to write down as many details of the case as the subject was able to recall.
3. At the completion of the recall of details task, the subjects were asked to follow a two-step procedure. Using the list of details that the subject recalled and wrote in Stage 2, the subject was asked to (a) write down all those details from the crime scene that you feel are *necessary and important* to be used in writing a profile concerning the characteristics and traits of the *kind or type* of person who would commit such an act as the one about which you just read, and (b) write down the *reason why you feel these details are important*, that is, what these details tell you about the person who committed this particular crime.
4. Each subject was then given the case jacket again and was asked to write a profile of the type of person who committed the crime they had just read and to give as much detail as possible. This step was recorded on audio tape.
5. Next, each subject was given a multiple choice question sheet which consisted of 20 questions about the suspect. These questions asked about the suspect's gender, age, race, and residence in relation to the occurrence of

the crime; employment data regarding type of occupation and work habits; suspect's use of alcohol and illicit drugs; vehicle; victim-offender relationship; likelihood that the offender committed similar crimes in the past as well as the likelihood that this particular offender will commit a similar act in the future. Five of these 20 questions were not scored because there were no correct answers to these questions (e.g., level of confidence in the subject's own prediction that the offender had a police record). For the remaining 15 questions that were scorable, the gender question had only two choices, whereas the other questions had 4–8 choices, with a total of 69 possible choices for the 15 questions.

6. The last step was a lineup task. Five written descriptions of possible suspects were given to each subject. From the five descriptions, the subjects were asked to order each of them, ranging from one to five, with number one being the suspect whom the subject thinks committed the crime, and number five being the person the subject thinks is least likely to have committed the crime. These descriptions of possible suspects varied in the number of correct and incorrect items.

Having completed Step 6 for the first case, each subject was asked to follow the same procedure—this time, analyzing the second crime.

The only procedural differences occurred with Group A, the expert/teacher profilers. Specifically, they were not asked to complete Sections 2 and 3 of the procedure, as the purpose of using these expert/teacher profilers was only to determine a base line for a comparison of the responses of the expert profilers with the other groups.

One section was performed by the expert/teacher profilers alone. At the completion of the Response Questionnaire Concerning Offender form for both the homicide and sex offense cases, the expert/teacher profilers were asked to complete the Probability Rating form in two different ways. First, these subjects were asked to rate their answers to the Response Questionnaire Concerning Offender form along an 11-point continuum. The weight given to each response was designated as: 0 = *impossible*; 5 = *uncertain*; 10 = *certain*. The subjects were informed that their responses could be placed at any point along the 11-point continuum. The expert/teacher profilers rated their answers to the questionnaire first, then they were asked to rate the remaining possible answers in that same question. In the second step, the expert/teacher profilers were supplied with the correct answer to each of the questions of the Response Questionnaire Concerning Offender form. The subjects were informed that the correct answer was to be regarded as a 10 on the same 0–10 scale, with 10 being regarded as certain. Knowing the correct answer to each of these 15 questions, the subjects were to score each of the other possible choices in its relative reasonableness as correct answers.

The Profile as an Investigative Aid

After all subjects in all groups had completed these procedures, five representative profiles, one from each of the five groups (expert/teachers, profilers,

detectives, psychologists, and students), were selected in the following manner: The longest and the shortest profiles were eliminated, and then one was randomly selected from the remaining profiles. The profiles contained no information that would link the author to a particular group (i.e., expert/teacher, profiler, detective, psychologist, student). Five detectives from a large, Eastern, metropolitan police department, who were not involved in any other part of this study, were given these representative profiles and the following instructions:

Looking at the following five profiles, which profile might provide you with some assistance if you were investigating this homicide? Please rank order these profiles from one to five, with number one being the profile you feel might best assist you and number five being the profile which you feel would be of least assistance in your investigation.

RESULTS

Outcome Analysis

The Written Profile

If expertise differs between the profiler group and the nonprofiler groups of detectives, psychologists, and students, the written profiles, of all the outcome and process measures, should reflect such differences. It is, after all, the written profile task which is most representative of what profilers actually do in their work. It was hypothesized that the profilers would write richer (i.e., more detailed) and more accurate profiles than subjects in the nonprofiler groups. The profiles that were written by each subject in each of the four groups were analyzed for (a) the *time* spent doing the report, (b) the *length* of the report, (c) the *number of predictions* made concerning the offender, the number of those predictions that were (d) general or (e) specific in nature, the number of those predictions which were (f) confirmable and nonconfirmable (i.e., able to be determined by the police reports as a correct statement), and the number of (g) accurate predictions where the predictions were confirmable (see Table 1).

For both the homicide and the sex offense cases, the profiles written by the professional profilers were indeed richer than the nonprofiler groups of detectives, psychologists, and students. An analysis of the subjects' responses using both multivariate (MANOVA) and univariate (ANOVA) measures (a 4×2 design, 4 groups of subjects, 2 cases) showed a significant main effect difference for the groups variable across all seven dependent measures, $F(3,37)$ values ranged from 9.32 to 20.91, all at $p < .001$. In addition, Scheffe (Hays, 1963) post hoc analyses revealed significant differences between profiler versus nonprofiler groups, law enforcement versus non-law-enforcement groups, and between professional versus nonprofessional groups for all seven dependent measures.

For the cases variable, there were significant main effects for five of the dependent measures ($p < .05$), with only the "time spent writing the report" and the "length of the report" variables failing to reach significance. Subjects in all groups recalled more details and made more predictions concerning the sex of-

Table 1. Analyses of the Written Profiles of the Homicide and Sex Offense Cases for Profilers (P), Detectives (D), Psychologists (Psy), and Students (S)

Area of analyses	Homicide ^a				Sex offense			
	P ^b	D	Psy	S	P	D	Psy	S
1. Mean time spent writing report (in minutes)	28.0	7.5	10.3	4.2	24.8	16.6	9.0	8.33
2. Mean length of report (in pages)	10.2	3.8	3.3	1.7	12.0	2.7	3.8	2.3
3. Mean number of predictions	82.8	33.2	27.8	13.2	130.6	47.2	53.6	23.7
a. Mean number of predictions in seven special categories	9.0	1.3	.5	.2	17.2	2.8	1.2	.6
4. Mean number of general predictions ^c	16.0	10.7	10.3	5.6	34.4	17.4	21.2	10.2
5. Mean number of specific predictions	66.8	22.5	17.5	7.5	91.2	29.8	32.4	13.5
6. Mean number of confirmable predictions	38.1	19.0	14.3	7.5	53.2	24.0	25.6	11.2
7. Mean number of accurate predictions	29.1	15.8	10.8	6.3	43.8	19.4	21.0	10.2

^a For variables 3–7, the *F* values were all significant at $p < .05$, showing a “case” main effect.

^b For variables 1–7, the *F* values were all significant at $p < .001$, showing a “group” main effect.

^c Only for variable 4 was there a significant ($p < .05$) Group \times Case interaction effect.

fense case than they did in the homicide case, with the profilers and psychologists showing the largest increases.

Looking at the detectives' rankings of which profile might best assist in an investigation, 80% of these independent detectives ranked the expert/teacher profile as the one they felt would assist their investigation the most; 80% ranked the profile written by the professional profilers as their second choice. This was followed by 80% selecting the detective's profile as their third choice, and 80% selecting the psychologist's profile as their fourth choice. There was 100% agreement that the student profile ranked fifth of the five choices.

Correct Responses

Accuracy measures for the Response Questionnaire Concerning Offender were computed on the basis of 15 possible correct answers, and all groups were significantly above chance performance in terms of the number of correct responses. A chi-square test found significant difference among the groups for the sex offense case, $\chi^2(3, N = 24) = 10.85, p < .05$; such difference was not found for the homicide case. Further analyses for the sex offense case showed that profilers scored significantly better than the other three groups combined, $\chi^2(1, N = 24) = 5.69, p < .05$; that the law enforcement groups of profilers and detectives did better than nonlaw enforcement groups of psychologists and students, $\chi^2(1, N = 24) = 8.2, p < .05$; and that the professional groups of profilers, detectives, and psychologists did better than the nonprofessional group of students, $\chi^2(1, N = 24) = 4.90, p < .05$.

An analysis of the specific questions for each case shows that profilers achieved higher group scores for the sex offense case in questions dealing with the age of the offender, the education of the offender, age, and condition of the

offender's automobile, and the victim-offender relationship. The profilers did not achieve higher scores than subjects in the other groups in these same categories for the homicide case, however. It was the detective group that scored higher in the homicide questions dealing with the offender's employment and the offender's residence in relation to the crime scene.

Table 2 shows the number of correct responses by group and case. While there was some variability within groups, there were no examples of any extreme ranges.

Accuracy Scores

The subjects' responses on the Response Questionnaire Concerning Offender form were analyzed in a different way by first deriving two sets of "accuracy" scores for each subject. The argument for this type of analysis is that all "incorrect" answers are not equally incorrect: Some incorrect answers are closer to the mark; others are far afield. Hence, the subjects' responses were converted into accuracy scores using weighted values for each of their 15 responses to the 15 scorable questions.

These weighted values were derived from scores obtained from expert/teachers (see Method section). A "judgment" score and a "reality" score were then computed for each subject, where the score for both judgment and reality could range from a minimum of 0 to a maximum of 150. An analysis of variance of judgment (4) Group \times (2) Case and reality, (4) Group \times (2) Case scores was computed, and a significant group effect resulted only for the reality scores, $F(3,40) = 3.28$, $p < .05$, for the sex offense case only. Only the profiler versus student group comparison was significant, $F(3,40) = 2.84$, $p < .05$.

Lineup Rankings

The question here was this: Would profilers be more apt to identify the correct offender from the lineup than would the other groups? In the sex offense case, the expert/teachers were accurate in picking out the offender 100% of the time, and the profilers were accurate 83% of the time. As for the other groups,

Table 2. Mean Number of Correct Responses to the Response Questionnaire Concerning Offender Form by Group and Case^a

Group	Homicide ^b		Sex offense ^b		Total ^c	
	Mean	SD	Mean	SD	Mean	SD
Profiler	5.3	0.80	10.0	1.15	15.3	1.60
Detective	7.0	2.50	8.5	1.54	15.5	2.40
Psychologist	6.0	1.20	6.5	1.43	12.5	2.40
Student	6.5	1.50	5.5	0.80	12.0	2.50

^a The 15 questions contained a total of 69 possible choices. If subjects were responding randomly, by chance they would get approximately 3.3 questions correct for each case.

^b Maximum possible score = 15.

^c Maximum possible score = 30.

accuracy is lower, and declines as we move from detectives (67%) to psychologists (50%) to students (16%).

Results varied between the sex offense and the homicide case in group ability to recognize the correct offender from the lineup. First, the percentages of correctly recognizing the homicide offender from a lineup were lower than the sex offense case for all the groups. And second, although the expert/teachers and profilers were more accurate than the other groups for the sex offense case lineup, these results were not reproduced for the homicide case lineup.

Process Analysis

Recall of Details

Given that the profilers scored better than the other three groups for the sex offense case, the question can be asked as to what accounts for these differences. Are the profilers processing the information given to them in ways that are different from the other three groups?

The first process area examined is the recall of details concerning the crime. From the lengthy list of details recalled by each subject, the number of correct details was tabulated for each case (see Table 3). In the sex offense case, there was no significant difference among the groups, although a significant difference did result for the homicide case, with profilers recalling more details than the nonprofiler groups of detectives, psychologists, and students. As to the hypothesis that detectives, of all the groups, would recall the greatest number of details, this was not confirmed. It is profilers who recall the most details.

Details as Necessary and Important

The questions that arise here are these: (a) Do profilers, as opposed to the nonprofiler groups (detectives, psychologists, students), cite more details as necessary and important, and (b) do they make different types of attributions, and

Table 3. Recall of Details by Group and Case

Group ^a	Number of details recalled			
	Homicide		Sex offense	
	Mean	SD	Mean	SD
Profiler	54	25.6	51	2.4
Detective	44	16.6	54	21.3
Psychologist	38	10.4	48	2.4
Student	35	5.2	47	2.4

^a The *n*'s for each group = 6. The profiler vs. nonprofiler (detective + psychologist + student) comparison, $\chi^2(1, n = 24) = 24, p < .01$. The law enforcement (profiler + detective) vs. nonlaw enforcement (psychologist + student) comparison, $\chi^2(1, n = 24) = 22.8, p < .01$. The professional (profiler + detective + psychologist) vs. nonprofessional comparison, $\chi^2(1, n = 24) = 12.10, p < .01$.

come up with different kinds of correlations or implications from these details? As it turns out, profilers do cite significantly more details as necessary and important than nonprofilers for the sex offense, $\chi^2(1, N = 24) = 8.0, p < .005$, and the homicide cases, $\chi^2(1, N = 24) = 14.7, p < .005$ (see Table 4).

To answer the second question, the subjects' answers to why they thought these details were necessary and important and what types of attributions they made from these details were evaluated and placed in one of three categories: (1) *specific psychological attributions given to a specific detail of the crime scene* (specific-specific); (2) *broad, global, and general attributions given to a specific detail of the crime scene* (specific-global); (3) *broad, global, and general psychological attributes given to the general crime scene, without regard to specific details of the crime* (global-global).

To check the reliability of assigning these responses to one of the three categories, a second rater conducted an independent evaluation of these responses. The rater's results were consistent with the first author's, as a Pearson product-moment correlation coefficient of $r = .94$ (Edwards, 1976, p. 35) was obtained.

Profilers, it can be argued, would attend to more specific details of the crime scene and make more specific attributions about the offender. The results do not support this hypothesis. For the sex offense case, profilers used the specific-specific category 42% of the time, whereas detectives used it 49% and psychologists 52% of the time; for the homicide case, the percentages were 61%, 57%, and 56% for the three groups, respectively. In both cases, the profilers, detectives, and psychologists most frequently used the specific-specific category (see Table 4). Although the profilers are not processing the data in qualitatively different ways from the nonprofilers, as the numbers show, they are doing more of it.

Table 4. Type of Detail-Type of Attribution for the Homicide and Sex Offense Cases by Group

Case/group	Type of detail-type of attribution									Total
	Specific-specific			Specific-global			Global-global			
	n	Percent	Rank	n	Percent	Rank	n	Percent	Rank	
Homicide^{a-c}										
Profiler	56	61	1	32	35	2	4	4	3	92
Detective	36	57	1	20	32	2	7	11	3	63
Psychologist	42	56	1	32	43	2	6	8	3	75
Student	11	34	2	18	56	1	3	9	3	32
Sex offense^{d-f}										
Profiler	35	42	1	29	35	2	19	23	3	83
Detective	35	49	1	25	35	2	12	16	3	72
Psychologist	28	52	1	18	33	2	8	15	3	54
Student	16	35	2	26	57	1	3	6	3	45

^a For the type of detail-attribution by group, the overall $\chi^2(6, n = 24) = 10.14, n.s.$

^b The Kendall $W = .81$.

^c For the total number of detail-attribution by group, the $\chi^2(3, n = 24) = 29.2, p < .01$.

^d For the type of detail-attribution by group, the overall $\chi^2(6, n = 24) = 11.7, n.s.$

^e The Kendall $W = .81$.

^f For the total number of detail-attribution by group, the $\chi^2(3, n = 24) = 13.9, p < .01$.

DISCUSSION

Concerning the outcome issue, professional profilers are more accurate (i.e., more correct answers, higher-accuracy scores, more correct lineup identifications) for the sex offense case than nonprofilers, but these accuracy differences dissipate when we look at the homicide case. There were, however, significant outcome differences between profiler and nonprofiler groups for the homicide case in all the analyses of the written profile.

While the overall outcome superiority of the profilers is most likely indicative of greater expertise, it must be kept in mind that an "investment" factor could also be invoked to explain these results. Psychologists and students may see this task as an interesting exercise, whereas profilers, and detectives, perhaps, see it as the "blood and guts" of their professions, and therefore generate lengthier profiles and spend more time on the task.

What accounts for the fact that profilers do better than nonprofilers for the sex offense case, and the fact that the outcome advantage is muted for the homicide case? One possibility that cannot be overlooked is the effect of sanitizing the crime reports. In compliance with the requests of the police agencies that offered these criminal cases, the cases had to be sanitized to the extent that no one reading them could identify the police agencies, the victims, or the offenders. Consequently, some of the very detailed information concerning the victims had to be deleted from the case file.

All of the profilers spontaneously mentioned that data were missing, whereas none of the other subjects mentioned it. Perhaps the absence of a very detailed and extensive report affected the profilers more, and particularly for the homicide case.

A second possibility is that there was more information, and more accurate information, for the profiler to work with in the sex offense case than in the homicide case. In sex offense crimes, the victim is available to offer details concerning the crime. The victim can relate what the offender did prior to the actual assault, during the assault, and following the assault. The very approach that the sex offender uses on his victim will tell the investigator a great deal about the offender (Groth, Burgess, & Holmstrom, 1977; Hazelwood, 1983; Macdonald & Michaud, 1987). As Hazelwood (1983) states: "Through an analysis of the offender's verbal, sexual, and physical behavior, it may be possible to determine what needs were being served and to project personality characteristics of the individual having such needs" (p. 25). This information is lost when the victim is not able to relate to the investigator just exactly what happened, as in a homicide case. For the homicide case, the profiler must reconstruct the crime with no verbal help from the victim, and this increases the probability of inaccuracies. One area of future research might examine the possible differences among profilers' offender profiles for homicide cases that have no witness to the crime and homicide cases where a witness to the homicide is available.

A third possibility as to why the profilers completed a more accurate profile on the sex offense case than they did on the homicide case relates to the pecu-

liarities of this particular homicide case: That is, in a few but significant ways, the offender did not fit the base-rates. Two common base-rates that are frequently used are the victim's age and the victim's race in order to suggest the age and race of the offender. It has been found that violent crimes are generally perpetrated upon members of one's own age group and are intraracial in nature (U.S. Department of Justice, 1987). Thus, where a white victim, approximately 25 years of age, is found murdered, the investigators might begin by narrowing the possible field of suspects to a Caucasian between the ages of 18 and 28. Because most violent crimes are committed by males, the profile might also suggest that—if there is no specific reason to think the crime was committed by a female—the offender will be a male. From these base-rates that suggest age, gender, and race, further assumptions and attributions are made. For example, if the offender is a white male between the ages of 18 and 22, some assumptions concerning his education, employment, marital status, and military record can be suggested.

What is problematic in this homicide case is that the offender did not fall within those age base-rates. Though he was a white male, his actual age was much higher than the victim's age. If the offender had been the same age as the victim, given the type of murder and defilement of the body, it would be most unlikely for this offender to have been married. Falling outside the base-rates again, this offender was, in fact, married. The errors of the expert/teacher profilers and the errors of the professional profilers were errors generally involving these base-rates. Their responses were within the distribution of the base-rates for such crimes. This same base-rate explanation might also be applied to the homicide lineup exercise. Most groups chose Profile D as their first choice (i.e., the profile that ranked fourth in correctness) because this profile fit the general and accepted base-rates in certain major categories for this kind of crime better than any of the other profiles.

It may seem surprising that the accuracy scores for the nonprofiler groups of detectives and psychologists came as close to the profilers as they did. Why were not greater differences observed between profilers and the nonprofiler groups? Two answers to this question are offered. The first is found in the very instruments used to test these differences. The use of a multiple choice questionnaire to determine measures of accuracy favors the nonprofiler groups because it gives the subjects cues as to what the possible answers are: It gives the subjects "categories" (i.e., the focal area of the question) that they might not ordinarily think about, and it gives a set number of possible choices. The correct responses of the nonprofiler groups may be artificially raised so that the true differences between profilers and the two nonprofilers groups of detectives and psychologists may be somewhat muted. This possibility seems to be borne out when a close examination of the written profile is made. It is in the written profile task—when a blank page was given to the subjects and they were required to write a profile without the assistance of cues—where significant outcome differences emerged. In the written profile, the more representative task of criminal personality profiling, the profiler group was clearly superior.

A final point on why the differences in outcome are not significantly higher for the profiler group than the nonprofiler groups: the small number of subjects.

With a larger sample, the differences are more easily and more accurately measured (Freedman, Pisani, & Purves, 1978).

Concerning the process issue, in general, profilers do not appear to process the material in qualitatively different ways from nonprofilers in their construction of profiles. There are, however, numerous quantitative process differences that favor the profiler over all nonprofiler groups for both cases.

It was hypothesized that the detectives would recall a greater number of details than any other group, given their training and orientation. A second hypothesis was that the profilers would recall more details that were necessary and important to profiling.

The first hypothesis was not confirmed: Detectives did not recall more details overall; rather, both law enforcement groups (profilers and detectives) recalled significantly more details than the non-law-enforcement groups of psychologists and students. Perhaps, as the expert/novice literature suggests, it is the law enforcement agents' familiarity with these kinds of cases and crime scenes that allows them to organize the information in ways that facilitate recall.

The second hypothesis was confirmed: As expected, the profilers did recall more details considered to be necessary and important to profiling for both cases. Combining these two findings suggests that recall per se is not the crucial factor in explaining why profilers generate more accurate predictions than detectives; rather, it is the profiler's greater ability to extract and designate more details as necessary and important than the detectives that makes the difference. Said another way, it is not a memory difference, but a higher-order extracting difference that is primarily associated with outcome accuracy.

It has been suggested that the process profilers use in deriving their profile follows a WHAT to WHY to WHO pattern. This is to say that once the details of the crime have been collected (WHAT) and the motivations for those particular details have been determined (WHY), the type of offender (WHO) can be suggested. Because we asked all the subjects to tell us their *reasons* for why a detail was important, the processes profilers and other groups used were clearly identifiable. Our analysis confirms that this motivational process is used for examining some details of the crime, but it is not the only process that is engaged. Two others have been identified in this work. Where the WHAT-WHY-WHO process is *motivational* (i.e., seeking the motivation for a crime scene detail) the second process can be described as *correlational*, a WHAT to WHO process. The third process is also correlational, but it involves a second-order correlation: It can be described as a WHAT to WHO followed by further assumptions (i.e., correlations) based on the first WHO prediction. In other words, this third process can be seen as a WHAT to WHO with a correlation/attribution loop.

The second of these processes, the WHAT to WHO, basically involves the profilers' use of correlations and crime base-rates. In knowing, for example, such a specific detail (WHAT) of a crime as the race of the victim, the profilers skip the motivational aspect (WHY) and suggest the same race for the offender (WHO). Psychological reasons or motivational causes (WHY) are not considered in this type of decision on the part of the profilers. Likewise, in the third of these processes, the WHAT to WHO loop, correlations and base-rates continue to be

used. For example, given that a first-level prediction has been made based on base-rates for an offender's age, then a second-level prediction based on base-rates for marital status is made. Again, these assumptions are based not on motivational causes (WHY), but move in an "if-then, if-then" correlational sequence from specific details of the crime (WHAT) toward a more specific portrait of the offender (WHO).

From the results obtained in this work, four suggestions are offered to improve accuracy. The first is to improve the base-rates by increasing the number of details available concerning offenders. The more offenders there are that contribute to the sample population of "homicide offenders" or "sex offenders," the more detailed and specific information is available about these individuals. Perhaps when larger samples are examined, the predictions that are made on these base-rates may increase in validity and in reliability.

The second suggestion is to develop a system of matrices of specific details for crime scenes in order to create convergent and discriminative lines for certain predictors. For example, on a particular kind of crime scene, do certain details (independent lines) tend to converge on a more youthful offender—even when the age of the victim generally might lead one to predict an older offender? And, third, while the offender's motivation to commit the crime might remain a mystery—even to the offender (Dietz, 1985), one area of research that would be of assistance to profiling would examine means by which offender motivation (WHY) can support or confirm the crime base-rates that are used in profiling—or, indeed, direct the profiler's line of thought about a particular offender.

A fourth suggestion derives from the observation that certain profilers were more accurate and more keenly perceptive with certain tasks than they were with others. For example, one profiler studied the medical examiner's report twice as long as any other profiler and incorporated more of this material into that particular written profile. Another profiler spent a greater amount of time studying and reviewing the crime scene photographs. Close examination with a magnifying glass revealed details others missed. A third profiler spent more time discussing the victimology report. Since individual profilers appear to enjoy certain areas of expertise within the general field of profiling, it seems plausible that more accurate and richer profiles would result from "group profiling" than from individual profiling. Empirical testing could determine whether too many cooks (profilers) spoil or enrich the broth.

From the results found here, a more elaborated conceptualization of the process of profiling needs to be developed. It has been shown in this work, as it has been theorized elsewhere (Dietz, 1985), that profiling is a complex process. It involves more than a simple, one-level analysis of crime scene details (i.e., the WHAT to WHY to WHO). The WHAT to WHO and the WHAT to WHO loop are two additional levels of analysis that are used. Thus, a criminal personality profile appears to be the result of a complex, multilevel series of attributions, correlations, and predictions. In conceptualizing this process, the theory of profiling—yet to be fully developed—ought to reflect these complexities. In this regard, conceptual and theoretical development, consistent with emerging empirical results, is needed.

The clinician, long familiar with the clinical versus actuarial controversy (Gough, 1962; Lindzey, 1965; Meehl, 1954, 1965; Phares, 1988; Sundberg, 1977), might well wonder whether this is the theoretical context for situating profiling, rather than the context of personality theory. And at the empirical level, when well-developed computer, actuarial-based profiling does come on-line in the near future, a new test of the seer versus sign controversy (i.e., Will profilers generate more accurate predictions than the actuarial-based computer program?) will be possible. Given that profilers use both motivational and correlational processes to generate predictions, perhaps such empirical tests in the future will reveal that profiling is an area where clinical predictions exceed actuarial. But at this stage in the development of profiling, the first evaluative step is to demonstrate that profilers do better than nonprofilers and to elucidate the processes they use.

In a field still in its nascent stage, the population of "experts" is limited. The sample size of experts was small (i.e., there were only 6 profilers and 4 expert profilers used in this study). The small sample may have limited the significance of the results (i.e., some results failing to reach significance, or reaching only moderate significance) where larger sample sizes might reveal even greater differences. The limited sample size also raises questions of the representativeness of the sample and the generalizability of the results; cautions are thus warranted. A replication of this study, using more subjects is another recommendation.

Though significant results were obtained for the sex offense case, not all results reached significance for the homicide case. Part of the explanation offered for this variance in results was the atypical nature of the homicide case. Specifically, many personal aspects of this particular offender in the homicide case were not consistent with existing crime base-rates. This explanation, though plausible, remains untested to date. Future research in criminal personality profiling should address this issue by using greater numbers of homicide and sex offense cases, as well as cases where profilers neither claim expertise nor typically profile. In the absence, yet, of such studies, generalizations to all sex offense or all homicide cases are not warranted.

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***CRIME SCENE AND PROFILE
CHARACTERISTICS OF
ORGANIZED AND
DISORGANIZED MURDERERS***

Crime Scene and Profile Characteristics of Organized and Disorganized Murderers

I. Profile Characteristics

A. Organized Murderers

1. Socially competent
2. Skilled work preferred
3. Above average intelligence
4. Sexually competent
5. High birth order
6. Father's work stable
7. Inconsistent childhood discipline
8. Angry, depressed mood before crime
9. Controlled mood during crime
10. Use of alcohol during crime
11. Precipitating situational stress
12. Living with partner
13. Mobility, with car in good condition
14. Follows crime in media
15. May change jobs or leave town
16. May take trophies from victim or crime scene to relive event
17. Indifference to welfare of society
18. Irresponsible and self centered
19. "Chameleon" personality
20. Manipulates people
21. Methodical and cunning
22. Cruises seeking victims
23. Lives some distance from crime scene
24. Fits well into contemporary society
25. Victim selection is random

B. Disorganized Murderers

1. Average intelligence
2. Socially immature
3. Poor work history
4. Sexually incompetent
5. Minimal birth order status

6. Father's work history unstable
7. Harsh discipline in childhood
8. Anxious mood during crime
9. Minimal use of alcohol
10. Minimal situational stress
11. Living alone
12. Lives/works near crime scene
13. Minimal interest in news media
14. Minimal change in life-style
15. Societal aversion
16. Feels rejected and lonely
17. Finds interpersonal relationships difficult
18. Lacks cunning
19. Commits crime in a frenzy
20. Kills in close proximity to residence (security)
21. Strange in appearance and behavior
22. Social outcast

II. Crime Scene Characteristics

A. Organized Murderers

1. Offense planned
 - a. Semblance of order existed prior to, during, and after crime
2. Carefully planned to deter detection
3. Victim is a targeted stranger
 - a. Of opportunity
 - b. Location staked out
4. Personalizes victim
5. Controlled conversation
6. Victims may share common characteristic
7. Crime scene reflects overall control
8. Socially adept
9. Uses verbal skills to capture victim
10. Gains victim's confidence
11. Demands submissive victim
12. Restraints used
13. Frequently uses victim's vehicle to commit offense
14. Aggressive acts prior to death
15. Body hidden
16. Weapon - brought and taken
17. Fantasy and ritual dominate
18. Absence of evidence
19. Transports victim or body

B. Disorganized Murderers

1. Overall impression
 - a. Committed suddenly
 - b. No set plan for deterring detection
 - c. Great disarray
 - d. Spontaneous, symbolic, unplanned quality
2. Offender kills instantly to have control
3. Uses blitz style attack
 - a. From behind
 - b. Victim caught unaware
 - c. Restraints not seen
4. Weapon
 - a. Typically one of opportunity
 - b. Taken from victim or scene
 - c. Often left at or near scene
 - d. Cause of death is often strangulation or blunt trauma
5. Depersonalization of victim
 - a. Mutilation follows death
 - b. Specific area targeted for brutality
 - c. Overkill
 - d. Attack to face
 - i. Killer knows victim
 - ii. Victim represents someone
6. Minimal verbal interaction
7. Uncontrolled slashing and stabbing
8. Bitemarks
9. Mutilation - exploratory
10. Cannibalism or vampirism
11. Insertion of foreign objects (curiosity)
 - a. Sexual experimentation
 - b. Usually no penis penetration
12. May keep dead body
13. Crime scene and death scene are usually the same
14. No attempt to conceal body
15. Lots of evidence
 - a. Fingerprints
 - b. Forensic
16. Ritualism
 - a. Crime follows fantasy
 - b. Body left in symbolic way

III. Scenario I

- A. Death scene same as crime scene
- B. Weapons of opportunity (knife-kitchen/bat)
- C. Weapons left
- D. Evidence (footprints)
- E. Overkill

IV. Scenario II

- A. Organized
- B. Locations
- C. Meet site
 - 1. Interpersonal skills
- D. Crime scene (work area)
- E. Dump site
- F. Takes murder weapon
- G. Attempt to hide evidence (water)
- H. Mobile - has transportation
- I. Interpersonal skills

V. Scenario III

- A. Organized
- B. Interpersonal skills
- C. Weapon brought/taken
- D. Crime scenes
 - 1. Meet site
 - 2. Murder site (vehicle)
 - 3. Dump site
- E. No evidence (shells)
- F. Drug murder
 - 1. High caliber
 - 2. Multiple shots
 - 3. Vital target (back of head)
 - 4. Motel
 - 5. Motive - robbery
- G. What does scene tell you?
- H. Victim sitting upright
- I. Motel receipts
 - 1. Records
 - 2. Phone calls lead to suspect

VI. Scenerio IV

- A. Crime scene and the death scene are the same
- B. Blitz attack
- C. Weapon of opportunity
 - 1. Screwdriver from car
- D. Weapon left at scene
- E. Tree branch at hand used postmortem
- F. No sexual assault
- G. No attempt to hide evidence

VII. Scenerio V

- A. Weapon of opportunity
- B. Weapon left at scene
- C. Overkill
- D. Posing
- E. No concern for evidence
 - 1. Feathers
 - 2. Footprints
 - 3. Semen

VIII. Scenerio VI

- A. Crime, death, and dump scenes different
- B. Fantasy acting out Postmortem
- C. Planning after crime
- D. Beating about head and manual strangulations mean what?
- E. Transports body
- F. Buries body, jewelry and clothes in different locations
- G. Uses victim's vehicle

IX. Scenerio VII

- A. Blitz attack from pantry
- B. Use of restraints - not brought
- C. Gag is victim's
- D. No sexual assault
- E. No anger - no overkill
- F. Trophy taken - ring
- G. Wooden spoons - exploration
- H. Weapon - knife left at scene (floor of bedroom)

- I. Criminally unsophisticated
- J. Enters while at laundry
- K. Offender has to know when to enter - surveillance from where?

PROFILING CONCEPTS

Profiling Concepts

- I. Mass Murder
 - A. Murder involving four or more victims
 - B. Committed by one person
 - C. At one location/ single event
 - D. One time period lasting minutes, hours, or days

- II. Spree Murder
 - A. Multiple murder/ single event
 - B. At two or more locations
 - C. No emotional “cooling off” period
 - D. Time period=short or long duration

- III. Serial Murder
 - A. Three or more murders as separate events
 - B. Emotional “cooling off” period in between
 - C. Involves premeditation and victim selection
 - D. Motive is psychological
 - E. Crime scene reflects sexual/sadistic overtones

- IV. Concealed
 - A. Concerted effort to ensure body not found
 - B. Delays discovery
 - C. Allows time for distancing

- V. Displayed
 - A. Body intentionally positioned
 - B. Placement in location where certain to be found
 - C. Positioning to disgrace, degrade, or devalue
 - D. Positioning to preserve victim dignity

- VI. Dumped
 - A. Little or no effort to conceal body
 - B. Haste as possible primary objective

VII. Staging

- A. Purposeful alteration of crime scene
- B. Done to redirect investigation away from offender
- C. Protection of victim's family

VIII. Victim Risk Level

- A. Degree to which individual contributes or exposes himself or herself to chance of injury
- B. Susceptibility of violent crime
- C. Extent of jeopardy - affected by faulty decisions or judgmental errors

IX. Offender Risk Level

- A. Degree to which offender places himself or herself in jeopardy
- B. Susceptibility to being caught
- C. Location, time, and circumstances need to be considered

X. One Neat Aspect

- A. Behavioral aspects of crime which appear to have nothing to do with the body
- B. Action which does not appear to fit in with the rest of the crime
- C. Possible indicator offender has been in mental institution within recent past

XI. Overkill

- A. Displayed trauma excessive to that which would be needed to end life
- B. Suggestive of highly personalized anger/hate
- C. Suggests some type of relationship
- D. Victim behavior can affect offender behavior
- E. Symbolic victim

***METHOD OF OPERATION
VS.
SIGNATURE***

Method of Operation Vs. Signature

The Crime is a reflection of the offender

I. Modus Operandi

That behavior which is necessary to successfully commit the crime

Modus Operandi is “Learned Behavior”

A. Purposes

1. Ensure the success of the crime
2. Protect the offender’s identification
3. Effect the offender’s escape

B. A criminal develops a successful Modus Operandi by trials of error

C. M.O.

1. Learned behavior
2. Dynamic-changes
3. Experience
4. Education
5. Offender Age

D. Serial crimes should not be matched by Modus Operandi alone

II. Signature

That behavior which is unnecessary to commit the crime

The “Signature” is the subject’s “calling card”

A. Aspects of Signature

1. Introduces the offender’s personality into the crime
2. Unusual behavior characteristics
3. Unique, ritualistic
4. Repetitive behavior
 - a. Verbal
 - b. Nonverbal

B. Examples of Signature

1. Posing
2. Foreign object insertion
3. Overkill
4. Crime scene adjustment
5. Excessive bondage
6. Scripting (verbal behavior)
7. Mutilation
8. Undoing

C. The Signature aspect of the crime should receive greater consideration than the victim similarities

III. M.O. Vs Signature

Robert Ben Rhodes

A. M.O.

1. Use of a ruse or con to get victim into truck
2. Restraints applied when victim falls asleep

B. Signature

1. Use of pornography
2. Use of restraints
3. Depersonalize
4. Torture
5. Takes photographs
6. Sequential photos
7. Humiliation of victim
8. Posing
9. Foreign object insertion
10. Camera angle (det. magazine)

IV. Serial Homicides

Bellevue, Washington 1990

A. Mary Ann Pohlreich

1. Body posed -- yes
2. Foreign object inserted -- yes
3. State of dress -- nude
4. Head/face covered -- yes
5. Postmortem activity -- yes
6. Cause of death -- blunt force to head
7. Item(s) taken -- yes
8. Semen identified -- yes (vagina)

B. Carol Marie Beethe

1. Body posed -- yes
2. Foreign object inserted -- yes
3. State of dress -- nude
4. Head/face covered -- yes
5. Postmortem activity -- yes
6. Cause of death -- blunt force to head
7. Item(s) taken -- yes
8. Semen identified -- no

C. Andrea S. Levine

1. Body posed -- yes
2. Foreign object inserted -- yes
3. State of dress -- nude
4. Head/face covered -- yes
5. Postmortem activity -- yes
6. Cause of death -- blunt force to head
7. Item(s) taken -- yes
8. Semen identified -- no

D. Signature Aspects

1. Foreign object insertion
2. Bodies posed
3. State of undress -- nude
4. Blunt force to head
5. Post mortem activity
6. Bodies displayed

7. Significant amount of time spent with the bodies
8. Posed to shock and offend
9. Bodies not concealed
10. Humiliation of victims
11. Head and face covered -- lid/pillow, plastic/sheet
12. Items taken from each scene -- clothing/jewelry/panties, knives, jewelry

OVERVIEW OF DROWNING

Drowning

by Arthur E. Westveer, Behavioral Science Unit, FBI

- I. A person drowns as the result of submersion, partial submersion, or immersion in a fluid. Drowning is usually accidental. Very few cases are suicides. Sometimes death in the water is due to natural causes, such as a heart attack or cerebral hemorrhage that occurred while the victim was swimming.
 - A. Mechanism
 1. Recently, the mechanism of drowning has been recognized as something more complex than simple mechanical obstruction of the air passage by fluid.
 2. The inhalation of water can and does result in its absorption by the circulating blood; the changes caused by this absorption contribute materially to death by drowning.
 3. The victim must have inhaled enough fluid and survived long enough for absorption and electrolyte exchange to take place. This can occur within a few minutes following total submersion.
 - B. Fresh Water
 1. Low-salt (.5%) precipitous absorption into the circulation takes place. This results in hemolysis and dilution of the blood constituents associated with an abrupt, violent increase in blood volume. The heart is rapidly overburdened by this increased load, and pulmonary edema is evident.
 2. Arrhythmias of the heartbeat, which culminate in ventricular tachycardia and fibrillation, lead to death within three to five minutes of submersion. An adult may inhale and absorb six pints or more of liquid.
 - C. Sea Water
 1. In contrast to fresh water, sea water is extremely salty (3.0% sodium chloride). When a body absorbs sea water, the high salinity of the water draws fluids from the blood into the lung tissue, causing severe pulmonary edema. Generally speaking, a salt water drowning resembles an asphyxial type of death more closely than a fresh water drowning does. A salt water drowning takes longer than a fresh water one, and a person drowning in salt water is likely to be more responsive to resuscitation than a person drowning in fresh water.

II. Signs of Drowning

There are consistent signs peculiar to drowning. The special difficulty in interpretation is to distinguish between accidental, suicidal, and homicidal drowning. For this reason, all available information concerning the death must be given to the pathologist prior to autopsy.

A. External signs of drowning

1. As cooling in water occurs at about twice the rate of cooling in air, most bodies are cool or cold when recovered from water. Body temperature falls at a rate of 5 degrees per hour. The body will reach the temperature of its surroundings in 5 or 6 hours; always within 12 hours of submersion. Exposure and oxygenation will frequently cause the head, neck, and front of the chest to turn a bright pink color.
2. Putrefaction is often present and the skin may be green or bronze or it may be exceptionally dark. The presence of foam (pulmonary edema) at the mouth or nostrils, or both, is an important, although in no way a conclusive, sign of drowning. Pulmonary edema is also caused by strangulation or epileptic seizure. Putrefaction will destroy foam. This foam is caused when fluid enters the air passages and provokes them to form mucus, which, when mixed with air, forms a foam from the violent respiratory efforts of the victim.
3. A bruised or bitten tongue may indicate that the victim struggled or had an epileptic seizure. Instantaneous rigor, which is rare, is sometimes a result of submersion. Weeds or sand may be held in the hands or feet, evidence that there was life at the time of submersion.
4. It is necessary to distinguish between changes due to drowning and those that are solely the result of submersion in water.

For instance, a person may inhale a thick suspension of sand in sea water. This could happen if the person were knocked down by a wave or hit his or her abdomen on a surfboard. Death occurs with appalling suddenness in these circumstances.

5. Chemicals in water may not contribute to the cause of death, but their detection in the body of the victim can confirm the fact of drowning in that fluid.

B. Internal signs of drowning

1. Putrefaction will abolish the internal signs of drowning. Foam is present in varying amounts in the air passages. The passages may be completely or just partially filled. Water will also be present in the air passages. This may be abundant and escape from the mouth when the body is turned.
2. The larynx may be congested. The lungs will be bulky or ballooned, often to the degree of overlapping the pericardium. There may be rib marking on the lungs.
3. Obstruction of the pulmonary circulation due to the inhalation of water results in distention of the right side of the heart and the great veins, which are filled with dark red blood. The blood also is likely to remain fluid and free from clots. Dilution of the blood by inhaled water is responsible for the prevention of coagulation. The blood often has a watery consistency and does not adhere to the examiner's hands.

III. The Time it Takes to Drown

- A. The amount of time it takes for a person to drown varies within somewhat wide limits and is affected by:
 1. circumstances of submersion
 2. kind of victim
 3. reactions to submersion
 4. volume of water inhaled
- B. The amount of time is reduced when submersion is unexpected and when the victim is out of shape or unable to swim
- C. Death may be immediate when due to cardiac inhibition. Those who panic will succumb more quickly than those who try to remain calm. Cramps and other injuries sustained at the time of submersion will also play a part.
- D. Sudden submersion into cold water can cause death from cardiac failure. The uncontrollable respiratory distress during cold immersion causes the victim to inhale water.
- E. Ordinarily, unconsciousness, if not death, ensues in two to ten minutes after submersion. Before death there may be a period of suspended animation during which it is still possible to resuscitate the victim. This is possible even if the victim has been submerged for as long as 30 minutes.

- F. The popular belief that a person sinks and rises three times before drowning is a misconception. There is wide variation in the number of times a person may sink before remaining submerged.
- G. There is usually a brief convulsive phase, followed by coma or suspended animation and death.
- H. The body eventually sinks and remains on the bottom until putrefaction sets in, causing the formation of gas, which in turn causes the body to float. This occurs in 7 to 14 days.

IV. Phases of Drowning

- A. Between 7,000 and 8,000 deaths by drowning occur in the U.S. each year. Drowning is the fourth leading cause of accidental death.
- B. Submersion is usually followed by a panicky struggle to reach the surface. When energy reserves are exhausted, the struggle subsides and actual drowning begins. The phases could be described as follows:
 - 1. Breath holding
 - 2. Swallowing of water, coughing, vomiting, and progressive loss of consciousness
 - 3. Profound unconsciousness and convulsions associated with gasping precede respiratory standstill, which is followed by failure of the heart. Irreversible changes in the brain and death occur within a very short time.
- C. When drowning is interrupted before terminal grasping has set in, spontaneous recovery sometimes occurs.
- D. Asphyxia occurs in only 10 or 12 percent of all drowning deaths. Spastic closure of the airway is not detectable during an autopsy.

MISCELLANEOUS

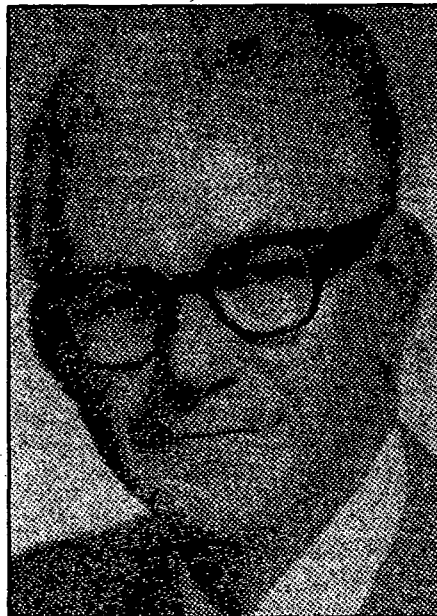
MURDER STALKED THE EXECUTIVE SUITE

SIXTEEN years old and fresh out of high school, Edward C. Stermer went to work for the Mudge Paper Company. Except for the war years, when Uncle Sam employed him as a flight instructor in York and Lancaster, Pennsylvania, it was the only job he ever had. And he was successful at it, too. When he was gunned down outside his South Baltimore, Maryland, office at 5:15 on the chill Thursday evening of December 16, 1976, he was the firm's president, a position he had held since 1960.

Less than 20 minutes after five slugs were pumped into his body from a 9-mm. automatic, the 62-year-old Stermer was at the emergency room door of University Hospital. It was already too late. Doctors had only to take a look at the handsome, gray-haired businessman to see that he was beyond the efforts of medical science. They pronounced him dead on arrival at 5:32 p.m.

At the crime scene on the 1400 block of Russell Street, meanwhile, homicide detectives recovered three spent shells evidently fired from the death weapon. While some investigators examined the victim's rented, 1974 Mercury in the Mudge parking lot, others grilled wit-

by **JOSEPH L. KOENIG**



Business tycoon Edward Stermer was shot down outside his office, and police could find no apparent motive—until they began checking a certain person's stock holdings

nesses who told them that just before he was slain Stermer had left his office in the rear of the building to go to a company Christmas party at a nearby motel.

"We spoke with a paper company employe who told us that he heard gunshots, looked out a window and saw Stermer lying face up on the sidewalk near the lot," a detective would report. "Some other workers rushed out of the building and found him bleeding heavily from chest wounds just two feet from the building.

"We also interviewed a passerby who said that at the time of the shooting he saw a man running down Russell Street. There were also some unconfirmed reports that the gunman was spotted getting into a Sun taxi, and we're trying to verify that right now."

In the first moments of the murder investigation, flak-jacketed officers from the Baltimore Police Department's Quick Response Team were sent into the area. Armed with high-powered shotguns, they combed a tunnel, running under Russell Street close to the shooting scene, but found nothing.

Other investigators reported better luck, coming up with a witness to the shooting in the person of Hassan R.

**For the paper company president, Baltimore
detectives discovered, wealth and success
became a mixed blessing—they got him killed**



Probe suddenly focused on Charles Brent (l.) and Hassam Erman, comptroller-treasurer for Stermer's paper company, who was in line to take over the firm

Erman, Mudge Paper's 53-year-old treasurer. Erman reportedly stated that he had left the office about two minutes before Stermer and was about a block away when he heard the shots and ran back toward the building.

"What did you see?" a detective had asked.

Hassan seemed apologetic as he replied that he had seen only "a shadow." He explained that he had glaucoma and was not wearing his glasses, so he was not even certain that the shadow was that of a person. When he left the office, he added, he had noticed nothing out of the ordinary.

In the homicide bureau at Baltimore police headquarters, that evening, detectives went over the meager evidence they had collected in the first few hours of the probe.

"It appears that Stermer had left the building and was walking toward the company parking lot when someone shot him five times in the chest," a detective said.

"Was it robbery?" a uniformed officer asked.

"That's what we thought at first," the detective answered. "Stermer was a rich man, with an income well into six figures. His wife told us that he usually cashed his paycheck on Thursday and carried between \$100 and \$200 in his wallet at all times. The wallet was gone,

but the killer didn't trouble to go through his pockets, or take his keys, or lift an expensive camera he was wearing around his neck.

"Not only that, but minutes before Stermer left the building another company executive went out the same door. He was just as prosperous-looking as Stermer, but no one tried to rob or shoot him. From the evidence we have so far, it seems as though whoever shot Stermer was gunning for him."

"If robbery wasn't the motive," the uniformed officer asked, "what do you suppose it could be—a personal thing, a business rivalry, an enemy of long-standing?"

"It's too soon to tell," the detective replied. "But I can promise you we're going to find out."

In succeeding weeks and even years, the detective would learn that such a promise was much easier to make than to keep. Edward C. Stermer had been an unusually private man, and although the basic facts of his life were a matter of public record, it was not an easy task to delve beneath the surface.

It was no secret that the slain businessman had made his home in suburban Timonium, Maryland. A Baltimore native, he had graduated from high school in 1931 and gone to work immediately for Mudge. In the 1930s, he had opened the firm's York,

Pennsylvania, office and after a stint as a World War II flight instructor had returned to his old job.

In 1960, he had been made president of the company. According to one close acquaintance he was a man with "a six-figure income, a successful man who was going to continue to be successful." His hobbies were golf and sailing.

But Stermer's business career was not without its setbacks. Perhaps its darkest hour had come just a month before his death, when, following plea-bargaining in state court, he had been fined \$5,000 and his firm assessed \$22,500 for allegedly substituting an inferior grade of paper than specified in contracts Mudge Paper Co. held with the city of Baltimore and state of Maryland. The charges to which Stermer had pleaded no contest indicated that he had been aware of an untrue statement in a \$61,000 contract which his firm had signed with the state in March, 1976.

According to the statement of facts agreed to when Stermer and Mudge entered their pleas, the Mudge Company evidently was low bidder on city and state contracts by submitting a price for the specified top grade paper that was an average between top grade and the next lowest grade. But when deliveries were made the lower-grade paper was substituted.

"Even though we went through our court problems a while ago," a company official said, "I still think most people in the industry hold us in high regard. Mr. Stermer was a smart, highly respected businessman."

"After the indictments came through, the people at Mudge were plenty embarrassed," an industry spokesman agreed. "They weren't crooks. It was just one of those things that sometimes happens. They were still highly regarded by their fellow tradesmen."

The next day, homicide investigators told newsmen that they had turned up disappointingly few clues in the murder case, but were eagerly awaiting the results of the autopsy on the victim.

"We still haven't determined the motive behind the killing," a detective said. "Right now, we're interested in speaking with anyone who was driving by the scene of the slaying about a quarter past five yesterday and we urge them to call the homicide department."

Later in the day, a medical examiner told police that fatal bullets had struck Edward Stermer in the heart, both lungs, the liver and stomach. Although the shots had been fired at such close range that powder burns were found on the victim's stomach, the report stated that the "chest wounds had the appearance of distant wounds."

The brutal slaying of Edward Stermer remained front page news for

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Murder Stalked Executive Suite

(Continued from page 16)

just two days before vanishing entirely from the Baltimore newspapers. This did not mean that it had been forgotten, as well, by homicide probers. On the contrary, detectives were working relentlessly to come up with the badly needed clue that would solve the mystery. But their efforts remained a secret outside the department until February 21, 1977, when two sketches of the possible triggerman appeared below headlines that a \$10,000 reward was being offered for information leading to his arrest and conviction.

The first drawing was that of a well-dressed, clean-shaven man in his mid-40s wearing a gray top coat and short-brimmed hat. He had been spotted by a truck driver who told detectives that he had noticed an "important-looking man" standing on the corner two blocks from the paper company's offices about an hour before the slaying. The driver explained that he had glanced twice at the man because he "looked strange" and out of place standing on the littered street while a black and white taxi was waiting nearby.

Lieutenant Arthur E. Westveer, the Baltimore homicide prober in charge of the case, said that the police artist's sketch was the only description his men had been able to obtain of someone who might have been hired to kill Stermer.

"If I were a hit man," he said, "I'd take a cab and pay a guy twenty bucks not to record where he took me," he said.

Although detectives had interviewed businessmen and construction workers in the area, he added, no one was able to explain why a man of such description would have been "hanging around." Neither had police been able to trace the cab.

The second drawing was that of a young man between the ages of 21 and 25 with long blond hair parted down the middle. He had been spotted by a night watchman at the construction site across the street as he tried to open the doors at the paper company on the night before and two days prior to the murder.

Lieutenant Westveer said his men believed the chances were "slim" that robbery had been behind the killing. He said the "execution-type" murder indicated that Stermer was slain by someone who knew whom he was after, knew how to kill and wanted his victim dead.

Westveer refused to completely rule out robbery as a motive, but insisted that three facts leaned toward the professional killing theory. The first, he said, was that Hassan Erman, the treasurer of Mudge Paper, who was well-dressed and as likely a target for a robbery as Stermer, had left the building only minutes before the doomed executive, yet he was not attacked. The second was that the 9 mm. automatic believed to be the death weapon was a sophisticated gun, costing about \$200, which a common bandit would not buy for a robbery. The final fact was that Stermer's pockets were not rifled by the slayer and that his valuable camera was left hanging from his neck.

Since both gun and Stermer's wallet were missing, the lieutenant went on, detectives were being hindered in their efforts. In fact, his men had not even been able to prove that Stermer was carrying his wallet the day he was shot. Reportedly they had spoken with a man who had lunched with the businessman three hours before the shooting and who told them that Stermer had paid the check with money he took from his pocket, rather than the wallet he normally carried.

Lt. Westveer said that although detectives had questioned at least 300 persons who knew the victim and also had probed every facet of his private life,

they had yet to find a single person who did not like Edward Stermer.

"He had so many friends and so many people liked the guy," Westveer said. "It's nice to hear he was a nice guy, but it's depressing. We want to find someone who didn't like him enough to kill him."

Another stumbling block, he pointed out, was the lack of a detailed description of the gunman.

"Whoever shot him could have disappeared in a matter of seconds," he said. The most likely escape route, probes agreed, would have been through the poorly lighted construction area near the death scene.

Detectives long ago had concluded it was highly improbable Stermer's legal problems had had anything to do with his death. Late in December they had spoken with one of his sons who told them that his father had decided to appeal for a reduction in the penalties, particularly a year-long prohibition on bidding for city and state contracts, "because he was convinced he hadn't done anything wrong."

The victim's widow had said that one of the reasons her late husband had pleaded no contest to the charges was that if he had fought the case "a lot of city and state people could lose their jobs.

"A lot of people could lose a lot of

things,'" she quoted him as having said. "Why do I have to plead no contest to a lie?"

"I know my husband wanted to clear his name," the distraught woman told investigators.

In the days immediately preceding his death, she added, Edward Stermer had been making the rounds of city and state agencies that were his long-time customers "as the first step in his appeal bid."

His son explained that prior to entering the no contest plea, Stermer had been led by prosecutors to believe that legal costs and possible maximum fines, in the event of conviction, could bankrupt the 141-year-old paper company. He said that his father was worried about financial hardship, not only for himself, but for all the firm's employees.

Before the indictment was made public on October 28, 1976, he went on, his father already had told the family that charges were pending. He also had explained how substitute products sometimes were furnished to city and state agencies in a sort of "gentleman's agreement."

His father told him that a city or state purchasing employee might forget to record a transaction, promptly or else might need in a hurry a certain grade of paper which Mudge did not have in

stock. In such a case, Stermer said, the firm often was told:

"Send us what you've got."

"It was a matter of deadlines, not fraud," the younger Stermer said.

In criminal court, defense counsel had explained that Mudge occasionally lost money in handling such emergencies, but he was willing to do so to protect the company's reputation for speedy delivery. Of the \$469,000 in sales involved in the charges, only \$5,300 could be counted as profit to the company, Stermer's son said.

The victim's widow recalled that she and her husband had gone over the company's records for substitutions of higher rather than lower quality paper and found the \$5,300 figure reduced to "\$1,600 or \$1,800."

Homicide detectives told newsmen that they had been unable to link Stermer's death to the criminal charges. Lieutenant Westveer said they had found that the person who tipped off the state's attorney's office to questionable business practices by the paper firm was not involved in the killing. However, Westveer did acknowledge that the scandal had distressed Stermer.

"He was very proud of his company, and it hurt him," he said. "Morally, he felt he didn't do anything wrong."

Stermer evidently had good reason to feel that way. An executive of the com-

pany told reporters that Mudge Paper "is still functioning as it did before the killing because of the way he set up the company." He added that the firm and its remaining stockholders were in the process of purchasing the 51 per cent of the Mudge stock held by the Stermer estate.

The public's response to publication of the sketches of the suspects was a bitter disappointment to the homicide investigators. When the trickle of leads dried up altogether, they had no choice but to turn their attention to newer, more pressing cases. This time, when the Stermer murder faded from the newspapers it did not return for nearly two years. But police never forgot the case and periodically reviewed the files the hope of finding some crucial clue they had overlooked.

In June of 1978, a Maryland state police undercover agent assigned to the contract murder squad elicited from one of his informants a few details concerning an "unsolved murder in South Baltimore." Certain that they would be interested in what he had found out, the trooper called his colleagues on the Baltimore Police Department and passed along the few leads he had uncovered. The city homicide probers were able to fit the new information into the partially developed picture of the Stermer case.

Because the state policeman had received his information third-hand, a city police source would report, Baltimore detectives had to work back to the source of the details. In time, they completed gathering their facts and late in the autumn they took their information to the state's attorney. After examining it carefully, he presented it to a grand jury.

As a result, on Friday, December 15, Baltimore homicide detectives obtained a warrant charging 27-year-old Charles E. Brent of Brookbury Drive in Reisterstown, Maryland, a community of 13,000 in Baltimore's northwest suburbs, with murder, armed robbery and handgun violations stemming from the murder of Edward C. Stermer. As soon as they were in possession of the long-awaited document, police went looking for the suspect, who also went under the name of Anthony Edward Perro.

Detectives Bryn Joyce and Benjamin Brannock of the state's attorney's office were unable to find him, and the assumption was that he had fled the state. Almost at once, Lieutenant Westveer issued a photograph of the wanted man to the news media.

Howard Gersh, head of the violent crimes unit of the state's attorney's office, and his assistant, Peter Semel, told reporters that they would not discuss any aspect of the probe. However, newsmen already had learned that while the police investigation was pro-

ceeding, the grand jury had spent about a month listening to witnesses who were acquainted with various aspects of the case. Reportedly, the investigative panel was seeking accomplices in the killing.

Newsmen believed that much of the renewed work on the case had come as the result of the impending expiration of the statute of limitations on some of the charges. Because the investigation had lasted for nearly two years, reporters felt that it would have to be brought to a halt in the near future, perhaps as soon as the next week.

Three days later, on Monday, December 18, 1978, employees of the Mudge Paper Company were stunned to learn that 55-year-old Hassan R. Erman, the firm's comptroller-treasurer, had been charged with arranging the murder-for-hire of Edward Stermer. Erman, who made his home on Garrison Forest Road in Owings Mills, Maryland, was taken into custody at his Russell Street office about 10:30 that morning on charges of first degree murder, assault, robbery and handgun violations.

One source close to the probe said that Erman was believed to have arranged Stermer's slaying purely for financial gain. Under an agreement, he noted, the stock of a deceased Mudge official was to be retired, and because there would then be fewer shares of outstanding stock, the value of all the remaining shares would increase. At the time of his death, Stermer was believed to have owned some 51 per cent of company stock.

Hassan R. Erman, newsmen learned, was a University of Baltimore graduate who had received his MBA degree from Loyola College in 1976. A Turkish native of the troubled island nation of Cyprus, Erman had been a Mudge employe for about 20 years. Hired as comptroller, he also had become a vice president in 1972 and reportedly owned about five per cent of the company's stock when Stermer died.

Booked on the charges on Monday afternoon, Erman was freed from custody that evening after posting bond of \$150,000.

The hunt for Charles E. Brent con-

tinued until Friday, December 22nd, when the accused triggerman was arrested in California and jailed pending an extradition request from Maryland. That same day, a Baltimore grand jury indicted him on charges of murder, robbery and conspiracy in the Stermer case and cited Hassan Erman on charges of murder, robbery, conspiracy and accessory before the fact of murder.

Questioned by newsmen about the details of Brent's arrest, Baltimore State's Attorney William A. Swisher said that the exact location where the suspect was being held would not be revealed pending further investigation into the murder. According to Assistant State's Attorney Semel, the probe was still underway and additional matters might be taken before the grand jury. It was reported that police still were eager to develop information about the missing death weapon.

At a pre-trial hearing on Friday, May 18, 1979, Assistant State's Attorney Harvey E. Greenberg said that Erman and Brent attempted to "cover up" their involvement in the case by lying to the

police for over a year, and that because the conspiracy continued for so long after the slaying, the charges were not subject to the one-year limitation on conspiracy. Greenberg went on to say that he would show, at the trial, that after Stermer was dead the defendants schemed to stalk and kill another officer of the paper company.

Prosecutor Greenberg said that the state would produce evidence showing that in 1977 and 1978 Charles Brent voluntarily made statements to Anne Arundel County and Baltimore police that were "false and misleading." There was a total of seven statements, he added, all of which was an effort to conceal the nature of the conspiracy and show that Hassan Erman was the intended victim of a scheme.

An attorney for Brent, who had been lodged in the Baltimore City Jail upon his return to Maryland, said that he was withdrawing a plea of not guilty by reason of insanity for his client and entering, instead, a general plea of innocent. Brent, it was noted, had been found competent to stand trial on the charges following mental examinations, in April, in Clifton T. Perkins State Hospital.

Four months later, at a Monday, September 24th, suppression of evidence hearing, Judge Marshall A. Levin barred press and public from his courtroom at the request of defense attorneys. State prosecutors offered no objection to the ruling. It was reported, nevertheless, that the matter under consideration by the court was the extent of Hassan Erman's financial involvement with Mudge Paper and whether or not the details of his holdings were to be excluded from trial testimony.

The murder trial got underway in the first week of October in Judge Levin's Baltimore Criminal Courtroom. In his opening remarks to the jury, Prosecutor Greenberg said that in addition to the murder of Edward Stermer, Hassan Erman had plotted the death of a vice-president of Mudge Paper as part of his plan to take over the company. At Erman's urging, he said, Charles Brent stalked the executive during a 1976 business trip to West Virginia, but the plan fizzled when the driver Brent had enlisted to help him became sick and "chickened out." Brent, he said, "worshipped, adored and was linked" to Erman, and was even wearing some of his clothes at the time of his arrest in California.

On Thursday, October 11th, the state called to the stand a friend of Charles Brent who testified that the suspected hit man had told her that he was going to do a "big job" that would make him wealthy "around Christmas time" in 1976.

"When I get all these jobs done," she

quoted him as having said, "I'll never have to worry about money again."

On another occasion, the woman said, her daughter "had a broken heart" and to cheer her up Brent brought her to Hassan Erman's house on Owings Mills to play tennis.

On Monday, October 15th, a Mudge Paper clerk told the court that Hassan Erman "surprised" the office staff on the afternoon of the slaying by allowing everyone to go home early.

Mudge Paper's secretary, the next day, testified that if both Edward Stermer and the firm's vice-president had died, the value of Hassan Erman's company stock would have increased almost tenfold, from \$47,700 to \$462,900. The company, the witness said, planned to use the proceeds from a life insurance policy taken out on Stermer to buy back and then retire his 51 per cent of the stock and the 35 per cent controlled by the vice-president.

On Wednesday, one of the three directors of the company at the time of the murder said that Hassan Erman would have been "best qualified" to take over Mudge Paper if both its top officers died. He added that earlier in 1976 Erman had recommended that the company buy an increased amount of insurance on Stermer's life, so that they would be in a position to redeem his stock in the event of his death.

On Thursday, October 18th, a senior clerk at the Baltimore Gas & Electric Company told the jury that in 1975 Erman had fallen so far behind in his payments that he owed the utility more than \$1,300. A Baltimore Federal Savings and Loan Association officer said that in 1975 and 1976, Erman paid late charges on 16 occasions when mortgage payments fell due on his home.

On Monday, October 22nd, a 26-year-old Reisterstown, Maryland, man testified that Charles Brent had paid him to drive his truck to and from the Mudge offices on Russell Street on the day of the slaying. Although he heard gunfire, he said, he did not actually witness the murder. Later, however, Brent reportedly told him that he had slain Edward Stermer.

On Wednesday, a former roommate of Brent's told the court that a week before the slaying the defendant asked his advice on how he would go about killing a "man in his sixties." The witness said he had told Brent he would shoot him in the torso, that "if he's in his sixties it probably wouldn't take much to kill him."

Taking the stand in his own defense on Friday, November 2nd, Brent admitted talking about killing Edward Stermer, but he denied having anything to do with his death or with suggesting that Mudge Paper's vice-president be slain. He told the court that it was the Reisterstown man who had testified

earlier who actually was the triggerman.

Back on the witness stand on Monday, November 5th, Brent said that he had expected to collect \$20,000 for "working out the details" of the murder of Mudge Paper's two top executives at Hassan Erman's urging. However, because things "kept getting screwed up," he said, he "called the whole thing off" and Erman never gave him any part of his fee. He was shocked, he said, to learn that Stermer had been murdered anyway.

Following the slaying, he said, the real killer harassed him for money and demanded that he speak with the detectives probing the murder.

"Go down there and get the police off my back," he quoted the man as saying.

In his closing arguments to the jury on Thursday, November 15th, Charles Brent's attorney said that his client was a "little silly and acted like a squirrel, but he just didn't have the guts" to kill Edward Stermer.

Hassan Erman's lawyer told the panel that his client "does not even be-

long" in court. Erman, he said, did not take the stand in his own defense because he did not need to and because Brent trapped himself in "lies" as he tried to implicate his client.

The attorney went on to say that the trial was "all about Mr. Brent," who was "trying to protect himself" when he made statements implicating his client while the police were "closing in on him" (Brent). He added that Brent was also trying to obtain the "\$10,000 reward" offered for a solution to the case and that when the police failed to believe some of his stories he went further and talked about "contract murders."

"There were no conversations and therefore no contact between Mr. Erman and Mr. Brent," the attorney said.

Another defense attorney said that the jury should acquit Erman because he was a family man, a hard-working businessman who had started out in life as a poor immigrant from Cyprus.

On Wednesday, November 14, Prosecutor Greenberg had told the jury that "there is an in exorable connection bet-

ween Mr. Brent and Mr. Erman" and that Brent "had the motive, opportunity and means to pull the trigger." Erman, he charged, was a man earning \$30,000 who was trying to keep up with the lifestyle of his firm's \$200,000-a-year salesmen.

The prosecutor went on to tell the jury that Erman had furnished Brent with the license number and West Virginia itinerary of Mudge Paper's vice-president. When Erman heard that Brent had failed to kill the vice-president, he said, he brought Brent to a Morton Street, Baltimore, apartment used by Stermer, so that he could murder the company president there. The plan failed, he said, when Brent evidently was bitten by a rat while waiting in ambush for Stermer and Erman had urged him to try again, on Russell Street, on December 16, 1976.

After three hours of deliberation on Friday, November 16th, the Baltimore Criminal Court jury returned guilty verdicts against both men. Judge Levin set sentencing for December 20th, unless new trials were granted. ♦♦♦

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