WHAT IMPACT WILL THE HUMAN GENOME PROJECT HAVE ON LAW ENFORCEMENT BY THE YEAR 2004?

TECHNICAL REPORT

BY

DONALD J. MAC NEIL

COMMISSION ON PEACE OFFICER STANDARDS AND TRAINING (POST)

COMMAND COLLEGE - CLASS XIX

SACRAMENTO, CALIFORNIA
JANUARY 1995

19-0389

WHAT IMPACT WILL THE HUMAN GENOME PROJECT HAVE ON LAW ENFORCEMENT BY THE YEAR 2004?

D. MacNeil. Sponsoring Agency: California Commission on Peace Officer Standards and Training (POST). 197 pp. Availability: Commission on POST, Center for Leadership Development, 1601 Alhambra Blvd., Sacramento, CA 95816-7083.
Single copies free: order #19-0389.
National Institute of Justice/NCJRS Microfiche Program, Box 6000, Rockville, MD 20850.
Microfiche fee. Microfiche number NCJ 157322.

ABSTRACT

This study examined the impacts of the newest frontier in medicine: genetics, as developed and guided by research through the Human Genome Project. It focuses on potential applications of genetic information in areas of law enforcement service. The study analyzes law enforcement's readiness level for dealing with new and abstract technology and finds it unsatisfactory. Futures research developed emerging trends and events related to this topic and developed them into scenarios. These scenarios provided a basis for the development of policy alternatives and a strategic plan to allow the model agency to appropriately deal with the applications of human genetics. The paper concludes that genetic revelations have begun to reshape the delivery of health care and they pose the same threat to law enforcement. The paper recommends systemic organizational changes and the aid of research institutions in preparing for this. The paper recommends systemic organizational changes and the aid of research institutions in preparing for this. Glossary of terms, bibliography, footnoting, and process illustrations are included.

WHAT IMPACT WILL THE HUMAN GENOME PROJECT HAVE ON LAW ENFORCEMENT BY THE YEAR 2004?

JOURNAL ARTICLE

BY

DONALD J. MAC NEIL

COMMISSION ON PEACE OFFICER
STANDARDS AND TRAINING (POST)

COMMAND COLLEGE - CLASS XIX

SACRAMENTO, CALIFORNIA
JANUARY 1995

This Command College Independent Study Project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future--creating it, constraining it, adapting to it. A futures study points the way.

The views and conclusions expressed in the Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (POST).

I. Introduction

In Edward Albee's p 1962 play, Who's Afraid of Virginia Woolf?, George (a historian) describes the agenda of modern biology to alter human chromosomes:

> ...The genetic makeup of a sperm cell change, reordered...to order, actually...for hair and eye color, stature, potency...I imagine hairiness, features, health...and mind. Most important...mind. All imbalances will be corrected, sifted out... propensity for various diseases will be gone, longevity assured. We will have a race of men...test tube bred...incubator born...superb and sublime.[1]

Considering the state of biological science in the early 1960's, George's view of the future was the ultimate fiction. Today however, George's fiction is rapidly becoming fact. The vehicle for this transformation is the Human Genome Project (HGP). The HGP is a 15 year "big science" cooperative endeavor of the National Institutes of Health (NIH) and the United States Department of Energy (DOE). The goal of the HGP is to map the entire human compliment of 46 chromosomes and develop a genetic blueprint for the functional expression of human heredity. Human beings have 22 pairs of autosomes and 1 pair of sex chromosomes. Normal human males have one X and one Y sex chromosome; human females have two X sex chromosomes. Within the human chromosomal package, genes are found. Genes are the fundamental expression of human heredity.

A gene is an ordered set of nucleotides located in a particular position on a chromosome. Simply put, genes are packaged combinations of deoxyribonucleic acid (DNA). DNA is the ladder like, double helix molecule that was discovered by James Watson and Francis Crick in 1953. DNA is a ubiquitous substance that can be found in nearly every cell in the human body. The composition of the DNA and the order in which the

---

[1] Edward M. Albee, Who's Afraid of Virginia Woolf, (New York: G.P. Putnam's Sons, 1962), p.63.

nucleotide bases are linked determine the genetic messages contained within the human body. Strung out in the sea of chemical messages in the human genome are some 100,000 genes.

The challenge confronting the HGP is to map each of these genes to each respective chromosome. This requires HGP scientists to sift through and analyze some 3 billion bits of information that spell out the instructions for making proteins, the basic building blocks of human life. As of the fall of 1994, the HGP is forecasted to conclude its operations sometime in the fall of 2004 or early 2005.[2] By then, about 100,000 genes and the exact sequence of their chemical constituent parts will have been identified.

For scientists racing to map the human genome, the past year has been extraordinarily productive. With automated cloning equipment and rough computerized maps to steer them through the vast stretches of DNA, scientists are finding human genes at the rate of more than one a day.[3] In the past 12 months, they have located the genes for Huntington's Disease, Lou Gherig's disease, the so-called "bubble boy disease", the disease featured in the film Lorenzo's Oil, a major form of ataxia (loss of coordinated movement) and a common form of colon cancer, among others. More stunning was the discovery of the first breast cancer gene known as BRCA1. This gene was discovered in September of 1994 and is responsible for at least 5 percent of all breast cancers.[4]

The rate of bonafide gene landmarking is likely to increase at an even faster rate. Companies such as Hewlett-Packard and Affymetrix Inc. are marketing a special DNA mapping computer chip that will drop analysis time from days to hours for genome mappers.[5] Prior to this announcement was another computer related development of a "superchip" capable of performing sequencing tasks at a rate 1000 times as fast as conventional

---

[2] P E Dewitt, The Genetic Revolution, *Time*, 17 January 1994, 32-39.
[3] ibid.
[4] Sue Goettinck, "When Doctors Can Tell You You'll Likely Get a Disease," *Dallas Morning News*, 14 November 1994, sec. 1.
[5] A.J. Hosetettler, "Hewlett-Packard News Release: DNA Chip Products", *San Jose Mercury News*, 21 November 1994., sec. 3A

means.[6] All of this means that the rate of genetic discoveries will increase rapidly as the HGP moves into the second half of it's study. This situation has caught many in the health care and biological sciences professions off guard. Barbara Biesecker, head of the genetic counseling training program at the National Center for Genome Research recently commented, "Clearly in the last few years, the main themes in the hallways are how we can keep up, that's sort of overwhelming to all of us."[7]

Despite the increasing rate of genetic discovery, the overall task of human genome mapping is quite tedious. Dr. Francis Collins who heads the HGP, has described the effort in locating a gene from scratch as like "trying to find a burned-out light bulb in a house located somewhere between the East and West coasts without knowing the state, much less the town or street the house is on."[8]

The question facing law enforcement is whether or not there is genetic information hidden in the human genome that is applicable to any of the facets of police service. Of great interest, of course, would be the discovery of such things like a "criminality gene." In fact, such a marker has already been discovered. It occurs when a human being is born with an X and Y chromosome; the genetic essence of being male. This genotype predicts violence and criminality at a rate nine times that of those not in this genotype, those with two X chromosomes, i.e. women.[9] A putative aggression gene was discovered in the summer of 1993.[10] This particular genetically triggered disorder causes there to be deficient levels of important enzymes Monoamine Oxidase A and B. These enzymes are crucial to the metabolization and breakdown of neurochemicals responsible for the development of the "fight of flight" response. This disorder is a rather rare condition that is complicated by other factors such as low IQ. and Attention Deficit Disorder. Nonetheless, a genetic link to a condition

---

[6] Kathleen Adams et. al, "Science-Chronicles," *Time*, 3 October 1994, p.29

[7] Sue Goettnick, When Doctors Can Tell You You'll Likely Get a Disease," *Dallas Morning News*, 14 November 1994, sec.1

[8] P.E Dewitt, "The Genetic Revolution," *Time*, 17 January 1994, p.34

[9] David Bejerkle, Andrea Dorfman and Christine Gorman, "DNA by Special Delivery," *Time*, 14 January 1994, 45-49

[10] Sarah Richardson, "Genetics Watch: A Violence in the Blood," *Discover*, October 1993, 30-33

that forecasted a predisposition to violence had for the first time, definitely been identified.

The overarching question is how applicable are genetic blueprints and the knowledge of genetic related diseases to the delivery of law enforcement services. Are there hidden in the recesses of human chromosomes, secrets that predict the ultimate development of bad behaviors or other conditions that would be usefully applied in a criminal justice setting? Someday, says Harvard molecular biologist Walter Gilbert, that diary-- the entire genetic record-- will fit on a single CD-ROM. "We look upon ourselves as having infinite potential," he writes in The Code of Codes. [11] "To recognize that we are determined, in a certain sense, by a finite collection of information that is knowable will change our view of ourselves. It is the closing of an intellectual frontier, with which we will have to come to terms."

"You're going to see craziness you won't believe," says George Annas, a Boston University professor of health law. He thinks it is only a matter of time before someone sweeps up Bill Clinton's hair trimmings at a barbershop, runs a genome scan on the DNA in the hair cells and publishes the list of diseases to which the President is heir.[12] It is this vision of the future that law enforcement must wade through in the new millennium.

The extent to which genetic discoveries identify conditions that are relevant to law enforcement are not clearly known. The sentiment of surprise expressed by many researchers should serve as a warning to law enforcement therefore that the HGP is full of unexpected developments. It is a wise decision therefore to prepare for the onslaught of discoveries that will occur in the next 10 years of HGP operation. Contributing to the "craziness" described by George Annas, will be the introduction of super computerchips that will increase the speed at which DNA sequences are deciphered. This development could lead to such announcements like, "discovery of the day." .

---

[11] Daniel Kevles and Leroy Hood, The Code of Codes, (Cambridge: Harvard University Press, 1992), p.87
[12] David Bjerkle, Andrea Dorfman and Christine Gorman, "DNA by Special Delivery," *Time*, 18 December 1993. p.46.

Issue Development

Christopher Wills is a professor of biology and a member of the Center for Molecular Genetics as the University of California at San Diego (UCSD). Wills has authored several books, one being "Exons, Introns and Talking Genes: the Science Behind the Human Genome Project."[13] Wills has stated that he believes that there will be useful information for law enforcement discovered during the remaining periods of genome mapping. Criminality genes and IQ genes are unlikely to be discovered, but there are conditions that would contribute to bad behaviors that are likely to be uncovered. The plain fact of the matter is, science will not really know until the actual finding is made. Genetic conditions predisposing an individual to high probabilities of cancer development will continue to grow in number. This knowledge opines Wills, will be useful to anyone in the business of hiring and assigning employees where the exposure to environmental "triggers" are great.

What is not well understood at this point, is the exact role that the environment plays in the development of genetically coded disorders. In some cases, like Huntington's Disease, the likelihood of development is nearly 100 percent if a person possesses the "bad" gene. In a case like diabetes mellitus, the likelihood of expression may be no more than 50 percent. Quite obviously, the environment plays a significant role in ordering these "bad genes" into action.[14] Study into this vital "trigger" relationship is underway in institutions throughout the world.

Wills was an early supporter in the use of DNA for the purposes of personal identification. In fact, Wills was a consultant to the San Diego County District Attorney's Office in the mid-80's when DNA fingerprinting was evolving. Wills posits that the HGP will help better establish DNA fingerprinting as an identification technique for law enforcement. What science learns about DNA in the course of human genome mapping will bolster its case as a reliable indicator of human

---

[13] Christopher Wills, Exons, Introns and Talking Genes, The Science Behind the Human Genome Project, (Harpers Press, 1991)

[14] Author's interview # 1 of Christopher Wills Ph.D. by telephone, 3 May 1993

identity. This according to Wills, should lead to expanded use of DNA data banks that utilize relational software to help identify suspects in cases where human tissue or fluids have been collected as evidence.[15]

Christopher Wills appeared in April, 1994 at a POST Command College Alumni workshop in San Francisco. Wills told the audience of the rapid pace of genetic discovery in the HGP. Wills described some of the discoveries described above and expressed cautious optimism for more profound discoveries in the future. Wills also commented upon the complex interaction between genes and the environment, Wills went on to advise law enforcement of the need to carefully monitor the developments in this area of science. Understanding what can and cannot be done with human genetic information is vitally important.

Following the April 1994 presentation, the author interviewed Wills for his intent in delivering the Command College lecture. Wills stated that he hoped to have left a clear message that it was very important for law enforcement to get an intellectual grip on the subject. In order to make important decisions regarding the use of genetic information in the future, law enforcement must have a good sense for what is taking place here in the present.[16]

As evidenced by the research cited previously, research in the field of human genetics is not about to slow. Hardly a day passes without some media mention of a genetic discovery related to or as a by-product of the HGP.[17] Because of this situation, it is apparent that law enforcement needs to initiate a program whereby the HGP can be evaluated for its potential effects on the delivery of law enforcement services. At present law enforcement has no system to prevent Professor George Annas's "craziness" from suffusing the profession when ultimately confronted with the discoveries of human genome mapping. This study was undertaken to

---

[15] Authors Interview # 2 of Christopher Wills Ph.D. by telephone, 17 May 1993.
[16] Authors interview # 3 of Christopher Wills Ph.D. by telephone, 2 May 1994
[17] Thomas Maugh, "Discovery of Breast Cancer Gene Called Major Advance." *Los Angeles Times*, 6 June 1994.

examine what law enforcement could or should do to prepare for the discoveries prompted by the HGP.

This examination into the activities of the HGP prompted a primary study issue and three sub-issues.

Primary Issue: What impact will the Human Genome Project have on law enforcement by the year 2004?

Sub-Issues:

- What impact will the Human Genome Project have on the selection, assignment and promotion of the law enforcement officer of the future?

- What impact will the Human Genome Project have on crime prevention and incarceration strategies for criminals by the year 2004?

- What Impact will the Human Genome Project have on criminal investigations by the year 2004?

Futures Study

The issue and sub-issues were examined in a futures study to see what potential impact they would have on the overall California law enforcement system. The analysis was conducted by the use of a nominal group technique (NGT).

Using a NGT panel comprised of law enforcement, legal, public policy and scientific experts, 40 events and 34 trends were originally identified during the NGT exercise. Using a winnowing technique, the NGT process was able to reduce the list down to the ten most important events and the ten most important trends. The events were then forecasted to show their probability of occurrence over a ten year period of time, 1994-2004.

The trends were forecast in similar fashion to demonstrate the trend over a ten year period of time. The data also illustrated a reflection for a period five years previous to the starting point of 1994. The window of examination for the ten trends covered a fifteen year period of time, 1989-2004.

Top Ten Events Identified: Each event is listed below along with a short definition.

Event #1 - "Genetic Data Base for Sex Offenders is Developed." This event describes a California stand alone system for the maintenance of DNA and genome blueprints of convicted sex offenders.

Event #2 - "Supreme Court Overturns Genetic Fingerprinting on Privacy Grounds." This event chronicles a United States Supreme Court decision that invalidates DNA fingerprinting on grounds of self-incrimination.

Event #3 - "TRW for Genetics is Developed." This event describes a TRW system akin to the current world wide credit system that is developed for the large scale maintenance of pertinent genetic records.

Event #4 - "National DNA Tracking System is Developed." This event describes a system designed to help identify the movement of disease and genetic mutation throughout the country.

Event #5 - "Legislation is Passed to Restrict the Use of Genetic Information." The event develops the idea that legislation could be drafted by the state legislature or congress. to limit the use of personal genetic reason.

Event #6 - "FBI Sets up the National Genetic Crime Information Center (NGCIC)."- This event constructs a nationwide DNA and genome repository of information accessible by individual state information systems.

Event #7 - "National Association for the Advancement of Colored People (NAACP) Comes Out in Firm Opposition to any Non-medical Use of

Genetic Information." This event illustrates minority group concern that government will use genetic information for nefarious purposes that will disproportionately affect minorities.

Event #8 - "Officer Involved in High Profile Case (i.e.. Rodney King II) Tests Positive for the "Aggressor Gene." The event uses recent genome discovery of the elusive aggression gene as the trigger for police misconduct in another infamous beating case.

Event #9 - "Genetic Testing Required as Pre-employment Condition for All Public Safety Jobs." The event describes a standard of genetic screening for medical and psychological conditions that could negatively effect peace officer performance has been initiated with the hiring of police officers.

Event #10- "Medical Smart Card Used Containing All of a Person's Individual Genetic Information." The event identifies the use of a small microprocessing identification card that among other things contains the users entire genome map.

Top Ten Trends Identified: Each trend is listed below with a brief definition.

Trend #1 - "California Crime Rate." The trend measures the level of crime as reported in annual FBI reports.

Trend #2 - "Level of Police Recruitment Based on Genetic Screening." The trend measures how much genetic screening has been woven into the recruiting and hiring of police officers.

Trend #3 - "Funding Levels for Big Science Projects." This trend assesses the levels of funding granted programs like the Human Genome Project (HGP) from the Federal government.

Trend #4 - "Level of Public Concern Over Privacy Issues." The trend measures public uneasiness with the uses of personal information and other issues of privacy.

Trend #5 - "Level of Public and Private Access to Genetic Information." The trend measures the extent to which the public and private industries can access banks of genetic information.

Trend #6 - "Religious and Special Interest Group Activity in Radical Science." The trend measures the level at which these groups react to the developments in cutting edge science like the Human Genome Project.

Trend #7 - "Ability to Detect the Aggressor Gene(s) in Law Enforcement Officers." This trend measures the efficacy of genetic screening for the so called aggressor gene in law enforcement officers.

Trend #8 - "The Quality of Genetic Forecasts." The trend measures the accuracy and depth of genetic forecasts as a result of on-going human genome mapping.

Trend #9 - "Amount of Crime Controlled Through Genetic Based Therapies." The trend measure the levels of genetic repairs occurring in the genomes of those people with identified sociopathologies.

Trend #10- "Level of Supreme Court Hearings on Genetic Related Issues." The trend measures the frequency with which the U.S. Supreme Court must deal with issues of genetics and genetics related issues.

Scenario For Consideration

A future driven scenario was developed based on the events and trends that were developed by the NGT. The events woven into this scenario were generated by a scenario generating computer program that assessed cross impact values for the events and then iterated them out in the form of a future scenario based on the probability of occurrence.[18]

The targeted organization for this scenario is the large all encompassing law enforcement system for the state of California. This organization is

[18] "SIGMA", Copyright the Policy Analysis Company, Washington D.C., 1992

visualized as containing the hundreds of small municipal police departments, sheriff's offices and district attorney's offices that dot California. In this organization, the California Department of Justice (Cal DOJ) serves as the lead law enforcement unit.

The scenario is spun using a news cast type snapshot occurring on a day in the new millennium. This method of storytelling establishes a setting where events and trends build upon one another and where cross-impacts can be readily viewed. This particular scenario depicts the optimistic future based on the iterations of the scenario generator. Of those generated scenarios, this account is one that ultimately serves as the basis for eventual strategic plan. The "news cast" format analyzes the catalysts of certain events and puts them in the context of the issue question: What will be the Impact of the Human Genome Project (HGP) on Law Enforcement by the Year 2004.

Optimistic Scenario of the Future

The FBI announced that it has made operational a data base that will maintain the genetic histories of persons convicted of certain sex offenses. This development follows a rash of child abductions and murders committed by convicted sex offenders. According to Assistant FBI Director Charles Stewart, this computer system will compile and make available to law enforcement, the genetic profile of convicted rapists, molesters and pedophiles for reference in emerging investigations. This FBI effort is enhanced by rapid advances occurring within the research laboratories of the Human Genome Project. The Human Genome Project is a 15-year program devoted to the complete mapping of the human genome. Though the FBI program seems to be well received by many in the current administration, presidential spokesperson Helen Kelly cautions that the program must not develop into a witch hunt of paroled or rehabilitated sex offenders each time a heinous criminal offense occurs. Such abuses she cautions, could result in a withdrawal of all funding and an abolition of the program.

A medical test was performed last week on each of the 4 police defendants charged in the beating of a black motorist. The attorney representing accused Officer Robert Van der Brook, announced that his client had tested positive for the presence of an aggressor gene. Van der Brook's attorney, James Wilson Jr., stated that he will defend his client's actions based on genetic predisposition toward violence. A spokesperson for the

prosecution indicated that the evidence of an aggressor gene is not an alibi for pummeling a confused and fearful motorist. Van der Brook and 3 other officers are charged in the beating of a motorist who had driven his electric car into a roadside drainage ditch. This incident has prompted a call from "CAPA" (Criminals Against Police Abuse) for genetic screening of police officers for the so-called aggressor gene. CAPA spokesman Charles Manson stated that technical revelations from the Human Genome Project now enable society to check for "soft" conditions that contribute to various types of aberrant behavior. Manson told reporters that public safety demanded that such tests be considered for police officers everywhere. Manson added that if time permitted, San Quentin prison guards should also take the test. Manson posited that San Quentin guards are heavily doused with the aggressor gene.

Doctor Leroy Hood of Lawrence-Livermore Labs responded to the latest developments in the motorist beating case. Doctor Hood is a supervising scientist within the Human Genome Project and is currently coordinating the computer programming efforts that are used to collate HGP mapping discoveries. Doctor Hood states that scientists have identified some areas on chromosome 7 that correspond to neurochemical deficits that may lead to uncontrollable violence. Hood cautioned that these developments are still preliminary and warrant more intense research. Hood stated that genetic screening of law enforcement officers is still some time away. Hood did publicly invite Charles Manson to provide a sample of his blood for analysis by the Human Genome Project. Manson has yet to respond.

Congress passed and sent to the president legislation aimed at narrowing the use of personal genetic information. In response to several radical discoveries made by the scientists at the Human Genome Project, congress moved to block the use of this information by law enforcement and private industry. Rules will require law enforcement and industry to secure court approval or consent to use certain types of genetic information. Law enforcement was given greater leeway in their access to this information provided that an exigency or that a great threat to public safety existed.

The League of Cities announce that a genetic screening test will now be a condition of pre-employment for public safety jobs. Reacting to the development of accurate tests for certain types of cancer genes and genes relating to aggression, the League announced that it is in the public's best interest to conduct such testing. The technology for this type of screening comes in large part from the Human Genome Project which is approximately 50% completed in the task of mapping the entire human genome. Doctor Christopher Wills cautioned the League during his

presentation, that mere presence of a particular "bad" gene does not conclusively determine the expression of the gene or the development of a related condition. Wills went on to explain that the role of the environment in the triggering and confluence of genetic conditions is significant.

The Supreme Court ruled that DNA fingerprinting is generally inadmissible evidence based on fifth amendment grounds. Using a doctrinal approach reminiscent of the Court's Miranda ruling, the opinion held that DNA is inherently private and coveted and cannot be used to establish personal identity. Jose Rivera, spokesman for the World Police Chiefs Association, downplayed the decision by stating that most defendants voluntarily give up their right to privacy and allow us the use of their genetic information already. Rivera added that criminal defendants routinely give up their right to remain silent even in the face of the country's age old Miranda decision. The Supreme Court did uphold the FBI's genetically based sex offender information system which had come under fire for the manner in which it collects and disseminates genetic information regarding criminals. The Court held that evidence samples supplied by most of the concerned criminals were handled over voluntarily to authorities. The FBI was found to be lawful in it's distribution of genetic information to other concerned law enforcement agencies.

Reacting to recent discoveries by the Human Genome Project, the NAACP announced today its opposition to anything but medical use of genetic information. Just a month after the Supreme Court acted to narrow the use of DNA evidence, the NAACP condemned the use of genetics and hereditary by government and industry. Spokesperson Al Smith, stated that the direction of the Human Genome Project is away from medicine and towards eugenics. Smith predicts increased levels of racism and discrimination based not on color but ultimately directed at people of color.

In reaction to the announcement by the NAACP, the American Association of Retired People urged the government to step up it's effort to completely map the genome. The AARP which is steadily gaining in membership and political influence, believes that hidden within the genome is the fountain of youth and other life extending discoveries. AARP spokesman George Carter remarked that ,"the NAACP has nothing better to do than carp at innocent governmental programs that can bring a higher quality of life to all Americans." Carter suggested that recent taxes enacted to balance the national health care program, should instead be used by the National Institutes of Health to fund more conferences on researching criminality and its relationship to genetics. "Leftover monies should be then devoted to

identifying the fountain of youth genes before time runs out," quipped Carter. TRW announced that they have christened a new information system to assist creditors and insurance companies in managing the deluge of genetic information spawned by work at the Human Genome Project. TRW will act as a clearing house for genetic information pertaining to clients who are applying for insurance and credit. Law enforcement and government entities will not be allowed access to this private genetic data base. Several biotech firms immediately announced that they intend to market genetic credit repair systems for individuals with "bad genes." "Bad genes are all in the eye of the beholder" said Kelly Di Luigi, president of ChromoFix. ChromoFix is one of several companies claiming that they can help repair bad genes and bad gene interpretations.

II. Strategic Planning

As described earlier, the law enforcement organization used as the model for strategic planning and implementation is the conglomerate of all California law enforcement agencies allied in the criminal justice system. In this organization, the California Department of Justice in the form of the Attorney General serves as titular head. Under the aegis of the Attorney General, the California Department of Justice, Director of Law Enforcement (DLE) serves as the day to day chief executive. In this institution, the Director of Law Enforcement does not wield direct power on the myriad allied organizations, rather, he/she functions in a role so as to influence positive outcomes on macroscopic issues such as those found in large science programs like the HGP.

Given the desired future state that was described by the scenario and mindful of the trends that underlie the future, the author's successful California law enforcement "organization" is found in this future condition:

- The various large and small police and sheriff's departments within the organization freely and quickly exchange information of all types.

- The organization has adopted controls, standards and training regimens for the understanding and use of applied genetic science.

- The organization has the capability of open dialogue with the community it serves, especially on issues of great moral and legal magnitude.

- The organization is networked with federal agencies, other state agencies and foreign law enforcement agencies on technological issues of mutual concern.

- The organization has access to research institutions that can be tapped for professional help in the determination of how complex scientific can be used in the delivery of law enforcement services.

- The organization is secure in it's funding for the research and development work necessary to ensure legal, ethical and practical uses for complex scientific issues like human genetics.

Mission Statement

The following mission statement was written by the author based upon experiences, research and interviews that were conducted in the futures research section. This mission statement was developed so as to serve as guidelines and objectives for the California law enforcement organization in attaining an effective plan and strategy for dealing with the use of human genetic information. The establishment of a mission statement is crucial to establishing a direction and a vision for the management and utilization of cutting edge genetic information developed in the new millennium.

•Develop and maintain an environment of interagency cooperation and support in the quest to evaluate and implement cutting edge scientific and genetic developments within the delivery of law enforcement services.

•Insure that our scientific competency is maintained at a level necessary to properly address the complex issues stemming from current and future issues in genetics and microbiology.

•Guarantee the highest levels of personal and professional integrity in the uses of human genetic and microbiologic information in the enforcement of the law.

•Maintain strict levels of security in the use and applications of information derived from genetic and microbiologic data bases.

•Evaluate options and be open-minded to networking and sharing of technical information with allied agencies engaged in enforcement of the law.

•Understand and allow for the diversity of thought and debate that will occur with the future applications of genetic and microbiologic science.

•Continually evaluate the policies and procedures pertaining to the way genetic and microbiologic evidence is collected, stored and used by law enforcement agencies.

Environmental Analysis

The State of California law enforcement community moves toward the future of genetic and microbiologic renaissance at a time of great change and challenge. Despite recurring economic woes and unresolved urban turmoil, California is in a position where the environment supports the efforts made to meet the goals of the mission statement.

Opportunities: Public sentiment has hit a point of great annoyance with crime. Law enforcement is in recovery from the public relations fiasco of the Rodney King affair. Support for the use and evaluation of new technologies such as human genetics is likely, especially if it has ramifications in solving or preventing the more odious of crimes such as rape and murder. Further adding to law enforcement's list of opportunities is the continuing expansion of the organization's multimedia capabilities. Allied component organizations in the system are all moving towards greater levels of computerization and automation. This shift in the

direction of the "information superhighway" facilitates the goals of information sharing and cooperation on projects involving high technology[19]. California law enforcement also has solidified its base of political support in the Assembly and Senate[20]. Regardless of the on-going political partisanship in both houses, law enforcement programs are generally well received.

Threats: As was evident in the technical research of this issue, discussion of the uses of human genetic information is highly charged. If law enforcement's efforts to apply genetic information becomes publicly twisted and distorted, it runs the risk of raising the ire of political and religious groups capable of derailing future applications.[21] Another potential threat is in the conduit for information exchange between federal and state agencies who may need access to DOE and NIH data. With no proven track record, this necessary bridge could prove faulty.[22] Another lingering problem for California is the lagging economic recovery from recession. Continued financial difficulties could jeopardize subsidization of expensive, controversial law enforcement programs like that which would evolve from discoveries within the HGP.

Organizational Analysis

Strengths: The organization adopted for this study is the California "conglomerate" of law enforcement. As proffered with the Department of Justice at its head, the organization is structurally sound and resource rich. Internal capacity analysis revealed the organization to be superior or above average in most pertinent categories of performance. The greatest strengths organizationally were documented in areas of technological capacity, interagency cooperation, line level support, leadership and technical independence.

---

[19]Michael Post, "Broadband Interactive Multimedia Telecommunications: The Impact on Law Enforcement in the New Millennium" (Thesis-Independent Study Project., California POST Command College, 1993), p.3.

[20]Harold Johnson, " We Like Mike [Huffington]," *National Review*, 10 October 1994, 26-27.

[21] Dan Lattin, "Secret Files on Americans' Genes; Scientists, Theologians Fear Databanks Could Prove Dangerous, *San Francisco Chronicle*, 17 February 1992, sec.

[22] R. Jackson, "Promote DNA Technology, Panel is Urged." Los Angeles Times, 19 November 1994, sec.A1

Weaknesses:

The most significant areas of organizational weakness are cited in aspects of information management and line level scientific fluency. The organization is struggling with the demands of multimedia and digital technology as it grapples with the challenges of the information superhighway.[23] The response to these challenges costs money. Often the hardware and software require huge capital outlays to initiate needed programs. This requirement is made against an anemic economy that has a somewhat dubious financial future as cited earlier. These internal weaknesses could jeopardize the efforts made at attaining the goals set by the mission statement and ultimate arrival at the desired future state.

Stakeholder Analysis

The stakeholders in this study were identified as those individuals or groups having the greatest overall impact on the issue. Sixteen stakeholders were identified in the study. The stakeholder group represents a broad spectrum of law enforcement organizations along with a diverse collection of groups outside the law enforcement system. Due to the far reaching implications of genetic applications by law enforcement, the stakeholder group was accordingly panoramic in representation. In this stakeholder group, HGP researchers were identified as a "snaildarter." This term signified the role that research scientists play in the development and application of genetic technology. Should for instance, researchers disapprove of a particular application of genetic research, they have the power to withhold expertise and guidance on the application side of their work.

An example of this occurred in mid-November 1994 at a symposium at the University of California at Riverside. The author was chairing a discussion on potential applications of genetic technology for law enforcement in the

[23] Michael Post, "Broadband Interactive Multimedia Telecommunications: The Impact on Law Enforcement in the New Millennium, (Thesis-Independent Study Project, California POST Command College, 1993) p.2.

next decade. In attendance was a diagonal slice of the University's academia. Attendees ranged from applied science engineers to biochemists researching aspects of breast cancer genetics. After listening to the author's presentation, a bio-chemist professed near horror that law enforcement was considering the use of genetic information in the discharge of criminal justice. That event describes in some sense why the snaildarter assignation rests with genome researchers.

Strategies for Reaching the Desired Future State

A number of strategies were developed by use of a Modified Policy Delphi. The threes top strategies developed by this forum were then discussed with a panel of diverse experts regarding the viability and reasonableness of each strategy. Ultimately, a strategy was chosen to be carried forward into transition management.

The strategy calls for California DOJ, the California Peace Officers Association (CPOA), the Commission on POST and the University of California at Riverside to form a consortium that will evaluate genetic discovery and then implement application strategies as need be. In this arrangement, DOJ (in the person of the Director of Law Enforcement) becomes the project manager for the implementation of this plan. CPOA and POST participate in significant support roles in their various capacities. The University of California at Riverside (UCR) functions as the scientific clearinghouse for research and application strategies. Specifically, the UCR College of Engineering with assistance from the College of Biologic Sciences and the College of Public Policy are called upon to provide the academic support necessary to develop viable uses for technology that is spawned by the HGP. The UCR component of this plan is housed in the Center for Crime Control within the Bourns College of Engineering.

The arrangement described above is tailored to identify, evaluate and apply relevant HGP discoveries in the areas defined by the sub-issues. The extent and significance of discoveries and their application to the sub-issues is not clearly understood at this time. The research was unable to establish

specific, exact effects the HGP would have on the areas of study. The complexity of this issue requires that the HGP be dealt with at a macro-level. Future studies can more closely analyze and evaluate HGP developments for impact on the sub-issues.

Transition Management Plan

A strategic plan of such organizational and technical magnitude required a transition management plan that brought together a variety of players who wield legitimate power and authority inside the California law enforcement system. The transition management team must be capable of providing wide spread support and catalysis to a plan that is foreign in the sense of organizational culture and history. This transition management team is identified as:

- The Director of the Division of Law Enforcement, California Dept. of Justice (DLE)
- The California Attorney General
- President, California Peace Officers Association
- President, California Police Chief's Association
- President, California Sheriff's Association
- Executive Director, Commission on Peace Officers Standards and Training (POST)
- President, California District Attorney's Association
- Chief, Bureau of Forensic Services, California Dept. of Justice

The transition management plan calls on the Director of Law Enforcement (DLE) to assume the project managers role. The DLE accomplishes this under aegis of the Attorney General. The DLE must then rally this "critical mass" toward the future state through an unusual apparatus. The transition management plan calls for heavy reliance on the UCR School of Engineering in the evaluation of genetic technology and the determination of potential applications within the areas defined by the study's sub-issues. As of November 1994, UCR is in the process of appointing and executive director who could function as the University's liaison with the law enforcement side of the critical mass team. It is likely that this individual

will be a retired chief executive of a large police or sheriff's organization within the California law enforcement system.[24] In the likely event that this individual is appointed, he/she will become a "de facto" member of the critical mass transition team.

This group of critical players each have areas of expertise and influence within the system. They represent constituencies that are comprised of front line users up and through those managers that would be tasked with very specific technological implementation responsibilities. The group would rely on a "task force" approach to plan implementation. The task force would be nominally headquartered at the University of California at Riverside and linked individually by an telecommunications internet system that is hardware maintained by the University. The task force would employ team building workshop techniques along with technology summits to maintain open communication channels and to ensure intelligent debate on matters of potential applications of genetic science.

As time goes by, additional committees will undoubtedly be added to the team to address specific issues that arise. This is an organizational necessity brought on by the University's work in other high technology areas such as robotics and information management. Those engineers working in these areas will likely be involved in the genetics side of the operation as well. This type of cross over is a likely outcome of this type of academic-law enforcement cooperative.[25]

Timetable

The plan calls for full implementation of the transition plan over a course of three years. The first year of the plan consists of the process of physical building of the transition management team along with several policy level meetings of a core group of critical mass players defined by the California Director of Law Enforcement.

---

[24] Author's interview of Dean Susan Hackwood, College of Engineering, University of California, Riverside 16 November 1994.

[25] Author's interview with Riverside County Sheriff Cois Byrd and Dean Susan Hackwood, 16 November 1994.

The second and third years call for the task force to begin actual operations as defined above. This timetable puts the task force in a position where HGP discoveries have likely accelerated causing more profound opportunities for application within the sub-issue areas.[26] During this period, the plan calls for frequent summits between critical mass players, derivative "ad hoc" committees and academia for the purpose of reevaluation and the resetting of goals and strategies.

Conclusion

The primary issue question, "What Impact Will the Human Genome Project Have on Law Enforcement?" can be best answered by review of the answers to the defining sub-issues. This task has become an inordinately complex one given the constant stream of technological discoveries and the often contradictory forecasts given by experts in the field of genetic research. On the day where the text of this article was completed, human genome research uncovered the genetic role in human romance.[27] This finding is illustrative of the evolutionary speed of the research. The speed of the research will continue to increase as indicated previously through the development of super computer chips that accelerate DNA sequencing programs. Adding to this speed will be the very recent achievements in positional cloning techniques. These developments will synergize computer enhancements and propel discoveries at even a faster pace.[28] Because of these situations, issue areas for study will undoubtedly get answered in different ways on a weekly basis.

Nonetheless the task in this study was to best assess the impact of human genome research on the issue and sub-issues and propose a realistic plan for arrival at the desired future state as defined through scenarios and other defining tools such as the organizational mission statement.

---

[26] Tim Beardsley, "Trends in Biological Research: Big Time Biology," *Scientific American*, November 1994: 90-97.

[27] Thomas Maugh "Genetic Role is Found In Romance," *Los Angeles Times*, 26 November 1994, sec.B8.

[28] J. David Brock "Positional Cloning", *Science and Medicine*, Nov/Dec 1994: 48-58

"What Impact Will the Human Genome Project Have on the Selection, Assignment and Promotion of the Law Enforcement Officer of the Future?"

Literature reviews and subject matter expert interviews strongly suggest that human genetic information will in fact be usable in facets of personnel management. As of the fall of 1994, medical aspects of human genetics are usable in the identification of afflictions that might be environmentally triggered or exacerbated by police service. Cancer genetics is the most prominent of these sub-area applications. As to whether or not behavioral genetics will come to fruition, in a fashion that could aid in the selection and assignment of best suited police officers, is unanswered. While there is ample scientific evidence to suggest that more specific behavioral related genes will be discovered through the term of the HGP. The extent to which these discoveries can be applied is widely debated among scientific experts.[29] A wait and see attitude seems most reasonable in the minds of all who claim expertise in this particular area[30] There is no specific answer to this question at this point in time. As the research clearly indicated, genetic science is at the perimeter of this question and it has stimulated intense scientific speculation and interest.

"What Impact Will the Human Genome Project Have on Criminal Investigations by the Year 2004?"

The answer to this sub-issue question is more concrete. As indicated by the various research methods, the HGP will create greater finesse in the use of DNA technology by law enforcement forensic scientists. From high capacity fast DNA sequencing computer chips, to improved positional cloning techniques, DNA fingerprinting technologies will be enhanced. The specificity of a DNA fingerprint will become better understood and more widely accepted as a result of human genome mapping. These two aspects of this issue question will in confluence stimulate the creation of DNA data banks that better solve criminal investigations for the law enforcement organization of this study in the new millennium.

---

[29] David J. Weatherall, The New Genetics and Clinical Practice, 3rd edition, (Oxford, Oxford University Press, 1991), p. ix.

[30] ibid.

"What Impact Will the Human Genome Project Have on Crime Prevention and Incarceration Strategies for Criminals by the Year 2004?"

This is the type of applied genetics that so worried the research bio-chemist mentioned earlier in this paper. That bio-chemist admitted that Project discoveries will undoubtedly shed light on the genetic precursors to sociopathic behaviors. What society and law enforcement do with this information is what so frightened the professor. What is unclear at this stage of research is the degree to which "bad genes' play in the ultimate expression of bad behavior. For instance, the "aggressor gene" is a clear cut guarantee of bad behavior expression in the future of the unfortunate victim who inherits the gene[31]. Fortunately, with appropriate drugs the enzyme deficiency in that case can be medically remedied.[32] For other conditions the situation is not nearly so clear or understandable at this moment in time. What is highly likely is the development of presymptomatic genetic counseling that will aid in the suppression of behaviors that may have links to criminal behaviors. This type of medical intervention may be possible at points extending from childhood through post-incarceration of convicted criminals. Genetic based therapies, or gene repair techniques may also be available for these conditions[33]. At present however there is great debate and contradictory evidence among experts regarding the outcome in this area. Only future study and experimentation can douse the speculation rampaging through halls of science.

Policy Considerations and Future Study Issues

The author's study has just scratched the surface of what is likely to be an on-going technical challenge for those professionals engaged in the delivery of law enforcement services. For as many questions that were answered in this study, there were dozens more that were generated and left unanswered. This was not the result of scholarly neglect, but rather it

---

[31] Sheryl Stolberg "Researchers Link Gene to Aggression," *Los Angeles Times*, 22 October 1993.
[32] J.M. Connor and M.A. Ferguson-Smith, Essential Medical Genetics, 4th edition, (Oxford, Blackwell Scientific Publications, 1993), p.111.
[33] Roger J. Porter and Thomas E. Malone, Biomedical Research: Collaboration and Conflict of Interest, (John Hopkins University Press, 1992): 64-66.

reflects the state of scientific turbulence caused by such a complex program as the Human Genome Project.

It is absolutely vital that law enforcement does not go this future road alone. This study emphasizes the desperate need for scientific and academic guidance that only a research institution can provide. In this study, the nominated university is the University of California, Riverside (UCR).This arrangement is an absolute necessity when one considers the notion that the Human Genome Project is in the on-going process of discovering a future. This future is immensely complex and interconnected with all corners of society. What that future will hold for law enforcement must be analyzed and considered proactively-not reactively. This bent toward proactivity is vital.

The mechanism for achieving the status of proactivity has been put forth through a thoughtful strategic and transition management plan. This plan is a first step in an on-going process of looking ahead and planning into the future. The plan must be considerate of the various stakeholders who were illuminated earlier and make use of the expertise that they add to the evaluation of evolving knowledge culled from the HGP.

Future study of this issue and sub-issues are paramount. If the strategic and transition management plans are effective, law enforcement will be able to keep abreast of scientific developments that bear on the issue. The process of monitoring scientific progress will at times be sluggish and misleading. Announcements of one discovery or another are frequently contradicted when attempted replication of the study fails. This is the reality of science, especially in the rapidly expanding field of applied genetics. This being the case, it is important that follow-on study occur within this fascinating field. This situation augurs for the cooperative ventures set forth in the strategic plan that link criminal justice practitioners with academics committed to the mission of law enforcement. Ultimate success in wading through the complexities of genetics will depend on a strong and reliable partnership between these players, one that is sustained through the years. The strengths and assets of the partnership can serve as a platform for future study in this field of science by those so interested.

This issue is not of the sort that can be boxed up and put away for a few years before work starts anew. The state of knowledge put forth in this paper will fade into obscurity rather quickly. This predicament demands that additional study commence immediately and that it take the form recommended in the strategic plan arrived at for this issue.

This Command College Independent Study Project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future--creating it, constraining it, adapting to it. A futures study points the way.

The views and conclusions expressed in the Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (POST).

TABLE OF CONTENTS

ILLUSTRATIONS

TABLES

GRAPHS

CHARTS

" And now, Mr. Foster went on, "I'd like to show you some very interesting conditioning for Alpha-Plus Intellectuals. We have a big batch of them on Rack 5, First Gallery Level, "he called to two boys who had started to go down to the ground floor....

But the Director had looked at his watch. "Ten to three he said. "No time for intellectual embryos, I'm afraid. We must go up to the Nurseries before the children have finished their afternoon sleep."

Mr. Foster was disappointed, "at least one glance at the Decanting room, " he pleaded.

"Very well, then," The Director smiled indulgently. "Just one glance"

- Aldous Huxley, Brave New World (1932)

What if Huxley's vision of the future does come true? Imagine the complexity of a society that has mastery over it's heredity and genetic destiny. Imagine a society where the most vexing of medical conditions have been overcome through mastery of genetic engineering. Suppose law enforcement had access to the secrets of genetic science, what would law enforcement do with it? Maybe more importantly, what could law enforcement do with it. It is the on-going effort of genetic research in and around the Human Genome Project that may bring law enforcement to Huxley's precipice with extraordinary implications for law enforcement in the next century.

In the fall of 1993, a four part television documentary entitled The Secret of Life played across America. This scientific expose was adapted from a book written by geneticists David Suzuki and Joseph Levine. This television production of Suzuki's and Levine's work was a stunning look at the challenges posed by scientific venture into the arena of genetic medicine and genetic research. This well received series made Huxley's world look imminent.

The research into the role genetics plays in human life is a relatively short story. It was shortly after World War II, that British professor Fred Sanger explored the nature of proteins and the nucleotides that held proteins together. Sanger's work on the nucleotide sequencing of insulin was a segue to the dramatic work of scientists James Watson and Francis Crick. It was Watson and Crick in 1953 that uncovered the nature of the genetic coding material known as Deoxyribonucleic acid (DNA). Though intellectually staggering at the time, Watson and Crick's work is now well known even by those outside the scientific community. As it turned out, DNA was a rather simple molecule in the retrospect of those scientists who pursued it. In fact a viral geneticist of that time, Max Delbruck, called DNA "that stupid molecule." To some, it was incredulous that this double helix of interconnected simple compounds was the secret to life. Following the winning of a Nobel Prize by Watson, Crick and their associate, H.F. Wilkins, the race was on to better understand the road map of human life. This race was bolstered by a Department of Energy (DOE) and National Institute of Health (NIH) funded program entitled, "The Human Genome Project" The project is located within a number of major college, university and military laboratories throughout the United States.[1] The stated goal of the project is to identify and map the entire genome which consists of 23 chromosomes and billions of chemical and genetic messages. Hidden in the human genome are believed to be the "blueprints" for many major illnesses and psychologic conditions know to afflict humans.

---

[1]Francis Collins, "A New Five Year Plan for the U.S. Human Genome Project"., *Science* Vol 262, October 1993: p.44

Understanding the work of the Project requires an understanding of what comprises the human genome. The genome is all the genetic material in the chromosomes of a particular organism. In this study, the genetic inquiry is limited to that information in the human genome. Within the genome are chromosomes which contain genes. It is the gene that is responsible for expressing or not expressing complex chemical messages involving DNA . These chemical messages containing endless DNA combinations are the "blueprints" for the multitude of biological processes taking place in the body. When there are biochemical mistakes at this level, the results are often seen in the development of disease and pathologies. It is on this microscopic level that scientists are working to fully map the human genetic blueprint.

The proposition of mapping the entire human genome is daunting when one considers that only 5 percent of the chemical base pairs in human DNA code for anything meaningful. From this perspective, Massachusetts Institute of Technology biologist Robert Weinberg, an authority on cancer genetics (oncogenetics) commented, "a gene appears as a small archipelago of information islands scattered amid a vast seas of drivel."[2] It is this observation that causes some to question the wisdom behind such a massive effort in mapping the genome. To many in the scientific community and government, the money and time spent in Human Genome Project efforts is a waste. Recent developments and discoveries from within the Project tend to suggest, that modern science is one the brink of landmark discoveries that could significantly treat disease and other conditions that are dictated by the chemical messages of the human genome. This forecast is driven by bonafide discoveries in the genetic causes of diseases such as Cystic Fibrosis (CF) and Huntington's Disease. Both of these gravely disabling diseases are now traceable to genetic starting points within the human genome.[3] In the case of Cystic Fibrosis, genetic medicine has advanced to a point where gene-based therapies are now in experimentation. For Cystic Fibrosis, good DNA is introduced into the body through an inactive respiratory virus.

---

2. Daniel Kevles, "Scientific and Social Issues in the Human Genome Project", *Phi Kappa Phi Journal*, Spring 1993, p.24

3 Nancy Wexler, " Presymptomatic testing for Huntington's Disease", *Phi Kappa Phi Journal*, Spring 1993: p.22

Upon becoming seated in pulmonary tissues, the virus releases the good DNA causing the body to produce an important enzyme missing in those who are afflicted with Cystic Fibrosis[4] The results of these experimental therapies have been mixed.

DNA has been a well-studied molecule since the 1950's. In fact, DNA has proceeded beyond academia and medicine and has become a fairly well known concept in law enforcement circles.[5] In the mid-1980s, the Federal Bureau of Investigation and the Board of Biology mutually engaged in the development of forensic techniques for the typing of DNA.[6] The logic was simple and based upon the uniqueness of each person's heredity. It was proffered by many in the scientific and forensic communities that DNA typing was a superior method for establishing personal identification when compared to conventional practices of the time[7]. Considering the immense number of nucleotide pairs in the human set of 23 chromosomes, about 3 billion, DNA fingerprinting comes as close to scientific and legal infallibility as is possible. Since any two human genomes differ at about 3 million sites, no two persons (barring identical twins) have the same DNA sequence. Unique identification with DNA typing is therefore possible, in principle, provided that enough sites of variation are examined. However, the DNA typing systems used today examine only a few sites of variation and have only limited resolution for measuring the variability at each site[8]. To say that two patterns match, without providing any scientifically valid estimate of the frequency with which such matches might occur by chance, is meaningless.

DNA typing and fingerprinting is still evolving. Legal and scientific challenges to this particular use of human genetics are posed constantly. The debate over this technology revolves around diagnostic quality control and population mathematics used to arrive at odds of the speculative

---

[4] Christopher Wills, *Exons, Introns and Talking Genes, The Science Behind the Human Genome Project,* (Harper Collins, 1991), p.194-220

[5] "Science Panel Endorses DNA Typing", *Los Angeles Times*, 15 April 1992, sec.A17

[6] U.S. Department of Justice, Federal Bureau of Investigation. Proceedings of the international symposium on the forensic aspects of DNA analysis. Washinton D.C.: U.S. Government Printing office, 1991

[7] ibid.

[8] Thompson WC, Ford S, *The meaning of a match: sources of ambiguity in the interpretation of a DNA print in forensic DNA technology*, (Chelsea, Michigan: Lewis Publishing, 1991)

identical match. The Human Genome Project is currently defining the entire scope of the human genetic "fingerprint". The similarities between the development of the Human Genome Project and the United States' effort in the Manhattan Project are interesting. The Manhattan Projects at both Los Alamos and Trinity, unleashed the unfathomable power of atomic energy and forever changed the way we live. Robert Oppenheimer, America's leading atomic scientist at that time was struck by the power of evolving science and its unstoppability. In appearing before Congress in 1945, Oppenheimer testified on the role of science in the development of the atomic bomb:

> When you come right down to it, the reason that we did this job is because it was an organic necessity. If you are a scientist, you cannot stop such a thing. If you are a scientist, you believe that it is good to find what realities are: that it is good to turn over to mankind at large the greatest possible power to control the world.[9]

Oppenheimer's vision of scientific inquiry is a dynamic force within the Human Genome Project. The potential knowledge and applications possible from the mapping of the human genome are as far reaching as was Oppenheimer's work in the study of atomic energy.

Despite what are held to be attainable goals of complete human genome mapping, there are vocal dissenters in the efforts to procure further funding for the Human Genome Project. Bernard Davis, a professor of medical ethics at Harvard Medical School, opined that the Human Genome Project is rapidly becoming an end to itself. Davis feels that the Human Genome Project has eluded mainstream scientific review and that it needs to be brought back in under the umbrella of total biomedical research.[10] Davis's position is further extended by some ethicists and sociologists who believe that knowledge of the human genome

---

[9]Jonathan Harwood, " Genetics, Eugenics and Evolution," *Special Issue of The Bristish Journal for the History of Science*, 22 (1989), pp.257-258.

[10] Bernard D. Davis, *The Genetic Revolution: Scientific Prospects and Public Perceptions* , (John Hopkins Press, 1991)

will result in a renewed interest in eugenics and a rise in nationalistic racism.

To blunt this type of dissent, and push the project ahead for full funding, NIH called on James D. Watson to return and assume the role of project steward. Watson came in, took control, and organized the various facets into a confederacy of scientists working toward the complete sequencing of the genome.

Watson set the project on a fifteen year plan set to conclude somewhere near 2010. The plan called for a funding of three billion dollars to accomplish plan goals. Interestingly, three percent of overall project funding is dedicated to the study of ethics related to the uses of Human Genome Project information.[11] Watson's strategy in setting a fifteen year deadline was to sweeten the drudgery of systematic sequencing by identifying a reasonable time frame for completion of the project. According to Watson, project completion could occur significantly before or painfully later than the original established deadlines. Recently however, there is a hint that Watson's time line may be significantly reduced. Scientists at the Argonne National Laboratory near Chicago have designed a special-purpose biochemical "superchip" that can determine gene sequences 1000 times as fast as conventional means. If it performs as promised, the one inch square chip could shave years and hundreds of millions of dollars off the Human Genome Project.[12]

Christopher Wills, a professor of biology and a member of the Center for Molecular Genetics at the University of California, San Diego (UCSD) and author of ,"Exons, Introns and Talking Genes: the Science Behind the Human Genome Project"[13] was interviewed regarding his sense for direction of Human Genome Project research and discoveries. He stated that he is confident that the Human Genome Project will, in fact, meet Watson's stated goal of human genome mapping, more than likely within

---

[11] ibid.

[12]. Chronicles, *Time Magazine,* 3 Oct. 1994, 29.

[13]. Christopher Wills, *Exons, Introns and Talking Genes, The Science Behind the Human Genome Project,* (Harpers Press, 1991)

the set fifteen year time frame. According to Wills, early discoveries such as those identifying the genes for CF and Huntington's Disease will be replicated by the identification of myriad markers for other disease. The diseases and syndromes that could potentially be identified range from various forms of genetically referred cancers to the identification of genetic markers for psychiatric illness.

Wills cautioned that these discoveries can be deceptive and must be interpreted in context. Wills stated that genetic mutations of plain old "bad" genes are not hard and fast forecasts of the development of disease. Disease expression explained Wills, is a complicated function of genetics and environmental interplay. Undoubtedly though, genetic markers for disease in great fashion help pave the way for a pathological expression sometime in the individual's future.[14]

Several years ago, it was reported that researchers at John Hopkins University had identified a chromosomal location for a gene responsible for "Attention Deficit Disorder" (ADD). What was originally thought to be a "soft" psychologic dysfunction was now identified as having roots in a genetic mutation. In Will's estimation, the ADD discovery was "will-o-the-wisp" and later proven to be a flawed study. Though Wills believes that a genetic tie to ADD is possible, he thinks society and researchers are too driven to finding quick fixes for conditions that have plagued man since creation. Wills went on to predict that cancer will become a matter of great focus within the context of human genome mapping. With the capability of oncogene detection, the possibility will exist for humans to tailor lifestyles so as to avoid the development of certain cancers.[15]

In Wills' book "Exons, Introns and Talking Genes",[16] he forecasts that a new specialty within Medicine will emerge from Human Genome Project efforts-that of "predictive medicine". Predictive medicine will evolve as a result of the ability to read much of the human genome. Predictive medicine would involve genetic profiling and counseling for

---

14. Author's interview #1 of Christopher Wills Ph.D. by telephone, 3 May 1993.
15. ibid
16. ibid

those who carry bonafide genetic risk factors. A predictive medicine physician might do a blood work-up, for instance, on a patient that might disclose a proclivity for the development of a particular type of cancer. That patient would be counseled to avoid known carcinogens and /or occupations where carcinogens might be proliferate.

Ultimately, Wills believes that the Human Genome Project will allow people to take a much deeper look into the soul. Wills claims that genetic knowledge will give man mastery and understanding to how he feels, acts, fights and loves. From this understanding could come radical new understandings and beliefs regarding the etiology of crime and aberrant behavior. Wills thinks that knowledge gleaned from the Project may aid development of new and different programs in the field of crime prevention and delinquency reduction.[17]

In the October 1993 issue of Discover magazine, an article appears, entitled: A Violence in the Blood. [18] The article announced a Massachusetts General Hospital discovery of an X chromosome link to violence or, in other words, the identification of an "aggression gene." Though researchers want to avoid the use of the term "aggression gene," the discovery represents a chromosomal link to a certain type of maladaptive aggressive behavior. This particular disorder originates as an improper encoding for the production of the vital nervous system enzyme: Monoamine Oxidase A, known as MAOA. MAOA is responsible for the timely breakdown of certain neurochemicals that cause feelings of exhilaration and anger. Bad MAOA function can lead to a half a dozen various types of psychologic pathologies. It is theorized that MAOA and a mysterious co-enzyme are culprits in other developmental problems such as Attention-Deficit Disorder[19]. When interviewed about this most recent study, Wills declined comment, since he had yet to read the abstract. Wills did comment, however, that this case is an illustration of the increasing speed of discoveries and knowledge related to the genome that are in synergy due to the capabilities of modern computers.

---

17. ibid
18. Sarah Richardson, "Genetics Watch; A Violence in the Blood," *Discover*, October 1993, 30-33
19. ibid

Daniel Kevles chairs the Program on Science, Ethics and Public Policy at the California Institute of Technology. In addition to the "Code of Codes," Kevles has authored: In the Name of Eugenics: Genetics and the Uses of Human Heredity[20]. In an interview, Kevles was heartened that law enforcement was interested in the applications of knowledge gained from the Human Genome Project. Having engaged in a number of programs that ushered DNA into the lexicon of modern law enforcement, Kevles now sees profound lessons for government in the Project. Kevles is optimistic that the Project will uncover numerous genetic links to diseases and behaviors found in the human genome. What society chooses to do with this information is another issue altogether. Kevles sees the power of genetic knowledge accelerated by advancing information systems that will make genetic knowledge potentially available to millions via personal computers. Kevles can sees the need for scrupulous management and control of genetic information.[21]

In The Code of Codes[22], Kevles explores health insurance and employment discrimination as a result of the genetics revolution. Kevles discusses the phenomenon of "adverse selection" or deselection based on the possession of a less-than-desirable genetic profile. According to Kevles, genetic deselection will potentially effect employment, insurance and job opportunity. The extent to which a undesirable genetic profile effects these areas is unclear.

What does the Human Genome Project spell for law enforcement in the new millennium? The hunt for the alcoholism or addiction gene is moving ahead and is believed to be located somewhere on chromosome 17.[23] Research through the Project has come close to more precisely nailing down the location of this so-called marker believed to cause elevated levels of an enzyme that breaks down ethyl alcohol in humans.

---

[20] Daniel J. Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity*, (University of California Press, 1986)

[21] Author's interview of Daniel Kevles Ph.d. by telephone, 5 May, 1993

[22] Daniel J. Kevles & Leroy Hood, *The Code of Codes*, (Harvard University Press, 1992)

[23] National Research Council, *Mapping and Sequencing the Human Genome* (Washinton, D.C.: National Academy Press, 1988), p.45

What if this gene is finally, unequivocally identified? Presuming that this work at the Project continues, what happens when the Project can identify the markers of manic-depression and the syndromes that accompany it?

What about the existence of the so-called aggression gene? Suppose that the Project enables man to get a much clearer picture of the oncogene/anti-oncogene relationship and that a human's genetic profile is clearly revealed at birth, or for that matter, revealed *in utero*? Would it then be possible for humans to avoid certain occupations that increase carcinogenic exposure thereby enabling man to avoid the development of certain cancers? What about defects coding for high cholesterol and the formation of coronary artery disease? Imagine what could be done if this information were made known to a patient well before the onset of symptoms? Acknowledging the significant factor that environment plays in the development of physical and mental disease does not diminish the importance that pre-symptomatic genetic counseling will have on human conduct in the future. All of these potential developments bear on the law enforcement which is comprised of human beings. It is the business of law enforcement to investigate and prevent crime committed by human beings as well. The applications of genetic science therefore have as many potential uses within the law enforcement system as those that may exist outside of it.

The potential impacts for the law enforcement community are numerous. The research that is being done portends that genetic information evolving from the Human Genome Project will increase exponentially through the course of this decade and through Project termination very early in the next century. In the search and discovery of information related to the Human Genome Project, the question begged is:

What will be the impact of the Human Genome Project on law enforcement by the year 2004?

Pertinent sub-issues were developed using a "Futures Wheel" (Chart #1, p.13) process that placed the issue of concern at the center of the wheel. Primary, secondary and tertiary impacts that directly extend from the issue

were identified. Participating in the first phase of this exercise were 6 Command College student classmates of the author, Dan Watson, Joseph Latta, Steven Krull, Willie Pannell and Eric Lillo. From this point, potential sub-issues were then discussed with subject matter experts for technical review.[24] Christopher Wills Ph.D.; Daniel Kevles Ph.D.; Donald J.R. Mac Neil MD. FACS ;and Los Angeles Times Science Reporter Thomas Maugh comprised this group of subject matter experts who were consulted. The futures wheel is illustration is enclosed on page 13 for reference.

The Futures Wheel process helped define the focus of this issue in terms of three subissues:

1. What impact will the Human Genome Project have on the selection, assignment and promotion of the law enforcement officer of the future?

Assuming that scientific research will identify markers for serious physical and psychological illness, how will it impact processes for selecting, assigning and promoting law enforcement employees? For instance would a law enforcement agency assign as rangemaster an officer who has demonstrated a predisposition to the formation of a malignancy that would be triggered by exposure to a know carcinogen such as lead? (Assuming, of course, the continuing use of lead and gun powder at that time.) Would a law enforcement agency deselect personnel for assignment based on the presence of a putative "aggressor gene?" Will privacy laws allow for the public use of such private and personal information?

2. What impact will the Human Genome Project have on crime prevention and incarceration strategies for criminals by the year 2004?

---

[24] Author's interviews conducted with this panel by telephone during the week 17-21 and 24-28 May 1993.

Some of this anticipated genetic knowledge conjures up thought of selective incapacitation for certain criminals that are biologically destined for recidivism, those with "bad genes." While others with more promising genetic profiles are treated more liberally because they hold the potential for social rehabilitation; those who don't have "bad genes." As Wills points out, how will human kind react when given the technology to microscopically look at the nature of man?[25] The importance of culture, discipline and values may undergo a renaissance due to genetic proof of their complicity in the determination of how and when bad genes become active.

3. What impact will the Human Genome Project have on criminal investigations by the year 2004?

At present, law enforcement and the entire criminal justice system is still debating DNA and its role in the determination of personal identification. Based on what has been discovered so far, it is reasonable to believe that pertinent personal genetic information could be developed into profiles that would assist law enforcement officers in the investigation of crime. DNA data banks could be accessed in much the same way that law enforcement currently access motor vehicle files and automated "wants and warrants" systems. Genetic data bases could be searched for culprits whose genetic profiles match that of a person who might have committed a particular type of crime. In this future state, how does a criminal justice system train law enforcement personnel so that they can sensibly apply this information in specific criminal investigations?

---

[25] Author's interview #2 of Christopher Wills by telephone, 17 May 1993

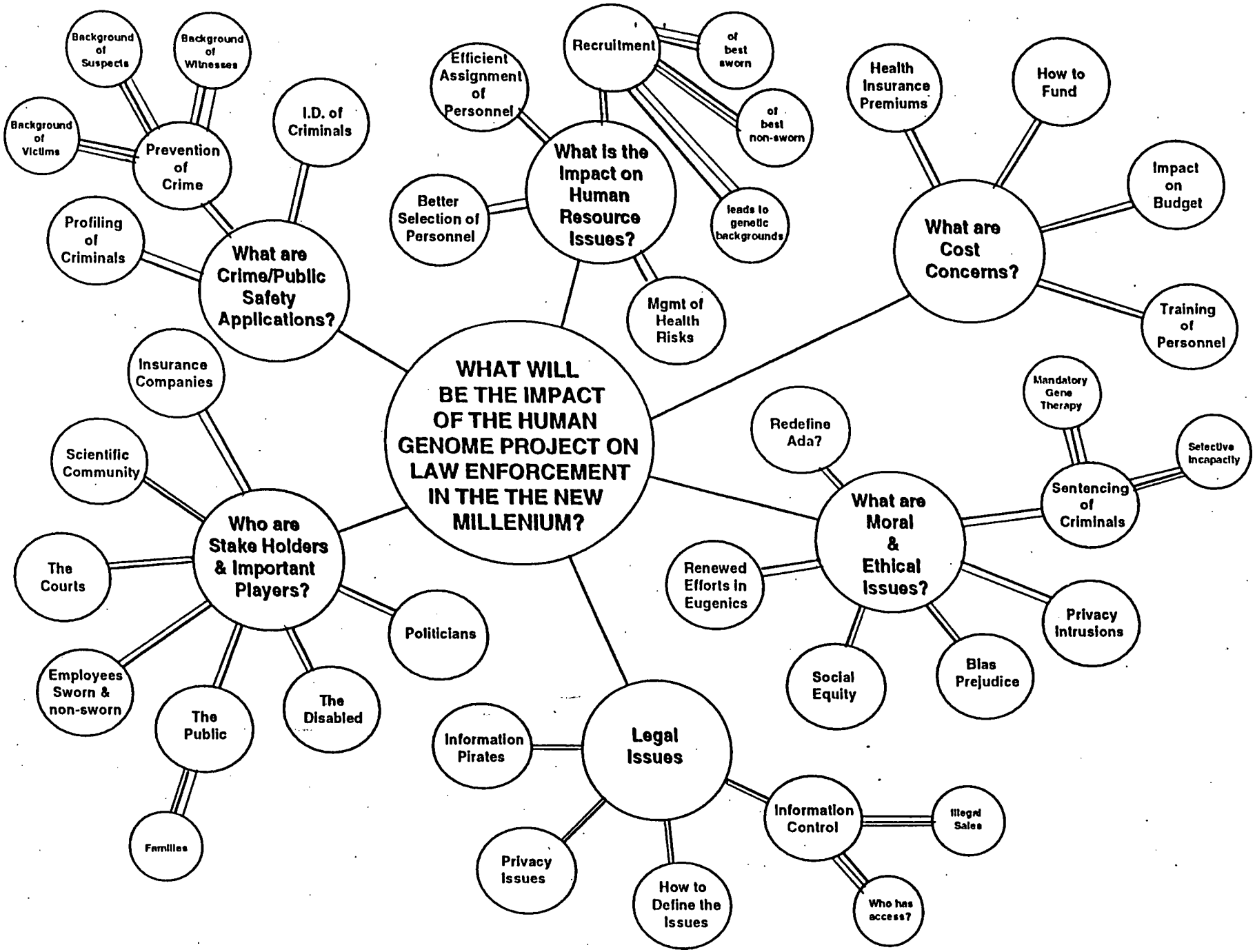


Illustration No. 1

13

FUTURES WHEEL **HUMAN GENOME PROJECT IMPACT ON LAW ENFORCEMENT** **LT. DON MAC NEIL**

Futures Research
Nominal Group Technique; Design and Research

A flow chart outlining the process that was followed in this research is included as Illustration #2 (Page 18). This illustration portrays the methodology used to examine the issue question.

Prior to the Nominal Group Technique (NGT), an expert scan was undertaken to help establish a scientific and scholarly basis for further futures research related to the issue question. This scan involved many of the researchers that aided the author in the formative stages of the study. This group was most helpful in identifying scientific and legal issues that were likely to emerge as the Human Genome Project proceeded toward conclusion. The scientists and physicians involved in this genius search were universally surprised and excited that law enforcement had initiated research into the potential ramifications of genome mapping. Each of these "professionals consultants" identified areas of possible impact relating to the issue question and the trio of sub-issues.

Those who participated in the professional scan are as follows:

Christopher Wills Ph.D.., a professor of molecular biology at University of California, San Diego. Wills is an expert in the uses of genetic information applied in criminal justice. Wills acted as the technical consultant for the San Diego County District Attorney in the mid-1980s when DNA fingerprinting first debuted. Wills has published a number of books related to the efforts of the Human Genome Project. Wills has also lectured to professional law enforcement organizations regarding the uses of human genetic knowledge in applied criminal justice.

Bernard Davis MD., a professor of medicine at Harvard Medical School. Though fighting an uphill battle against cancer, Davis took time to give the author a medical practitioner's perspective to the uses of human genome

information in the future. Davis offered a tempered opinion of what would become of the information obtained form human genome mapping. Nonetheless, Davis felt that law enforcement would benefit from early investigation into areas of potential impact.

Edwin Delattre Ph.D., a professor of ethics at Boston University. Delattre is a well known author who frequently writes on issues such as values, morals and the etiology of crime. Delattre's most recent publications have dealt with corruption and decay within the ranks of law enforcement.

Daniel Kevles Ph.D., a professor of the humanities at California Institute of Technology (Cal Tech). Kevles has published several revealing books dealing with the ethics and morality involved with the uses of human genetic information.

Marc Lappe Ph.D., a professor of health policy and ethics at the University of Illinois College of Medicine at Chicago. Lappe has published a book entitled " Justice and the Human Genome." The writing and investigation behind Lappe's book was funded by the DOE as a part of the Human Genome Project's devotion to ethics study. Lappe is optimistic that there will be widespread uses of human genetic information in society. Law enforcement and the criminal justice system are just one of many areas in society that will have to deal with information generated as a result of human genome research.[26]

Thomas Maugh, science writer for the Los Angeles Times. Maugh has written extensively on the various developments within the Human Genome Project. Many singular genetic discoveries made in early mapping efforts were reported by Maugh.

Donald Mac Neil MD.., FACS a general surgeon and past chief of surgery at Hollywood Presbyterian-Queen of Angels Medical Center in Los Angeles, California. Mac Neil has had an extensive practice in the field of cancer related surgery. Mac Neil is the father of the author and a technical

---

[26] Authors Interview #1 by telephone with Marc Lappe Ph.D., 9 September 1993

confidant at various points in the process. Mac Neil's observations as a clinical medical doctor gave the author a platform for understanding how genetic knowledge may find its way into the clinical strategies of practicing physicians.

Following the professional scan, the author began the design of the Nominal Group Technique (NGT) used in the futures study of this issue. The author's intention was to gather a group of non-academic professionals who had a particular expertise that bore on the issue and the defining sub-issues. The author attempted to recruit some of the scientists identified previously, but due to a variety of conflicts they were unable to participate directly in this process. Those participants that were selected for the panel, were all familiar with the Human Genome Project. Several participants had been closely following Human Genome Project efforts in newspaper and periodical articles.

NGT participants were all personally invited by the author and advised of the nature of the study. Each participant was described the NGT process and advised of the Modified Policy Delphi technique that followed. Participants were mailed introductory packages of materials that contained articles authored by members of the genius panel relating to the field of inquiry. Aiding the NGT process, was the fact that several NGT participants had undergraduate degrees in biologic or physical sciences. In those cases, the author sent them more advanced scientific materials in preparation for the NGT process.

The panel convened on November, 19 1993 at the Glendale Police Department (Calif.). Each panelist was supplied with a notepad and pens of differing colors to facilitate the deliberations and voting that would be forthcoming.

The NGT flow chart is contained on the following page. Illustration outlines the order in which events occurred during the process. The illustration begins with issue and sub-issue identification and concludes with "X-MPACT" analysis.

NOMINAL GROUP TECHNIQUE
PROCESS FLOW CHART

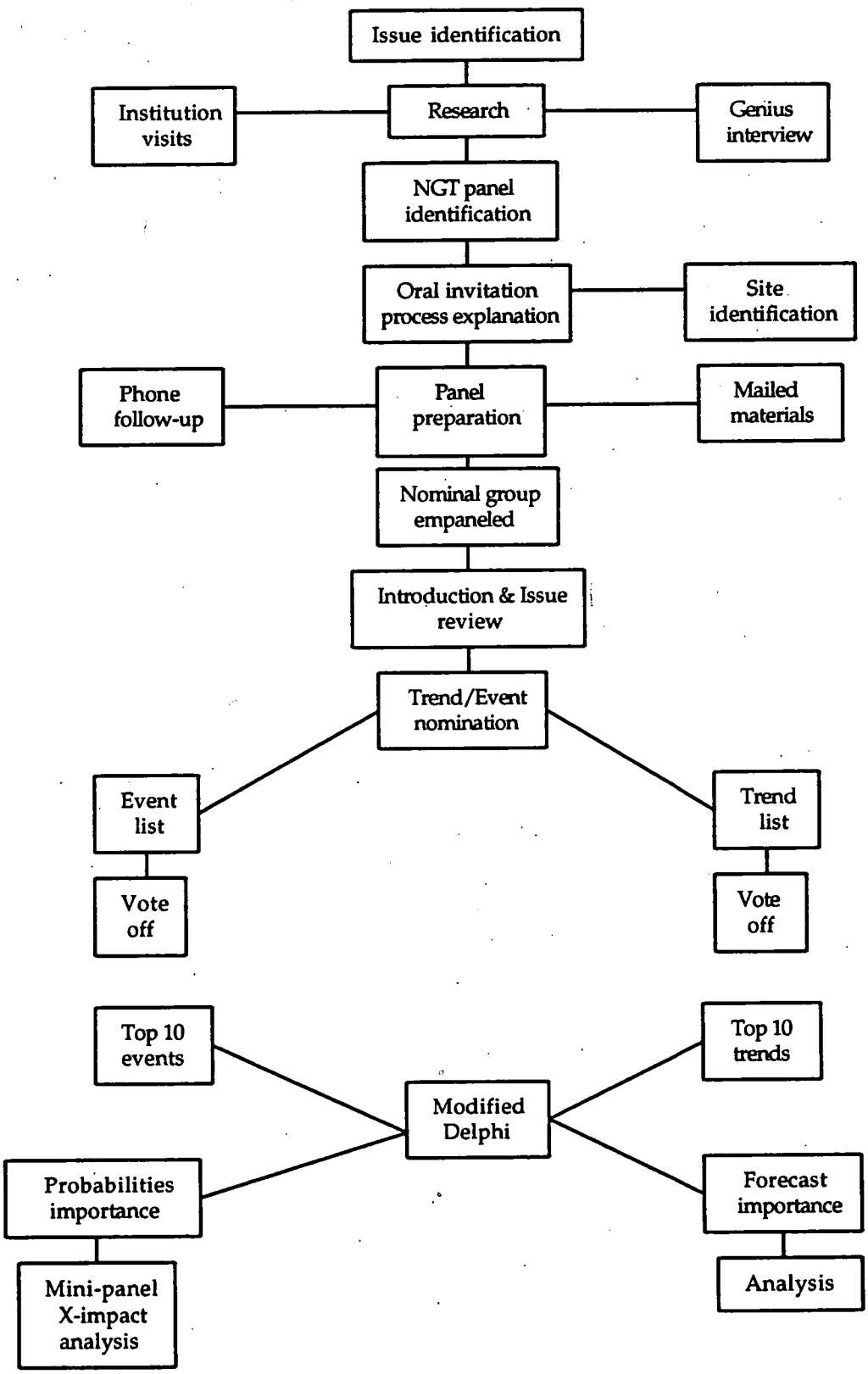


Illustration No. 2

The NGT panel consisted of the following individuals:

Captain Michael Post of the Glendale Police Department (Calif.). Post is the organization's executive in overall charge of several high technology programs. Post is a California Command College graduate who undertook the study of digital communication and other evolving communication technologies and their impact on law enforcement. Post has earned a masters degree from California Polytechnic University.

Captain Thomas Hoefel of the Burbank Police Department. Hoefel is a graduate of the California Command College and is the executive in charge of his department's patrol division. Hoefel has a earned a masters degree from Pepperdine University and is an admitted member of the California Bar.

Lieutenant Gary Schram of the Los Angeles County District Attorney's Office, Bureau of Investigation. Schram has worked closely with the use of DNA in criminal prosecutions. As of this writing, Schram is part of the investigating team assigned to the O.J. Simpson trial. In that trial, DNA fingerprinting has become the centerpiece of legal and scientific debate. Schram is an associate professor of criminal justice at California State University, Los Angeles.

J. Raymond Wells, retired supervising criminalist of the Los Angeles County Sheriff's Department. Wells has a undergraduate degree in chemistry and a masters degree in molecular biology. Wells has also conducted significant doctoral work in the area of pharmacology. Wells is currently working as a forensic consultant. Wells specializes in cases of blood type identification and the uses of DNA fingerprinting in criminal prosecutions.

Howard J. Shopenn Esq., criminal defense attorney in private practice in Southern California. Shopenn is a well known defense lawyer in the

defense of capital crime suspects. Shopenn has had numerous courtroom debates over the uses of DNA evidence against clients he represents. Shopenn earned an undergraduate degree in biology from University of California, Los Angeles before entering law school.

Juli C. Scott, a senior assistant city attorney for the city of Burbank. Scott's experience has focused on the defense of municipalities who have been sued for biased personnel practices. Before entering law school, Scott earned an undergraduate degree in history. Scott indicated a great personal interest in the eugenics efforts of the late 19th century and those undertaken by Nazi Germany in the second world war. This background in the study of history enriched the perspectives of the panelists.

Captain Ronald L. De Pompa of the Glendale Police Department (Calif.). De Pompa is the executive in charge of the Department's patrol services. De Pompa received a masters degree from the University of Southern California. De Pompa is a nationally recognized expert in the field of drug and alcohol abuse. De Pompa is a professor of criminal justice at Glendale Community College.

Edward Kamlan, a reporter for the Glendale News Press. Kamlan is routinely assigned to cover police and criminal justice stories by his newspaper. Kamlan was assigned to follow several notable trials where DNA evidence became the crux of the prosecution's case. The reporter has educated himself in this particular area of human genetics by thorough personal study.

The author was aided in the NGT by Command College classmate Joseph Latta. Latta is a lieutenant with the Burbank Police Department and a member of Command College Class Nineteen.

The NGT panel was gathered and introduced. The panelists were given an overview of the issue and sub-issues. The "futures wheel" that was developed earlier in the study, was projected onto a screen for a discussion and a short question and answer period. The author highlighted some

seminal discoveries of the Human Genome Project for the panelists. Additionally, the author synopsized the comments of the professional panel that had been interviewed prior. A glossary of genetic terms identical to that which is enclosed in this project as Appendix 1, was supplied to each panelist.

The group was then supplied the definitions of trends and events as they related to the exercise.

An event was described as "a one time, discreet occurrence," something where one can remember both before and after the event occurred. A trend was described as " a series of related events by which change is measured over time." The group was told that the objective of the session was to identify the top 10 trends and events out of the dozens that would be generated by the panel. The group was instructed to silently and individually generate potential trends and events that could occur in the 10 year future relating to the issue question and the three subissues. The panel was instructed to conceptualize the 10 year period as beginning in 1994. Since the panel was convening in late November 1993, the author thought it was reasonable to adjust the forecasting date by one month into 1994. This adjustment then allowed the ten year forecasting window to coincide with the probable completion of the Human Genome Project. The panelists were requested to write down their ideas as they emerged, the author and the secretary/recorder would ultimately distill the idea into a trend or event after discussion.

After a period of 15 minutes, the panelists were asked to cease their silent generation of ideas. In "round robin" fashion, statements were solicited and placed on flip charts. The flip charts were placed in full view of the panelists and identified separately as a trend or event chart. This process gleaned 47 nominated events and 34 nominated trends. After a short recess, the panelists were asked to preliminary vote for those items they thought were most important. This step was repeated twice more due to a lack of panel consensus. The final vote clearly identified 10 "top" trends and 10 top events. A complete listing of the 47 events and 34 trends is contained in

panel consensus. The final vote clearly identified 10 "top" trends and 10 top events. A complete listing of the 47 events and 34 trends is contained in Appendix 2 and 3. which begin on page 156 and extend through page 106. In addition, a glossary of genetic terms is located as Appendix No.1 on page 154.

The following sections deal with the identification of the specific trends and events that were nominated for futures study.

The top 10 trends generated by the Nominal Group were:

1. **The Level of California Crime.** This trend was defined as the crime rate as defined by FBI reporting standards. Of specific importance within the crime rate, was the level of violent crime. Violent crime is a significant component of the overall reporting procedure to the FBI. Violent crime was thought by the panel to be a driver for use or non-use of human genetic information.

2. **The Level of Police Recruitment Based on Genetic Screening.** This trend identified the level at which police agencies would use human genetic information as part of the recruiting and hiring process for sworn officers. Screening was not limited to or for any particular condition or affliction.

3. **The Level of Funding for Big Science Projects.** The panelists had the cancellation of the Super Collider Project on their minds when this trend was voted on. Would the Human Genome Project be susceptible to a similar demise? If so, the issue and sub-issue questions would be answered with a very simple, no. If project funding remains at current levels, or it increases, the impact on the issues and sub-issues is likely to be much more profound.

4. **The Level of Public Concern Over Privacy Issues.** This trend is defined as the overall societal concerns with government's encroachment into areas of privacy. Should the public concern be heightened over the issue period, there could be some delay in the uses of genetic information. This potential scenario would conceivably restrict the impact of the Project on the issue and sub-issues.

5. **The Level of Public and Private Access to Genetic Information.** The panel was interested in how much genetic information would be accessible by both government and private agencies. Would human genetic information be privileged and cloistered or would it be

readily accessible? Criminal justice uses of Project harvested information would obviously depend on a suitable degree of information access

6. **The Level of Religious and Special Interest Group in Radical Science.** The panel was specifically interested in how religious groups and civil rights groups might react to expanding discovery and uses of human genetic information. There was across the board consensus that heightened activism by these groups could cause a hysteria or paranoia that could blunt the extent to which the Project impacts the issue and sub-issues.

7. **The Ability to Detect an Aggressor Gene(s) in Law Enforcement Officers.** This trend was defined by the panel as the level of accuracy and sophistication with which such tests could be carried out on public safety officers. As the Human Genome Project marches on, it was expected that the ability to test for such a defect should increase. If that in fact is the case, it significantly impacts the issue and sub-issue number 1.

8. **The Quality of Genetic Forecasts.** This trend is of great consequence in the estimation of the panel. Quite obviously, if genetic forecasting is a poor, inexact outcome of the Human Genome Project, then the Project's impact on the issue and sub-issues is greatly diminished. Should forecasting become more exact, that outcome would be reversed.

9. **The Amount of Crime Controlled Through Genetic Based Therapies.** This trend was a technical reach in thought by the panel, but nonetheless, it was viewed a dramatic indicator as to effect the Project has on the issue question. Specifically, the panel was interested in the level of genetic remedies, or drugs developed based on a genetic discovery, that are used to control aberrant behavior and crime. This trend had special relevance to sub-issue number 2, the Impact of the Human Genome Project on crime prevention and crime control.

10. **Number of Supreme Court hearings on genetic related issues.** This trend effects the issue and the defining sub-issues significantly. It was offered by the panel's lawyers that increased numbers

of hearings by the Supreme Court could significantly hamper or considerably expand the use of human genetic information gleaned from the Human Genome Project.

These are the panel's top 10 events following Nominal Group Technique deliberations:

1. **Genetic Data Base for Sex Offenders is Developed.** This event represented the panel's belief that sex offenses are an important driver to the ultimate establishment of a data base system that makes use of a criminal's genetic profile. Considering the public's reaction to notorious sex offenses, the panel felt that sex offenses would trigger the first law enforcement genetically grounded data base.

2. **Supreme Court Overturns Genetic Fingerprinting on Privacy Grounds.** This event ran in the same vein as trend number 10 which focused on the level of Supreme Court hearings in this new field. The panel expressed its sentiment that the Supreme Court could topple the technology based on the sacred grounds of "privacy".

3. **TRW for Genetic Information is Developed.** The panel defined this event as the establishment of a nationwide data base accessible to business, medicine and government that contained personal genetic information.

4. **National DNA Tracking System is Developed.** Defined as a government operated system that maintained DNA blueprints that could be used for such things as populations studies and health care. This particular tracking system was not designed to serve as a basis for a criminal justice information system.

5. **Legislation is Passed to Restrict the Use of Genetic Information.** The panel defined this event broadly in the sense that it can be applied by either state and national legislatures. The event involves government, through its elected officials, moving against the expansion of

genetic information dissemination. This event was defined as having a broad scope inclusive of both governmental and non-governmental uses of genetic information.

6. **The FBI Sets Up the National Genetic Crime Information Center (NGCIC).** This event is defined as a criminal justice version of event number 4. This system would be solely accessible to criminal justice institutions for their use in the investigation and prevention of crime.

7. **NAACP Comes Out in Firm Opposition to Any Non-Medical Use of Genetic Information.** The panel defined this as a high profile stance taken by the NAACP against anything but the medical use of genetic information. The panel felt that this event would occur with great fervor and controversy surrounding it.

8. **Officer Involved in High Profile Excessive Force Case (i.e. Rodney King II) Tests Positive for Presence of Aggressor Gene.** The panel defined this event as another case of excessive force of the type of the Rodney King case. In this event, one of the subject officers tests positive for the putative "aggressor gene."

9. **Genetic Testing Required as a Pre-Employment Condition for All Public Safety Jobs.** This event as intended by the panel, is a follow-on to Event number 8 in that all public safety officers would be subjected to entry-level testing for genetic defects that would effect job performance. This event has significant bearing on project sub-issue number 1.

10. **Medical Smart Card Debuts and Contains All of an Individual's Personal Genetic Information.** The panel defined this event as the unveiling of a nationwide medical identification card that would contain all the pertinent genetic information that could be gleaned from a patient's genome. The card would also contain other pertinent medical records such as prior X-rays, electrocardiograms and treatment histories.

After final trend and event identification was completed, the panel was directed to complete two other voting and forecasting instruments. The first, which was directed towards events concerned probabilities and impact values if the event were to occur. Additionally, the year at which the probability first exceeded zero was estimated.

The next step involved the completion of a trend instrument. The trend instrument asked the panelists to estimate trend levels at three different points in time. The instrument asked for estimates at points, 5 years prior, 5 years hence and 10 years hence. The 1993 value (the year of NGT convention) was held constant. One additional value was obtained for each trend. Each panelist was asked to place a value on each trend based on how helpful it would be to have a forecast for the trend. These ballot sheets were collected and the panel was dismissed. Data collection and ordering was completed by the author and Command College classmate Joseph Latta.

The event and trend data obtained from the NGT and Modified Delphi processes follows in summarized table form. The tables reflect the panel median figures for each trend and event. Additional tables were developed to layout the individual votes of panelists and identify low, median and high values for the various data collection points. Those tables can be found in t Appendix 4.

Tables one and two pages 27 and 28, are charts that plot the relevant data of each trend and event. These illustrations are accompanied by author analysis and comment. In the NGT process, events were forecasted first, followed by the forecasting of trends. The subsequent illustrations and explanations are therefore offered in that order.

EVENT EVALUATION

Event #	EVENT STATEMENT	* Years Until Probability First Exceeds Zero	* PROBABILITY		IMPACT ON THE ISSUE AREA IF THE EVENT OCCURRED	
			Five Years From Now (0-100%)	Ten Years From Now (0-100%)	* Positive (0-10 Scale)	* Negative (0-10 Scale)
1	Genetic data base for sex offenders is developed.	4	22.5	50	10	1.5
2	Supreme Court overturns genetic finger-printing on privacy grounds.	4	30	50	2.5	8
3	TRW for genetics is developed.	7	0	37.5	7.5	6.5
4	National DNA tracking system is developed.	3	17.5	85	8	2.5
5	Legislation passed to restrict the use of genetic information.	2	50	65	5	5.5
6	FBI sets up National Genetic Crime Information Center (NGCIC).	4	12.5	62.5	10	2.5
7	NAACP comes out in firm opposition to any non-medical use of genetic information.	2	50	100	3	7.5
8	Officer involved in Rodney King II incident tests positive for presence of aggressor gene.	3	25	77.5	8	6.5
9	Genetic testing required as pre-employment condition for all public safety jobs.	5	10	40	5.5	4.5
10	Medical "smart" card used containing all of a person's individual genetic information	3	20	55	9	4

* Panel Medians

Table N. i

TREND EVALUATION

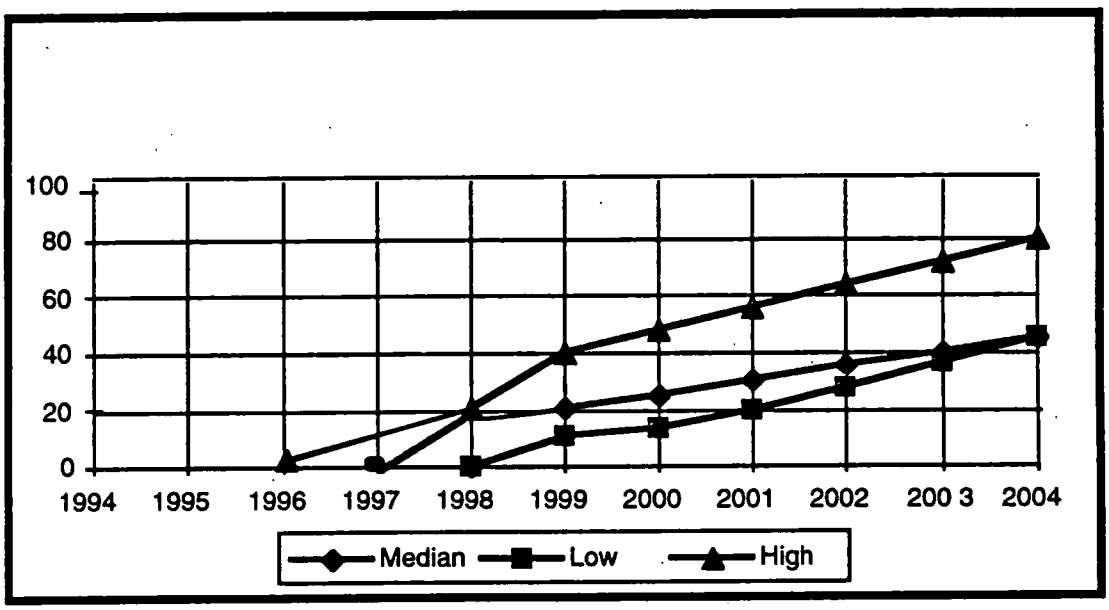
Trend #	TREND STATEMENT (Abbreviated)	LEVEL OF THE TREND (Today = 100)			
		5 Years Ago	Today	Five Years From Now	Ten years From Now
1	California Crime Rate	90	100	120	130
2	Level of police recruitment based on genetic screening	100	100	100	125
3	Funding Level for Big Science Projects	90	100	110	125
4	Level of Public Concern over privacy issues	100	100	100	130
5	Level of Public and Private access to Genetic Information	50	100	120	130
6	Religious and Special Interest group activity in radical science	80	100	120	150
7	Ability to detect the aggressor gene(s) in law enforcement ofrs.	95	100	105	150
8	The Quality of Genetic Forecasts	60	100	125	182.5
9	Amount of crime controlled through genetic based therapies	100	100	100	120
10	The Level of Supreme Court hearings on genetic related issues	100	100	112.5	145

Table No.2

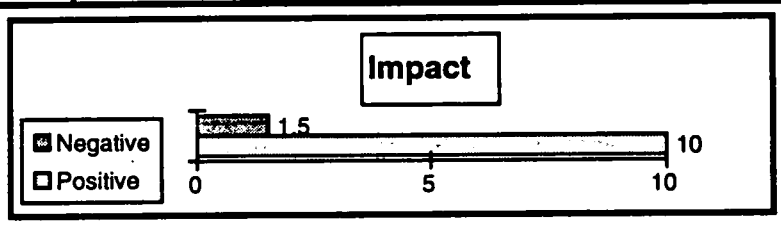
Events Identification and Analysis

Graph No.1

Event No.1
Genetic Data Base For Sex Offenders is Developed



	1st Exceeds 0	5 years	10 years
Low	5	10	45
Median	4	22.5	50
High	3	40	80



The panel nominated this event after some opening discussion regarding the necessity for better sex offender tracking systems. The Federal Bureau of Investigation (FBI) has already opened a DNA repository for DNA

fingerprintings. The library of DNA information is small at the present. Seven states have opened their own individual data banks for general DNA applications but their operations are still in fledgling conditions.[27] This proposed event specifies an individual data base for sex offenders containing the array of personal genome information.

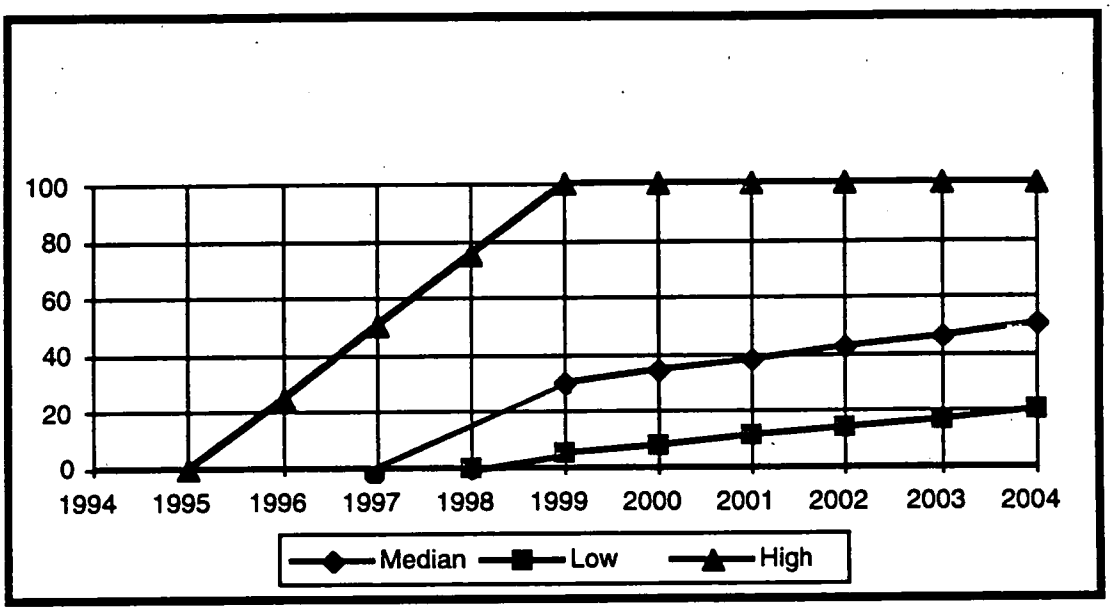
All three measurements suggest at least even odds that such a data base will be functional by the end of the issue period. Both the high and low forecasts for "first year exceeding zero" are within one year of the median. The theme of the probabilities seems to be that there will be little chance of this event becoming evident during the first 5-year period of the issue question. The second 5-year period represents a much greater probability.

The panel identified this event as has having a predominantly positive effect on the issue question. Should the event occur, the Human Genome Project (HGP) would have a momentous effect on law enforcement. This event would likely have a very high impact on the sub-issue question dealing with how the HGP will effect criminal investigations.

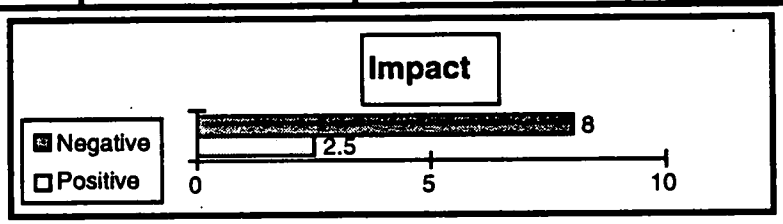
27 "DNA Technology in Forensic Science, National Research Council, 1991: p.124

Graph 2

Event No.2
Supreme Court Overturns Genetic Fingerprinting On Privacy Grounds



	1st Exceeds 0	5 years	10 years
Low	5	5	20
Median	4	30	50
High	1	100	100



This is an event that the lawyers of the panel anticipate with great certainty. Their forecasts are represented by the high probability figures. This event appears to be a bit of a wild card when looking at the recent history of DNA typing in the United States. A majority of the individual states and their high courts have allowed DNA typing into the courtroom. In some

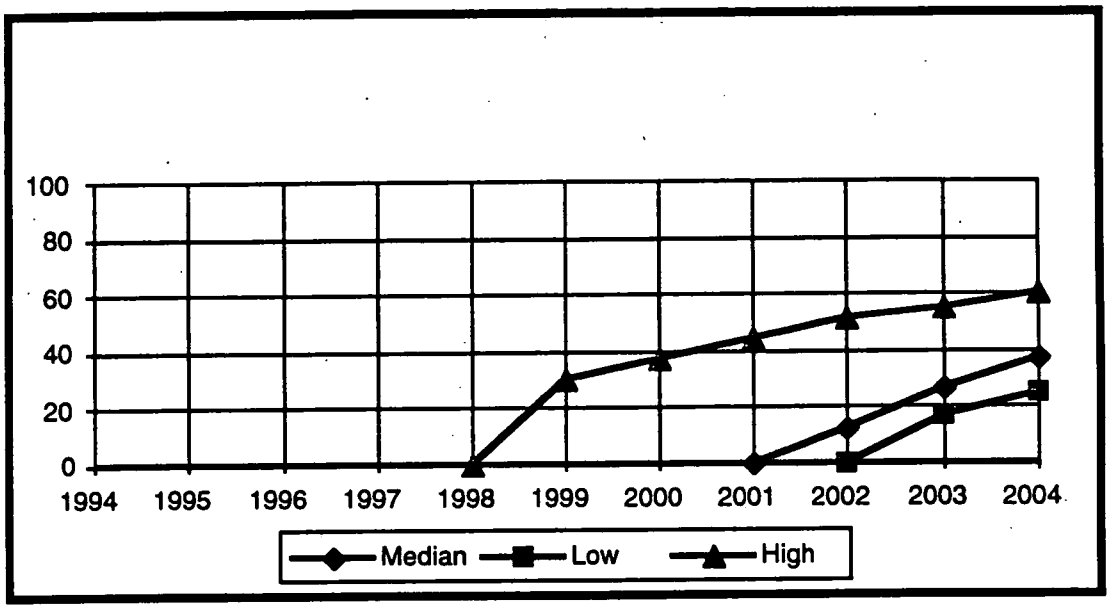
cases, these admissions have occurred with very little fanfare.[28] The panelists who fell about the median mark feel that at the 10-year mark there is a 50-50 chance the Supreme Court will move in some way against DNA fingerprinting. The gist of their thought is that the likelihood of such action increases in a linear relationship with the accuracy and controversy of HGP spun technology.

Were this event to occur, the panel voted the outcome to be rather detrimental to the issue question. The positive votes seemed to be driven by "Orwellian" fears of technology run amuck.

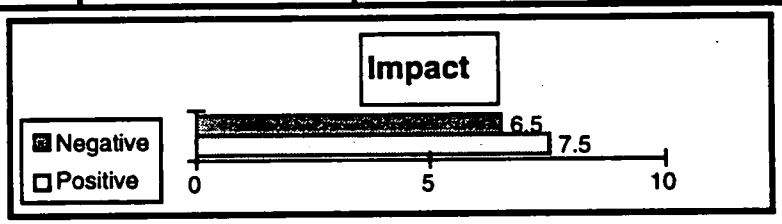
[28] ibid. p.134

Graph. No.3

Event No.3
Genetic TRW Developed



	1st Exceeds 0	5 years	10 years
Low	8	0	25
Median	7	0	37.5
High	5	30	60

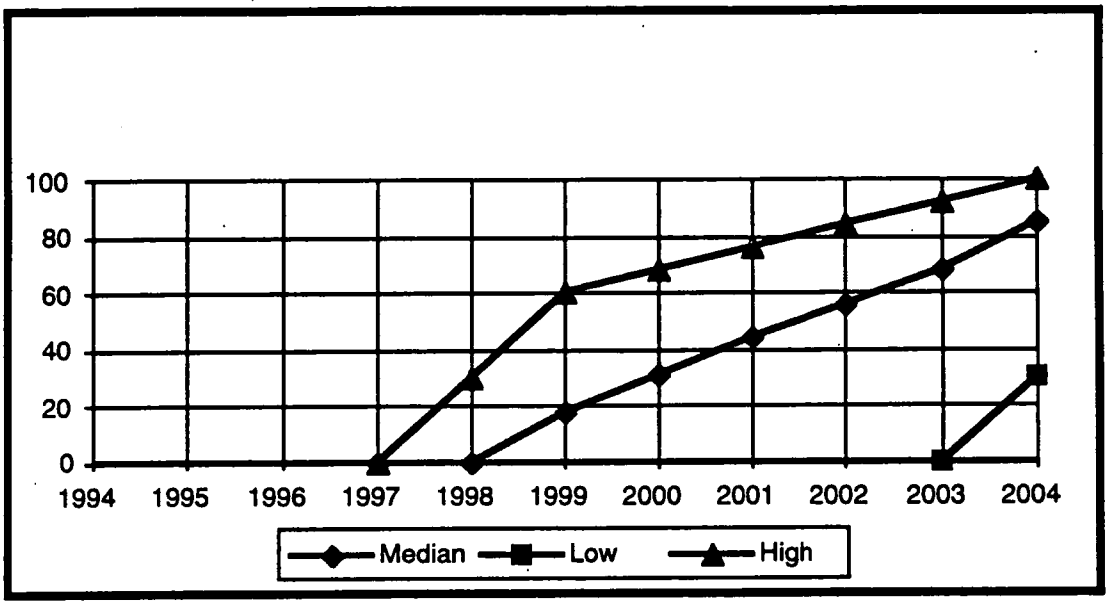


Ignoring the high value for a moment, this event seems to qualify as a wild card. This is an event with low probability and high impact. The high vote on this issue ranged a great deal from the other votes, most of which were cast in proximity to the median. The median probabilities were not very optimistic for this event. The "first year exceeds zero" mark was quite far out as well.

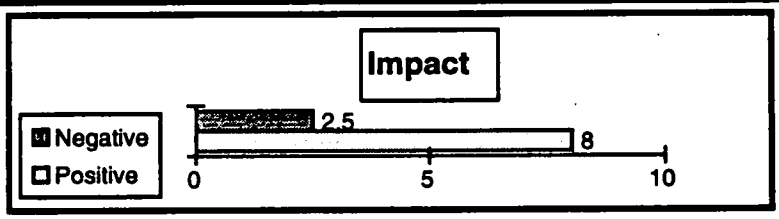
This event seemed to stretch the imaginational limits of all the panelists. One particular panelist has a unique background in digital technology and has done some research into the heralded "Information Superhighway." It was his belief that the "info highway" will be a catalyst for the development of a TRW for genetic information. This panelist persisted through all the process as the group's wild card thinker, pointing out that genetic engineering itself is a wild card event of the 20th century.

Graph No.4

Event No.4
National DNA Tracking System Is Developed



	1st Exceeds 0	5 years	10 years
Low	10	0	30
Median	4	17.5	85
High	3	60	100



The event is distinguishable from Event No.1 and Event No.3 in that it describes a federal government program that stores, follows and analyzes personal genome packages of individuals through a lifetime. This event had an Orwellian ring to it as well. As proposed, the National DNA Tracking system would also examine breeding tendencies and IQ outcomes

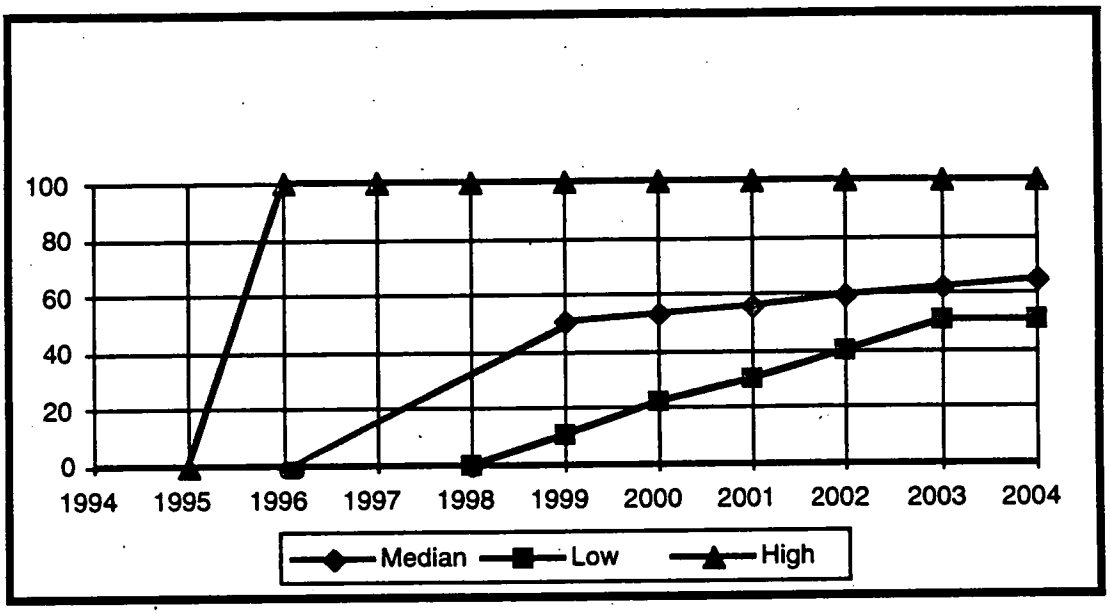
through this tracking system. This event has a moderate wild card factor to it.

The median and low probabilities are similar in the respect that they indicate little evidence of this event by the 5-year mark. At that point the median value moves more to the high probability for year 10. Both median and high values at year 10 infer a high degree of certainty for this event. Six of the eight panelists voted probabilities of 75% or more for this event at year ten. The high vote at year 10 (100%) was cast by the panel's bio-chemist.

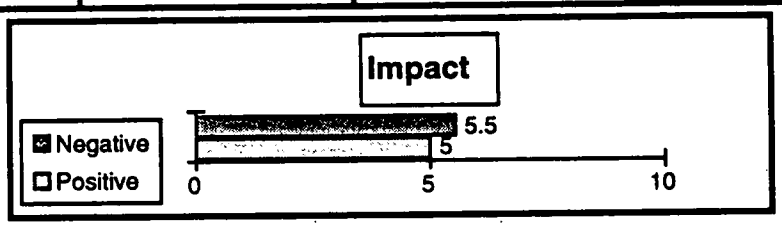
Despite the Huxley-Orwell spin to this event, it was voted as having strong positive consequences on the issue question. Four of the eight panelists assigned this event positive impact factors of 9 or above.

Graph No.5

Event No.5
Legislation Passed To Restrict The Use Of Genetic Information



	1st Exceeds 0	5 years	10 years
Low	5	10	50
Median	2	50	65
High	1	100	100



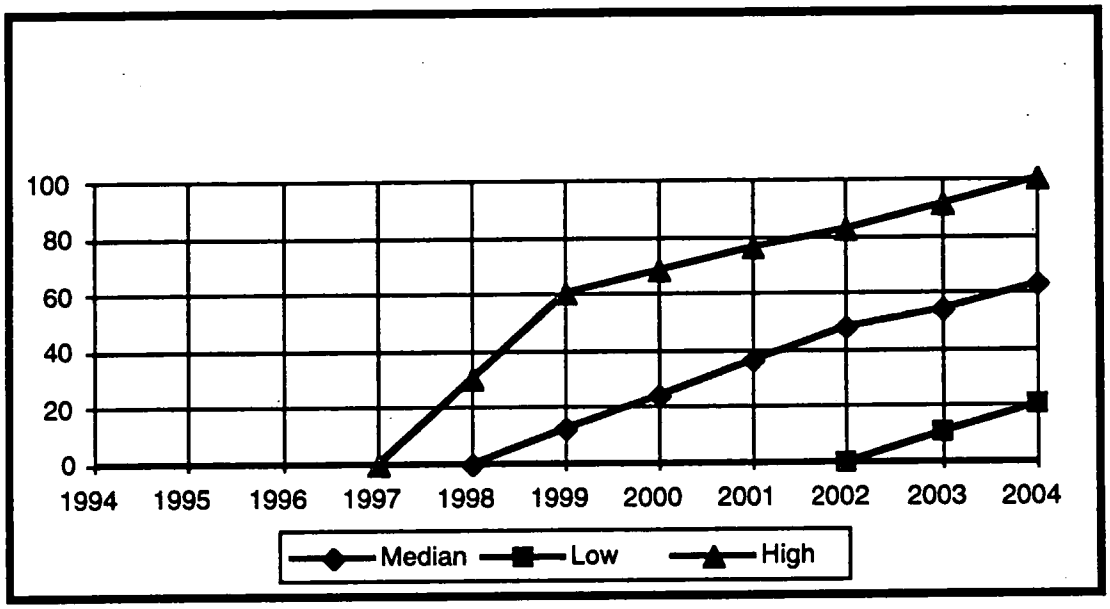
This event was identified by the panel as a more probable occurrence. At year ten, all three measurements were at 50% or greater. At the point of "first exceeds zero," the median and high values forecast an early evidence of probability.

Concurrent to this NGT panel was the recent public debate over embryonic cloning. During much of the coverage, politicians could be heard debating the wisdom of legislating in this area. This recent event undoubtedly had some influence on the panel.

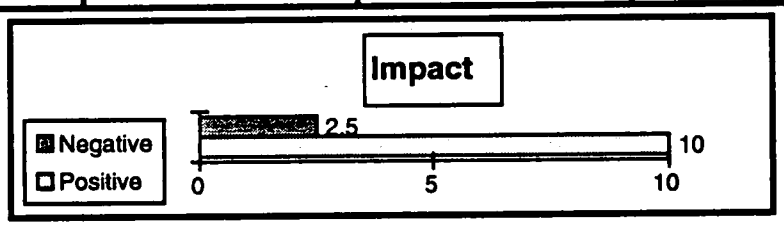
The panel cast dichotomous votes on the importance of this event to the issue. It was seen as having slightly more negative connotations than positive ones. The positive voting seemed to flow from a belief that legislation would bring control to the issue and prevent HGP research from being ruined through misuse.

Graph No.6

Event No.6
National Genetic Crime Information Center



	1st Exceeds 0	5 years	10 years
Low	8	0	20
Median	4	12.5	62.5
High	3	60	100



The panel proposed this event as a future emulation of today's National Crime Information Center system managed by the FBI. The event was originally nominated by the panel's "wild card" member, but after a few moments to absorb the idea, the event was enthusiastically commented on by all panelists. It was pointed out that the FBI and some smaller state information systems have already begun to operate DNA laboratories.

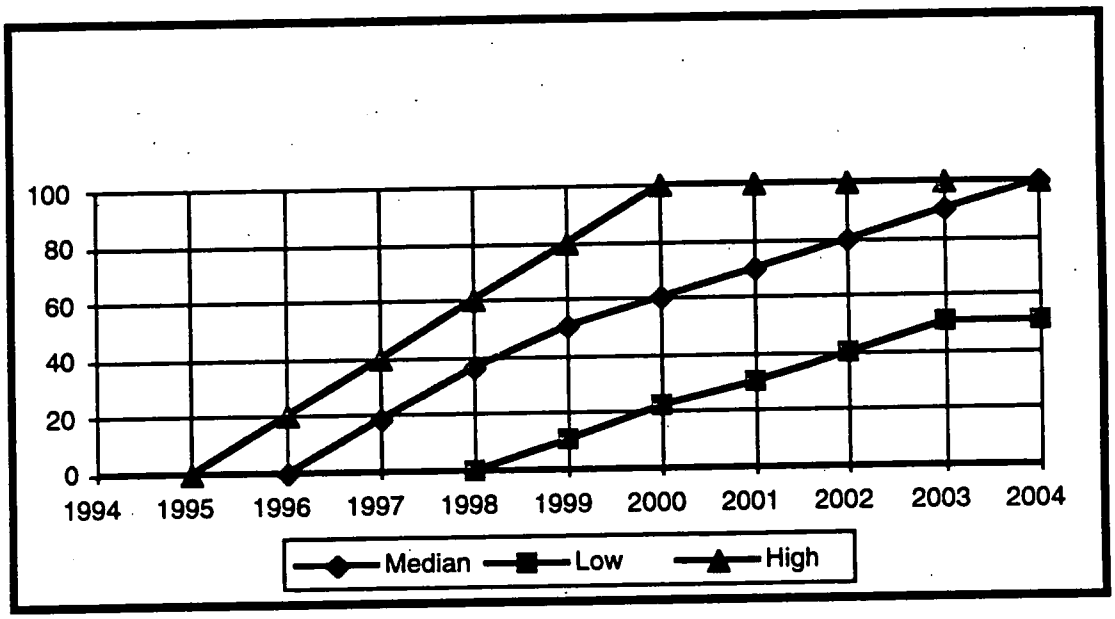
With the burgeoning variety of genetic information that will flow from the genome project, it is anticipated that some centralized information system will be necessary to manage the myriad pieces of genetic information applicable to criminal investigations. All agreed that this event had a "Future Shock" quality to it.

Group consensus was most noticeable in the positive value ascribed to this event should it occur. The negative aspects of the event were seemingly insignificant. Using the historical value of the NCIC system to law enforcement as a point of comparison, the panel overwhelming felt this event would be of great benefit.

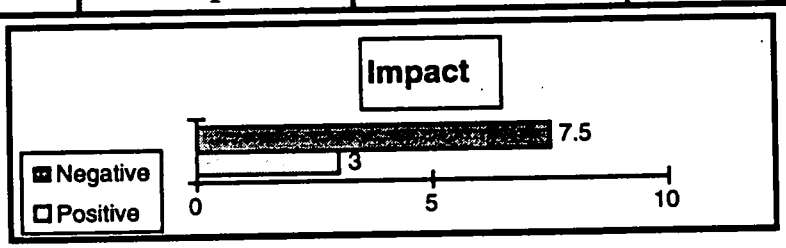
As to the probabilities, the panel demonstrated a wide spread in values at both the 10-year and 5-year forecasts. The theme of the voting seems to be that this event is a late bloomer. The low forecast was cast by the panel's journalist member. The high vote was cast by the panel's criminal defense lawyer. Though the median value for "first exceeds zero" is at year 4, it essentially only has a 1 in 10 probability at year 5. The probability snaps up though at year 10 to 62.5%.

Graph No.7

Event No.7
NAACP Opposes Non-Medical Uses Of Genetic Information



	1st Exceeds 0	5 years	10 years
Low	4	15	50
Median	2	50	100
High	1	80	100



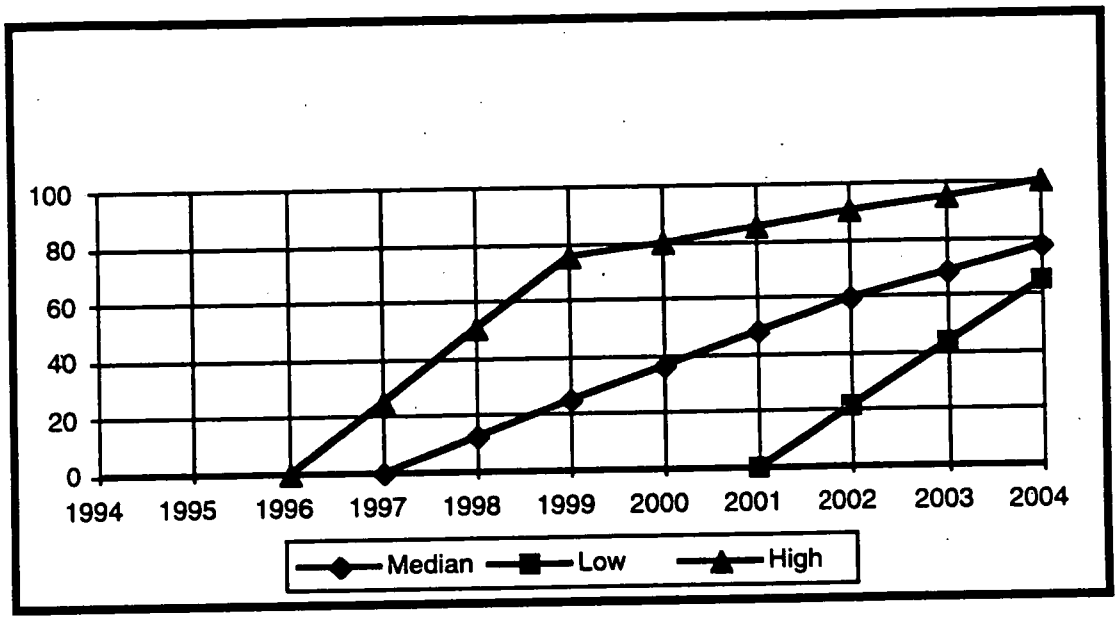
This event reflects some of the sentiment expressed in the sidebar discussions that accompanied the nomination of Trend No.6, Religious and Special Interest Activism in Radical Science. Cited in the analysis of Trend No. 6 is an incident that depicts an example of how this event may be

staged. Since the NAACP has already announced their interest in this field of study, it was of no surprise to find that the voting fixed high probabilities across the board. At year ten, there seems to be a strong sense of certainty regarding the occurrence of this issue. Year 5 median value affixes a 50/50 chance to this event. The event also demonstrates an early entry at "first exceeds zero" indicating that present debate and discoveries may be enough to prompt the event.

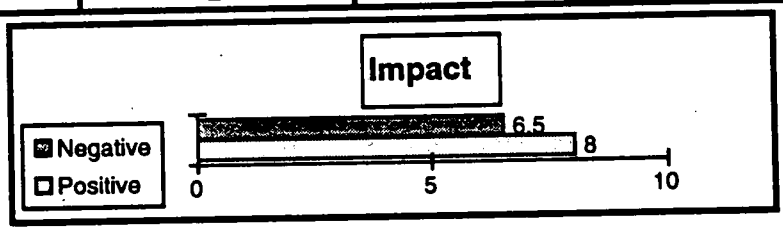
Almost unequivocally stated is the panel's belief that this event would have moderately negative consequences for the issue.

Graph No.8

Event No.8
High Profile Case: Officer Tests Positive for "Aggressor Gene"



	1st Exceeds 0	5 years	10 years
Low	7	0	50
Median	3	25	77.5
High	2	75	100



This event is somewhat complex due to the compound manner in which it was proposed and ultimately refined. The event calls for another "Rodney King " type incident to occur. Within that event, one of the involved officers is found to possess the so called "aggressor" gene. The upheaval caused by a second "Rodney King" type assault is the catalyst for making

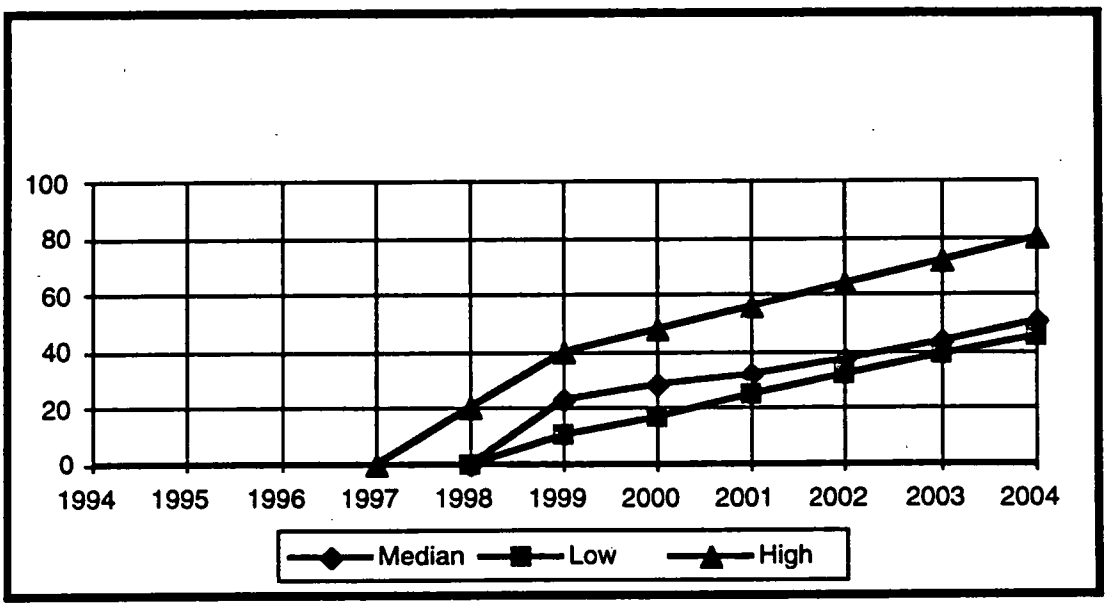
this "aggressor" gene incident more than a generic "Rodney King II" civil rights abuse case.

All but one panelist thought that this event had some chance of occurrence by year five. The minimal probability at year 10 was set at 50% by two panelists, the remaining panelists hovered about the median of 77.5%. Disregarding the one errant high vote at year 5, it appears this event is more a late bloomer, but one with significant certainty in the opinion of the panel.

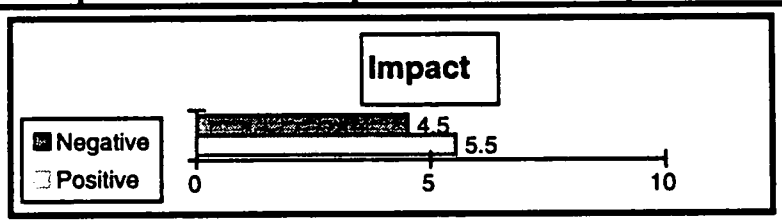
Impact was determined to be fairly equal. It was felt that the event has negative consequences for law enforcement in some rather obvious ways. Positive value will develop as a result of the public outcry. In reaction to this event, law enforcement would have impetus to broaden the scope of law enforcement officer pre-screening for aggression related defects. The event would be a catalyst for the issue.

Graph No.9

Event No.9
Pre-Employment Genetic Screening For Public Safety Officers



	1st Exceeds 0	5 years	10 years
Low	8	0	30
Median	5	10	40
High	4	50	100



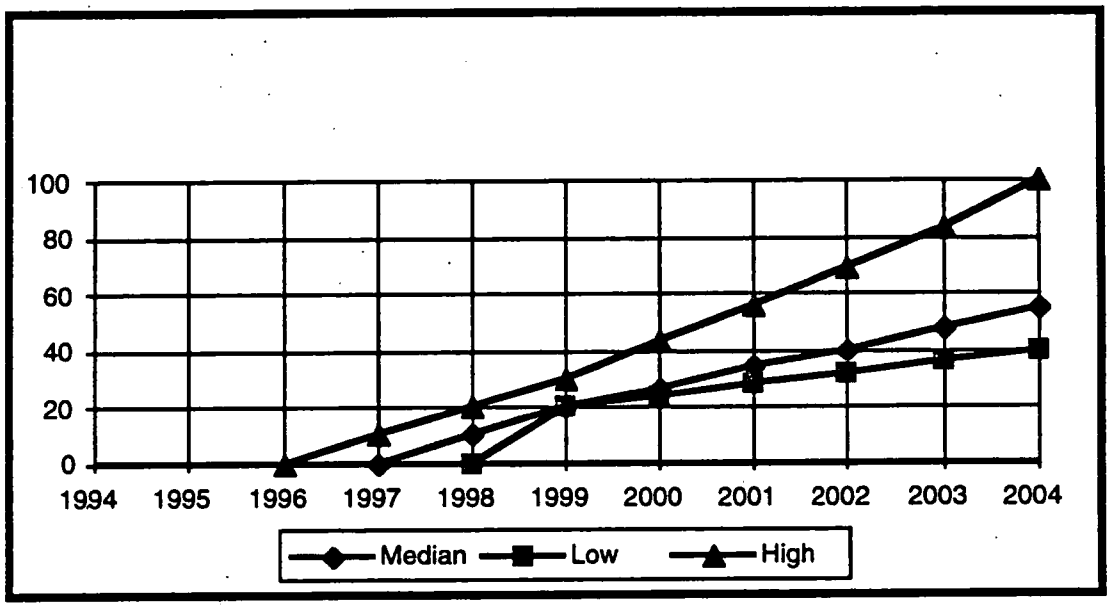
This event has some properties of the incident described in Event No.8 (Aggressor Gene). There is some cross-impact force acting on this event if event No.8 were to occur. Theoretically this event would preempt Event No.8 were it to occur before Event No.8. Panel comment identified this event has having cross-impact bearing on socially painted events like Event No.7 (NAACP Opposed). This event would likely spur Event No.7 in to

evidence in acceleration of forecasted values. The panel's voting however suggests that this event is latent until late in the issue question. It seems reasonable to believe that the probability of this event accelerates in the case of Event No.8. In any case, the panel's voting put this event almost into the "wild card" column. Median values for this event are very modest. The low values give it little chance of occurrence. Genetic pre-employment tests were felt by the panel to be "a ways out there."

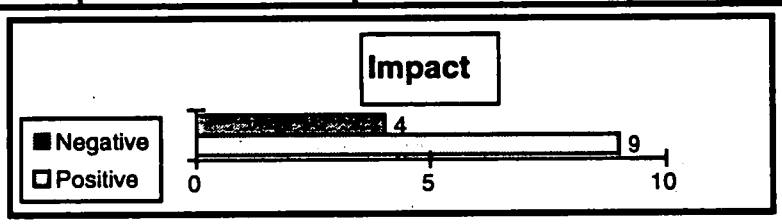
Impact values were nearly equal and represented modest values.

Graph No.10

Event No.10
Medical "Smart Card Used" For All Personal Genetic Data



	1st Exceeds 0	5 years	10 years
Low	5	20	40
Median	3	20	55
High	2	30	100



This event is another nomination by the panel that pushes the envelope. The panel anticipates that the medical smart card will ultimately hit the market despite its earlier dismissal by the health care industry. In addition to carrying x-rays, blood work and patient history, the card will house each patient's genetic and hereditary transcription. Again, it is safe to remark that this event has some cross-impact value on earlier events. The

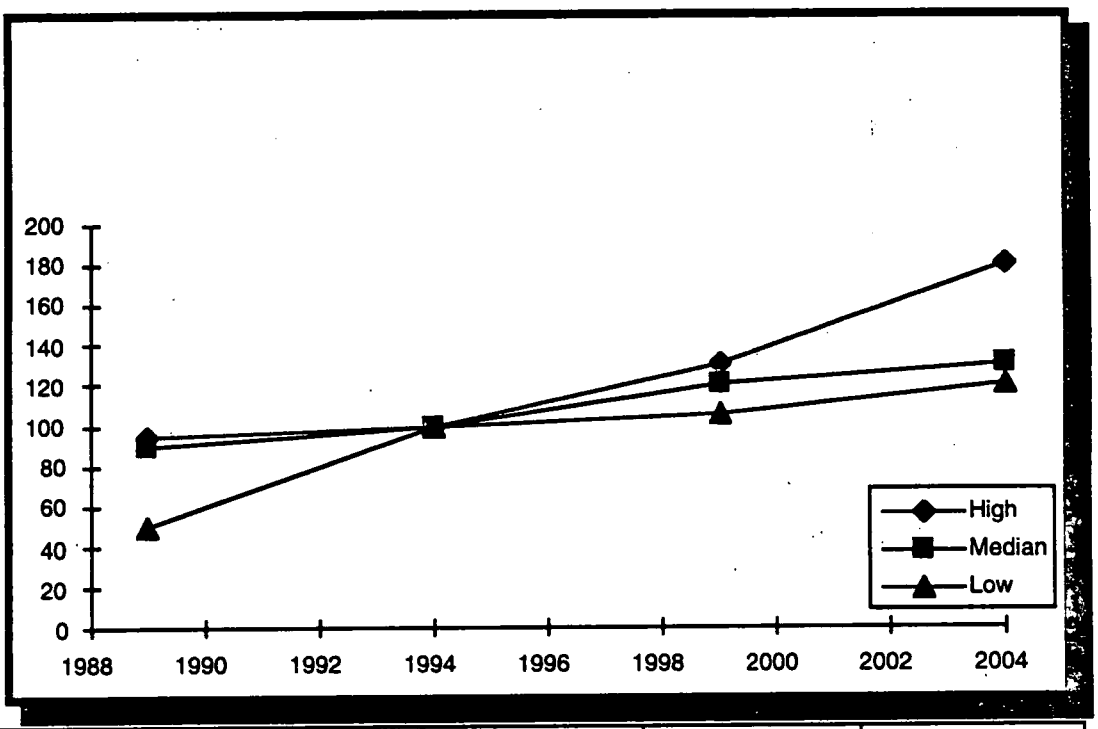
topic caused the journalist member of the panel to raise the eugenics issue once again. If that were a standard reaction of the public, then Event No.7: NAACP Activism etc., would certainly be accelerated. This event also abets Event No.1: Sex Offender Data Base etc., Event No.3: Genetic TRW etc., Event No.4: National DNA Tracking etc., and Event No.6 FBI-NCGIC etc.

The panel voted the event to "first exceed zero" rather early as seen in the median value of 3 years. However, 5-year probability is minimal and nudges up to slightly better than 50/50 by year 10. Though not a wild card incident, the event is still a distance out.

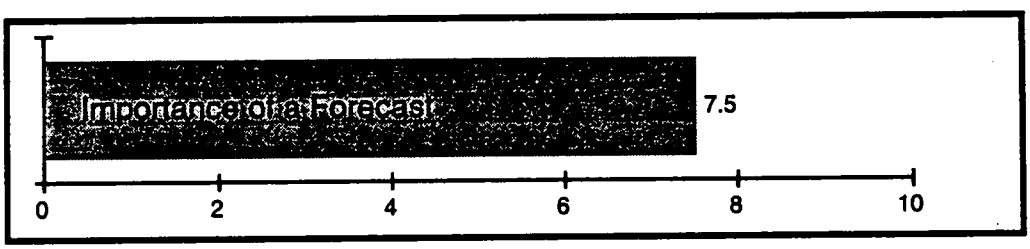
The impact of the event is mainly interpreted as very positive. The fact that the bulk of one's genetic information is all in one place and that it is relatively easy to review, bodes well for the issue question in the mind of the panel. The negative vote seemed to flow from the "Big Brother" nature of such an event. In such a case, it might have a chilling influence on movement in the issue question.

g Graph No.11

Trend No.1
California Crime Rate



	1989	Today	1999	2004
High	**95**	**100**	**130**	**180**
Median	**90**	**100**	**120**	**130**
Low	**50**	**100**	**105**	**120**



The panel identified the California crime rate, as expressed by the California index, as a trend important to the issue question. Discussion and voting indicated consensus in the sense that the crime rate had been lower 5 years ago and that California was experiencing a moderate increase

in crime as expressed in the index. This summation is quite accurate, since 1987 the California index has risen 16 percent. More telling, over that same period, violent crime rose 113 percent. [29] In examining national crime rates for the same period, the crime rate for violent acts increased 10 percent.[30] The panel suggested that the overall crime rate will increase at a moderate rate out to the tenth year of the issue question. The voting spread table above illustrates a tight consensus between low and median figures. The high estimation for the tenth year may be considered spurious. That vote was cast by one panelist who consistently exhibited wide ranges from panel median values.

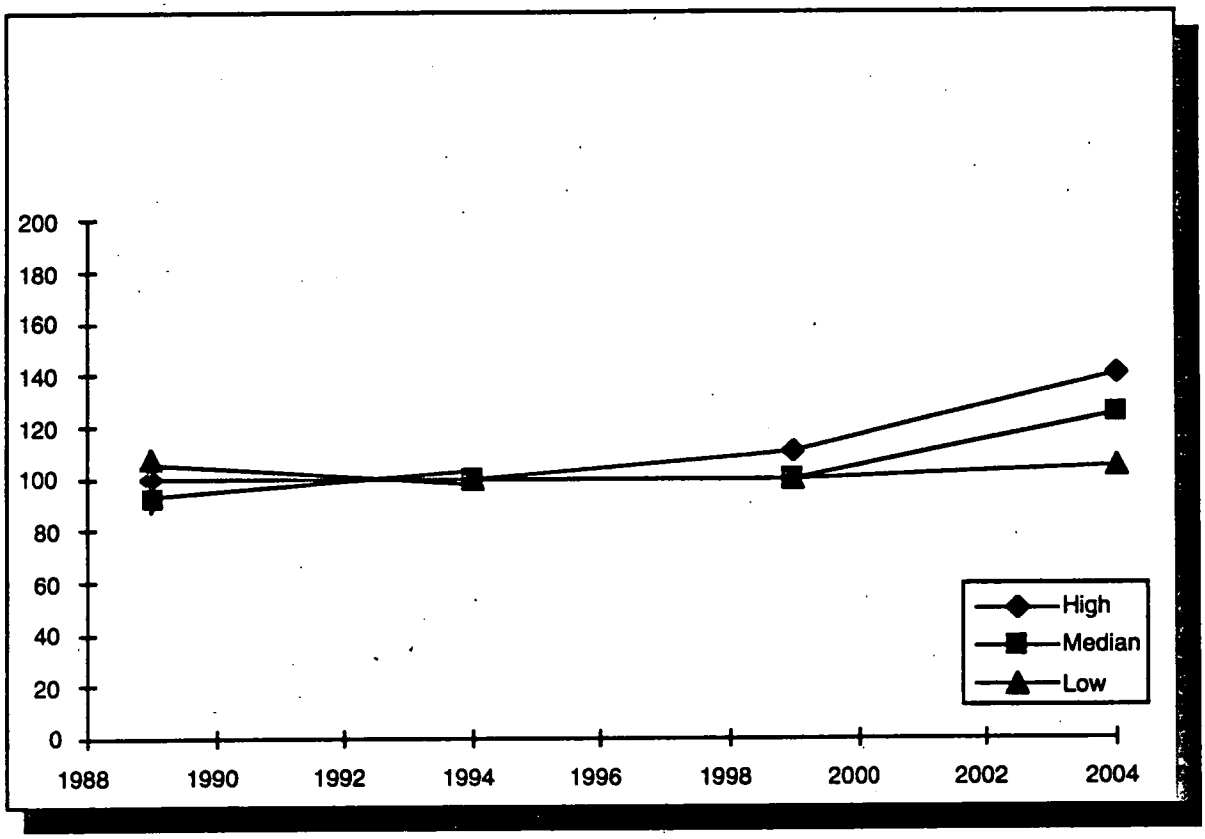
The importance of this trend to the issue is significant. Crime, especially violent crime, can drive progress in the area of genetic applications within criminal justice. The corollary is that increasing levels of crime will mute public resistance to anti-crime uses of genetic information. Reducing crime rates, will cause the public to react more hesitantly and skeptically to HGP applications in the arena of crime control.

---

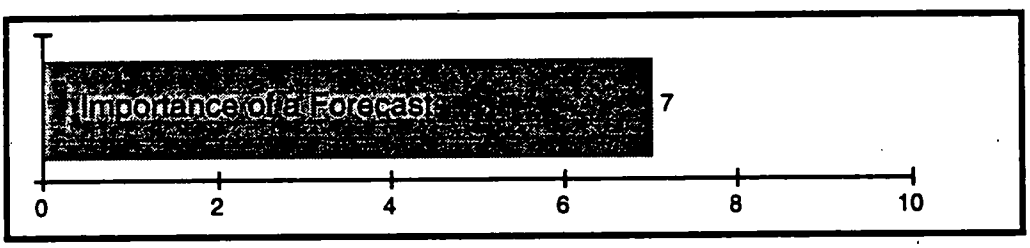
[29] Los Angeles County, California Criminal Justice Profile, 1991, p. 5
[30] Crime in the United States 1991, August-1992, p.58

Graph No.12

Trend No.2
Recruitment Based on Genetic Screening



	1989	Today	1999	2004
High	**100**	**100**	**110**	**140**
Median	**100**	**100**	**100**	**125**
Low	**100**	**100**	**100**	**105**



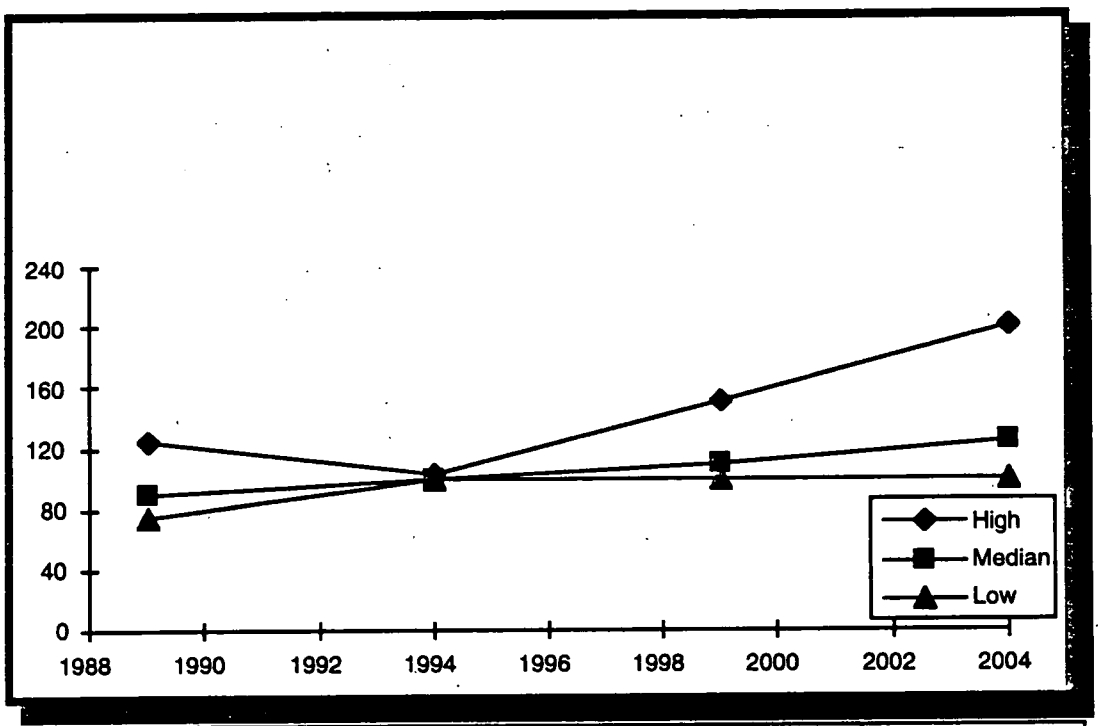
The panel felt that this trend would be of great significance to the overall issue. The panel was aware that genetic screening does take place in various industries within this country. For instance, the insurance industry has been utilizing a genetic based cancer screening technology for the past several years[31] However, it was felt that there are no employers who hire an individual based on a genetic-DNA profile. There was agreement across the board that this trend would show little or no upward movement within the first 5-year period. Moving out to the 10 year mark, it was ventured that the level of genetic screening would be such that some employers will be recruiting individuals based on their genetic profile. The gist of the group's findings is that recruitment based on genetic profiles will move slowly upward in the early phases of the period and ultimately gain some upward momentum toward the end of the period.

---

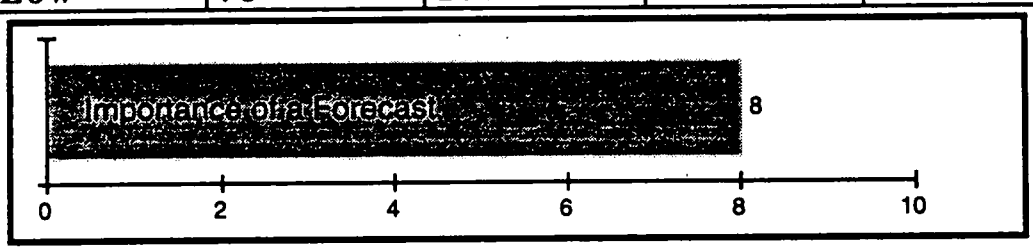
31 "Transamerica-Occidental Life Screening for Cancer", *Los Angeles Times*, 15 Oct. 1992, sec. D2

Graph No.13

Trend No.3
Funding Level For Big Science Projects



	1989	Today	1999	2004
High	125	100	150	200
Median	90	100	110	125
Low	75	100	100	100



The panel identified the Human Genome Project (HGP)as a "Big Science" project. As such, the HGP is sensitive to the wavering levels of governmental funding. The recent termination of the Super Collider project by Congress was remembered by all the participants. Current data

on "Big Science" funding suggests that the trend is steadily headed upward. "Big Science" spending is up almost 15 percent from 1989 to 1993.[32] HGP budget under DOE and NIH has steadily increased over that period by some 14 percent[33] HGP researchers all agree that this funding level is barely sufficient, but it at least seems to be capable of sustaining appropraite study. The high forecast avers that "Big Science" projects will rocket ahead in funding through the period, in contradiction of the recent super collider affair. The median forecasts suggests a moderate increase in funding that is much more in keeping with the historical data that is available. Without much debate, the panel agreed that funding levels for "Big Science" are crucial to the HGP and the ultimate answer to the issue question.

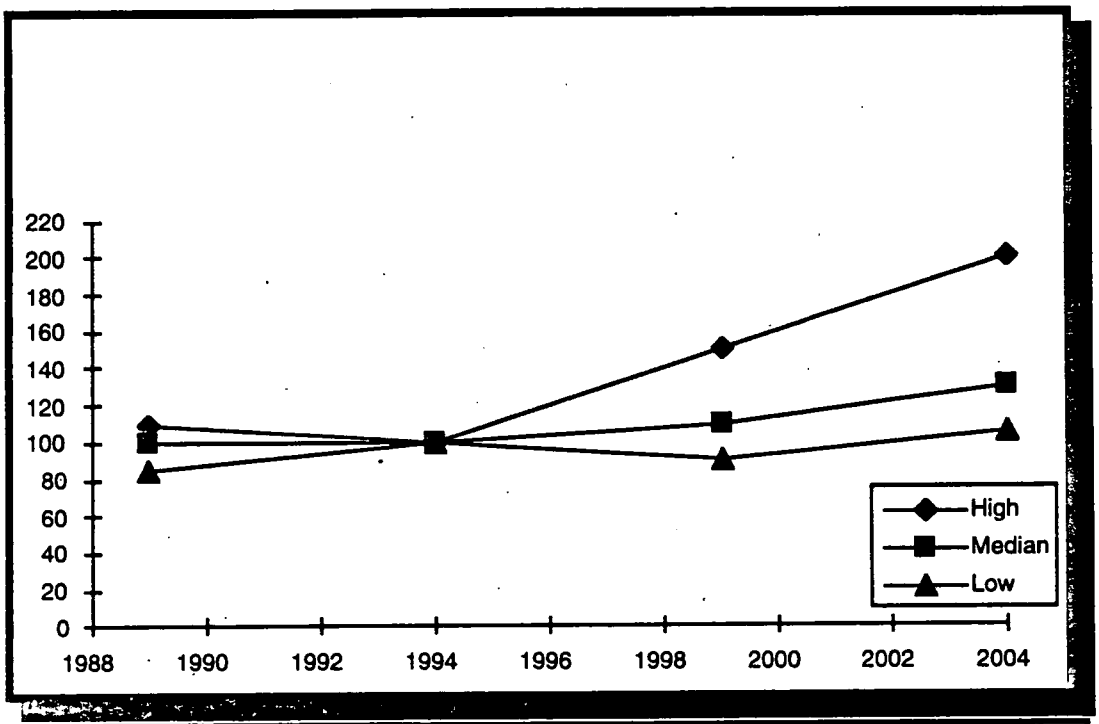
---

[32] *USA Today*, 2 Feb. 1993, sec. A, source: Batelle Memorial Institute

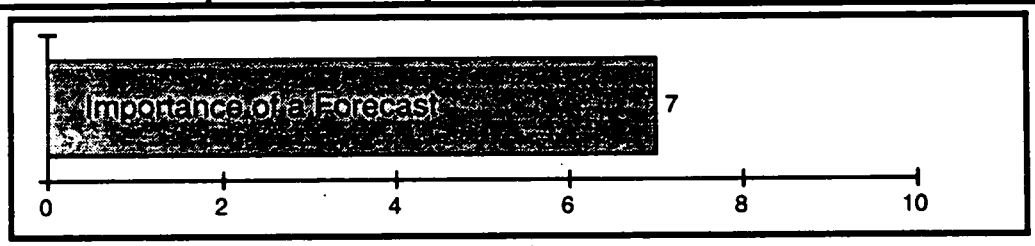
[33] "National Institute of Health Genome Budget", *Science*, Volume 262, October 1993, p.21

Graph No.14

Trend No.4
Public Concern Over Privacy Isssues



	1989	Today	1999	2004
High	110	100	150	200
Median	100	100	100	130
Low	85	100	90	105

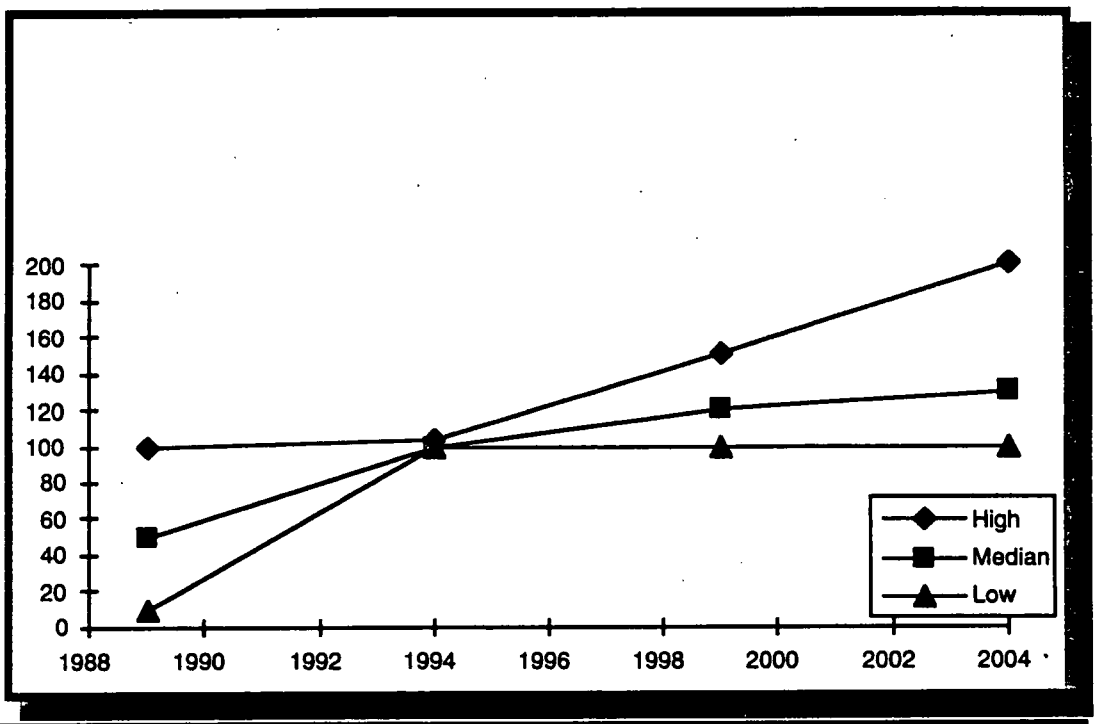


The panel identified this trend as an emerging force that will weigh heavily on the issue question. The panel felt that this issue is potent enough to blunt many uses of HGP information in the future should public concern be raised. The recent outcry against the process of human embryonic cloning suggests that concern over privacy, especially in the area of heredity and

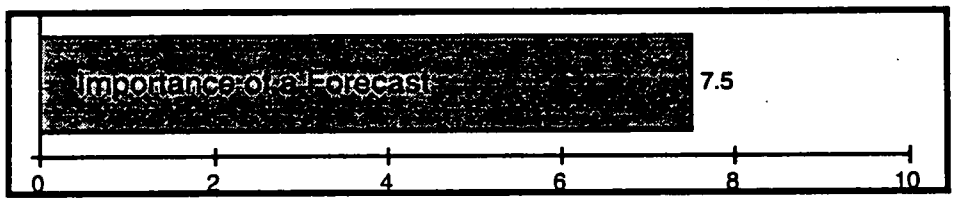
the uses of genetic information, will be high. Save for the high forecast, the sentiment of the panel was that the issue would remain in a fairly dormant trend line until the later phases of the issue period. At that time, it is anticipated that more pertinent discoveries will occur and as a result the public's concern over privacy issues will increase. This trend seems to closely parallel Trend No.6, Religious and Special Interest Group Activism. This trend and Trend No.6 can be viewed as dimensions of one another.

Graph No.15

Trend No.5
Level Of Public & Private Access to Genetic Information



	1989	Today	1999	2004
High	110	100	150	200
Median	50	100	120	130
Low	10	100	100	100



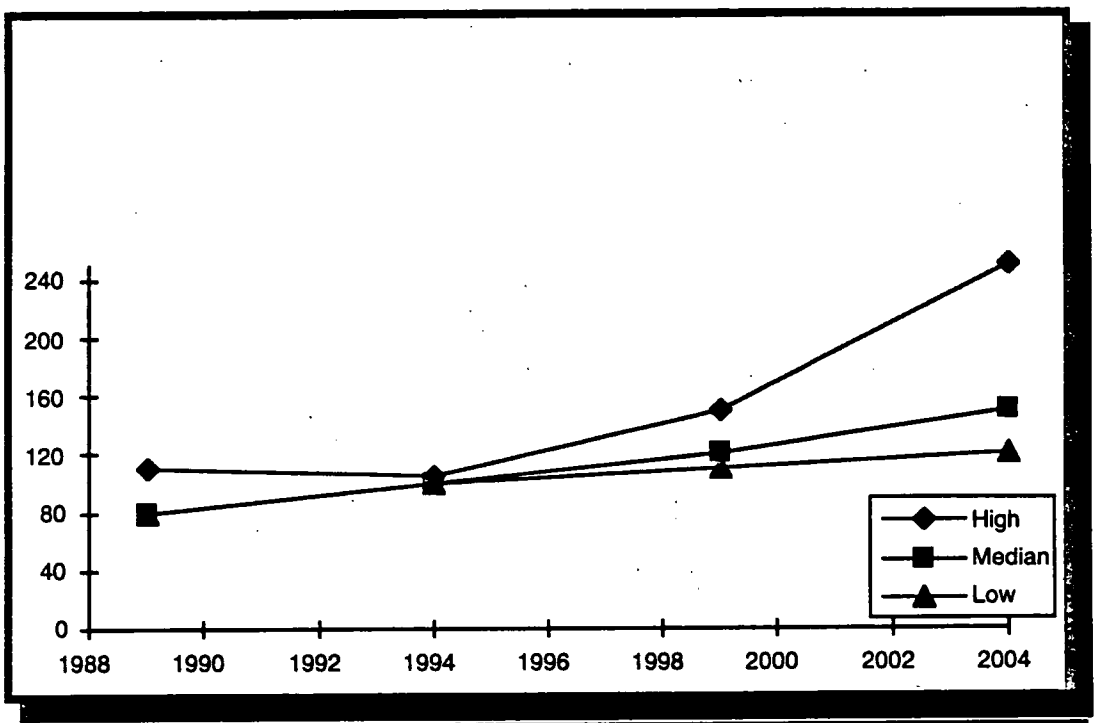
Some members of the panel were surprised to find out that the FBI is currently operating a national DNA bank.[34] Quite obviously, this is a data bank that public and private entities cannot access. The panel felt that

[34] "Science Panel Endorses DNA Typing", *Los Angeles Times*, 15 April 1992, sec. A17

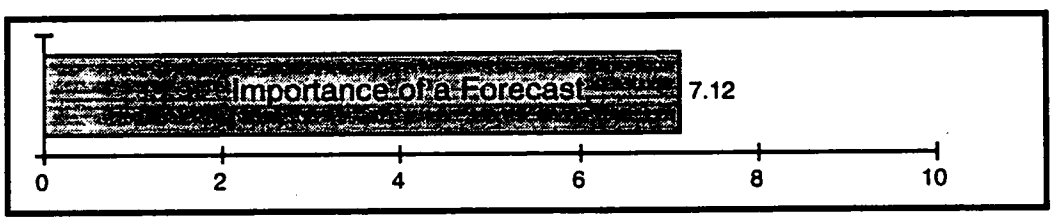
access to genetic data would definitely alter the uses of HGP information. For the past five years, the panel demonstrated varied estimations of access, ranging from more than today's value to somewhere near zero. Though the low expression held a unmoving trend line, median and high figures demonstrated an upward trend during the first and second 5-year period. The median value indicates a rather slow, shallow and even increase through both periods.

Graph No.16

Trend No.6
Religious and Special Interest Group Activity in Radical Science



	1989	Today	1999	2004
High	110	100	150	250
Median	80	100	120	150
Low	50	100	110	120



This trend expressed some of the panel's sentiment identified in Trend Number 4, "Public Concern Over Privacy Issues." There is some historical precedence pertaining to special interest group activism in

reaction to HGP activities. For instance, in the fall of 1993, the National Institutes of Health (NIH) issued a grant to the University of Maryland to hold a conference entitled, "Genetic Factors and Crime." This symposium was to be held under the sponsorship of the HGP and it was supposed to feature some interesting genetic links with crime. Almost immediately, the Congressional Black Caucus and the NAACP protested. The protestations were so vehement that the NIH withdrew the funding based on claims that the university had employed "unethical tactics" in collecting data. The NIH ultimately flip-flopped and has now stated their intent to re-fund the program.[35] Another similar incident occurred a short time later involving the censure of a USC professor who was prepared to render an opinion on the inheritability of certain criminal behaviors such as thievery and violent assault. The professor was chased from a lecture hall by irate protesters, and then he was also accosted by throngs of media trying to get a morsel of his research. The symposium he was to have chaired was cancelled.[36]

The above incidents illustrate the panel's interest in this trend. In this trend, the high forecast is skewed significantly. This is probably attributable to the fact that the one panelist had a great sensitivity for legal defense issues and matters of civil rights. The median figures demonstrate a precipitous movement upwards from the year 1994 to the close of the study period. This 50% increase over a 10-year period seems a rather reasonable forecast. By all accounts, the HGP should be in high gear during this period. It seems quite likely that we will see more seminars like "Genetic Factors and Crime" during this time.

Another dimension of this trend is organized religious activism. The potential participants run the range from the Catholic Church to Operation Rescue. Religious concern over developments in the area of genetics are fairly well known and actually precede the activity of the secular special interests.

---

35 "Violence Research: NIH Told to Reconsider Crime Meeting," *Science*, Volume 262, October 1993, p.23

36 "Fear Clouds Search for Genetic Roots of Violence," *Los Angeles Times*, 30 Dec. 1993, sec.A1

A significant debate was generated in the fall of 1991 for instance, when a conference of pan-religious theologians voiced concern that HGP geneticists may soon be playing God.[37] The recent public discussions of human embryonic cloning also barometers the potential special interest and religious reactions to the HGP. Inasmuch as the "religious right" has acquired significant political clout, the potential for a high speed collision between these groups and the HGP is a possibility.

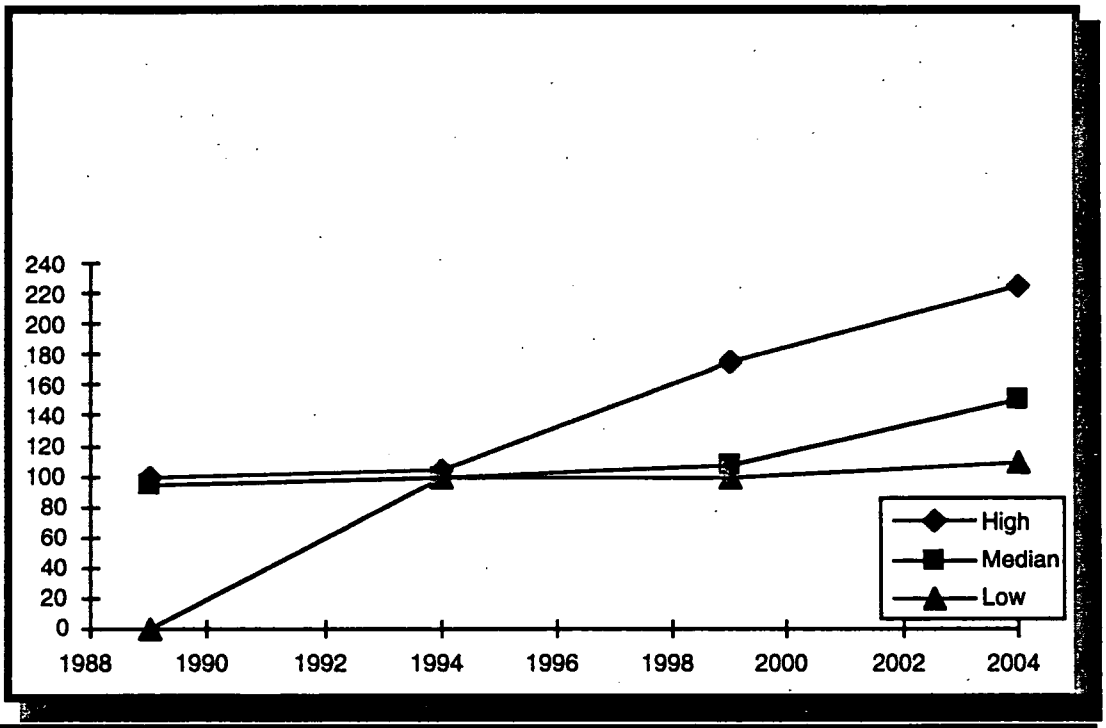
In sum, the panel was cohesive in their assessment of this trend is quite consequential to the issue.

---

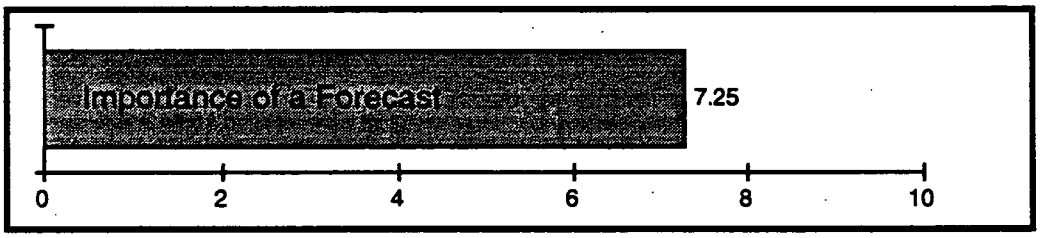
[37] "Gene Research Starts Ethics Debate," *San Francisco Chronicle*, 9 Dec.1991

Graph No.17

Trend No.7
Ability to Detect the "Aggressor Gene(s)" in Law Enforcement Officers



	1989	Today	1999	2004
High	100	100	175	225
Median	95	100	105	150
Low	0	100	100	110



This trend is considerably speculative when viewed in terms of today's technology. What seems to have caught the panel's fancy, was the recent

discovery of the so called "aggressor gene."[38] The discovery, though quite narrow in a technological scope, has given some impetus to the belief that someday during the life of the HGP, a rather simple blood test could reveal the potential for uncontrollable fits of aggressive behavior. In the minds of the panelists, the ramifications of this were enormous. The panel spent some time in discussing how such a test could be applied to police officers and other public safety officials. There was some expectation that gross, unmitigated violence on the part of rogue police officers may some day be avoidable with the ability to diagnose a potent genetic underlying cause.

In analyzing the spread of forecasts for this trend, the high and low contrast is interesting. While one panelist with a science training thought the trend would skyrocket, another without such training, thought that the aggressor gene business was nothing but "will-o-the-wisp." The median value however expressed a feeling that the rate of detection capability will significantly increase in the last 5 years of the issue question, the so called renaissance period for the HGP.

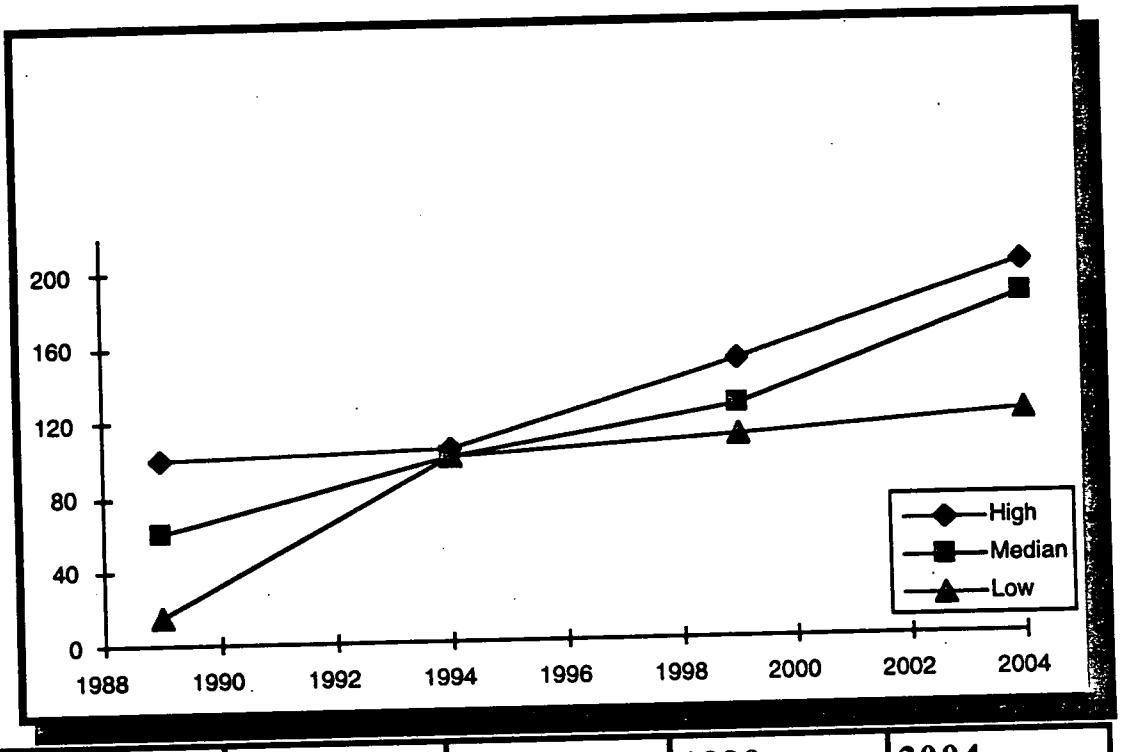
This trend like so many of the others is very much cross dependent and cross impacted. The panel remarked frequently on the ethical debates that would rage from implementation of "aggressor gene" testing. Collateral issues such as this can prove a driver in both an upward and downward sense.

---

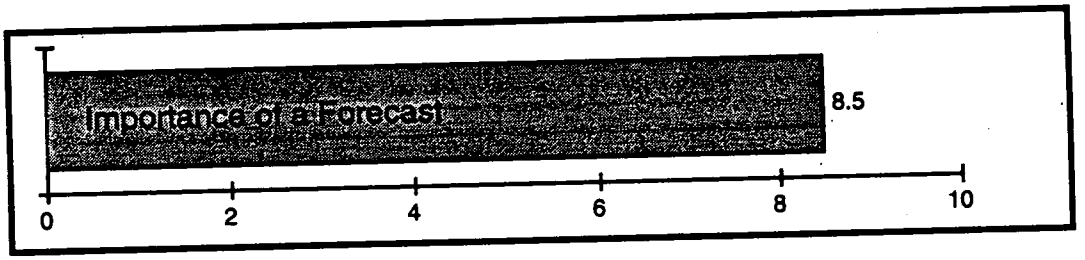
[38]"Genetics Watch: A Violence in the Blood," *Discover*, October-1993, p,30-31.

Graph No.18

Trend No.8
The Quality of Genetic Forecasts



	1989	Today	1999	2004
High	100	100	150	200
Median	60	100	125	182.50
Low	10	100	110	120



In just the last 3 years, American society was witnessed the bonafide discovery of genes which are responsible for some of the most insidious diseases known to man. Cystic Fibrosis, Huntington's Disease and Muscular Dystrophy are just a few of those afflictions that can now be

presymptomatically tested for with a near 95 percent accuracy rate. Other genetically linked diseases are accurately identified at much lower rates.[39]

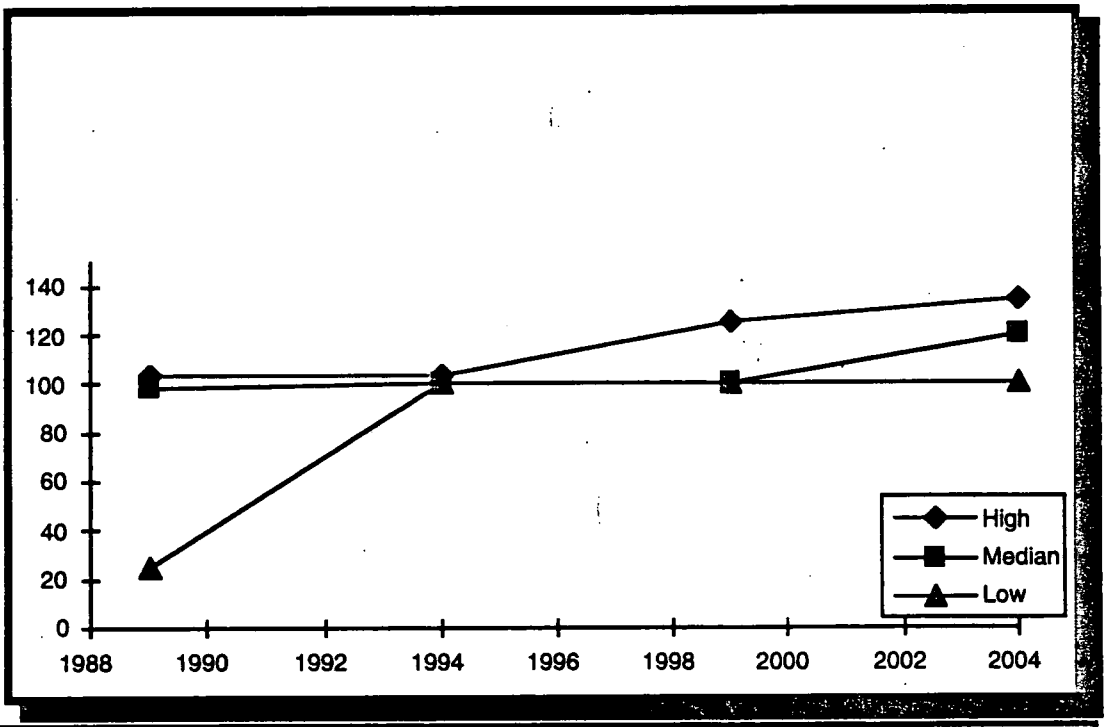
The panel demonstrated their enthusiasm for the future of genome research in their forecast for this event. The high value for this forecast is again seen moving in almost logarithmic proportions, doubling over the course of the 10-year study period. The median value also moves upward a great deal, but reflects a belief that genome research and prediction accuracy will initially build more slowly. In reflection, the median forecasts a very optimistic picture for the quality of genetic predictions through the issue period. This feeling seems sensible considering the rapidity of recent genome discoveries. Some panelists remarked that the technological future of the HGP seemed more clear than the future of some of the more sociological based trends. Their sense was that the sociological linked trends were more volatile than the scientific ones.

---

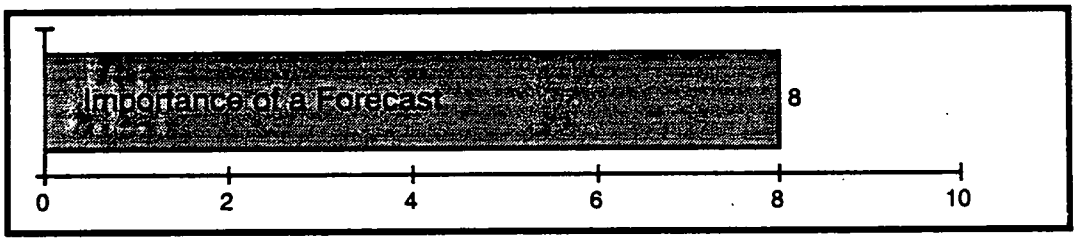
[39] "Half a Tithe For Ethics", Edward J. Larson MD., *Phi Beta Kappa Journal*, Spring 1993, p.15

Graph No.19

Trend No.9
The Amount of Crime Controlled Through Gene Therapy



	1989	Today	1999	2004
High	100	100	125	135
Median	100	100	100	120
Low	25	100	100	100



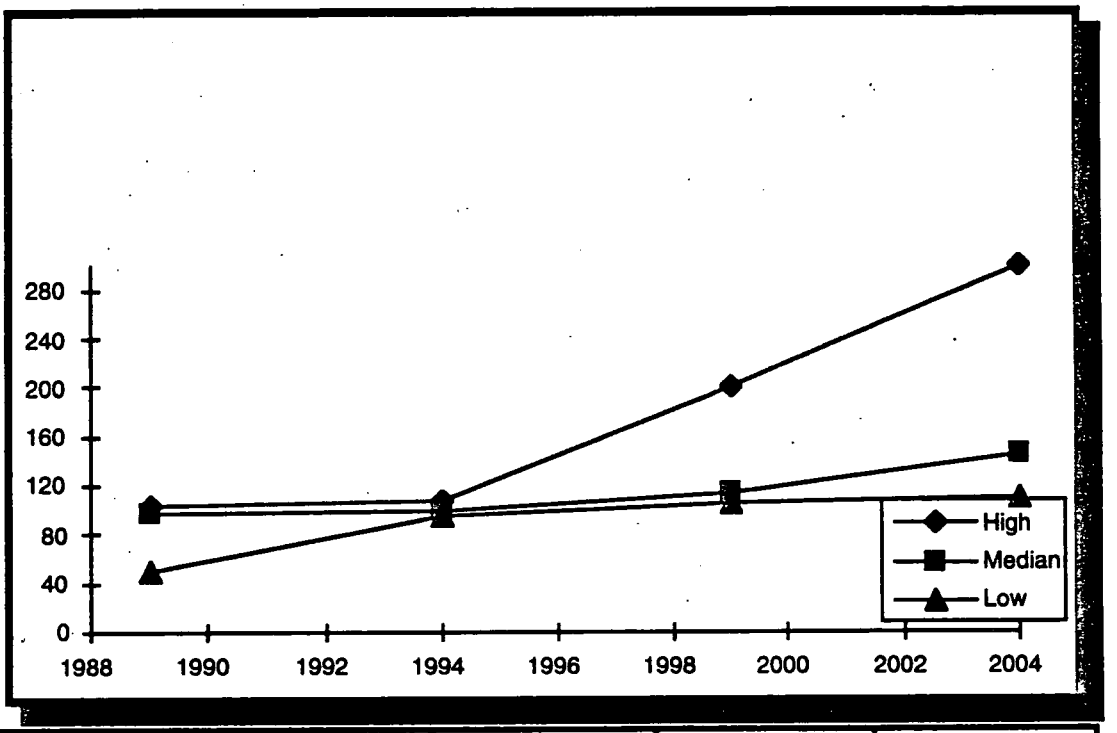
Trend No.9 is another far reaching concept identified by this panel. The author could not locate any treatment programs involving criminals wherein gene therapy was attempted. Discussion in some scientific circles has dealt with genetic remedies for addiction-related disease, however,

little has been ventured regarding the potential for control of crime through gene therapy. The panel was building on the concept of the aggressor gene that was discussed in Trend No. 7 and the belief that if a "bad" gene can be located, it can be repaired. This position though a little naive is not such a wild thought. What will most likely develop is a combined genetic-molecular biology approach to some forms of crime. It is reasonable to expect that medications will be developed to rectify imbalances caused by genetic mistakes. This is already the case for some types of inherited mental disorders.

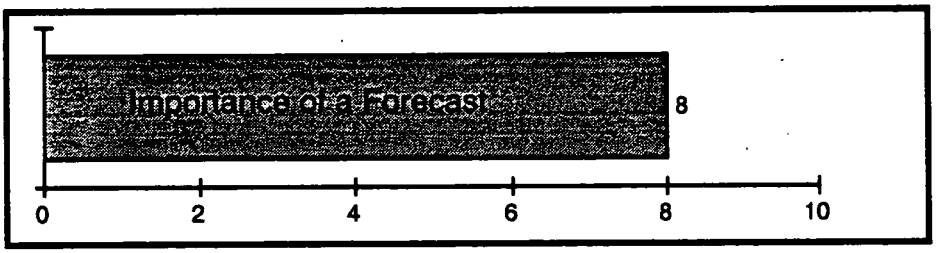
The panel's overall feeling is that not much will happen in this particular facet of genetics until sometime in the 2nd half of the issue period. The low projection was quite more pessimistic in forecasting the future. The low forecast cited increased genetic therapy since 1989, an estimation that appears rather bald in the face of what we know of the past. The low forecast then suggests that the trend will flatten through the future. The majority of the panel thought the inverse to be the case as we move out 10 years from the present.

Graph No.20

Trend No.10
Supreme Court Hearings on Genetic Use Issues



	1989	Today	1999	2004
High	100	100	200	300
Median	100	100	112.5	145
Low	50	100	105	110



This trend is one of the volatile measurements that the panel had mentioned in discussion. The lawyers of the panel knew of no Supreme Court case decisions involving the use of genetic information to date. In the related

CROSS-IMPACT ANALYSIS

Following the Nominal Group Technique exercise, the author consulted with a Class 19 Command College classmate and a graduate of a prior Command College to develop values for input into the cross-impact matrix. Participating with the author in establishing input values were:

Captain Michael Post of the Glendale (Calif.) Police Department. Post is the officer-in-charge of several high technology programs in evoloution within his organization. Post is a graduate of Command College Class 16.

Lieutenant Joseph Latta of the Burbank Police Department. Latta is a classmate of the author's in Post Command College Class 19.

In assessing cross-impact values, the mini-panel considered the median probability value for each event at the 10-year mark as was set by the nominal group panel. The group noticed that the nominated events could be profiled into one of three distinct "STEEP" type categories. The events seemed to fall into distinctions that were either social, political or technological. The category of economics is touched by these events and in some cases seems to be the bottom line to some probabilities. There did not appear to be any appreciable environmental aspect to any of the events.

The cross-impact group assessed the issue as primarily consisting of a clash of societal fears against radical technological developments. The panel was split as to what force would ultimately prevail. On the one hand, technological advance often steam rolls a reticent society. There are modern examples of this. Nuclear power for instance, was discussed as a technological development that was tenaciously resisted by many corners of society. Nuclear power is now responsible for more electricity in America than oil. More social in nature is the history of *in vitro* fertilization techniques in America. This medical advancement was stridently resisted

by much of the society. As time went by and the benefits of this technology became well known, the technology was ultimately accepted. The question facing the group in it' analysis and valuation of cross-impact was the following: Has society reached a point in evolution where a scientific development is so controversial that it can be stymied by social activism and the law? In some cases it seemed so.

Event No.7, "NAACP Comes out in Firm Opposition to Any Non-Medical Use of Genetic Information," is an example of an expected sociology driven event, though it is debatable whether of not the NAACP is a social welfare group as opposed to a political action committee. Some even doubted that the NAACP would survive as a credible activist power into the next century. In the scenarios of these events, it was believed that if Event No.7 occurred, it would not be a death sentence to further developments and applications of the technology. It was suggested however that it might be a harbinger of political and legal resistance to further applications of genetic science. It was felt that this incident would lessen some scientific fervor, but that it would not stop scientific progress.

Event No.5, "Legislation Passed to Restrict the Use of Genetic Information" was seen as an escalation of Event No.7 although the modified Delphi calculations placed the negative value of this event as less then that of Event No.7. The group saw this event has having a greater ability to mute the scientific applications. Event No.5 was still viewed though as not particularly damning to further scientific progress or applications of it within criminal justice circles.

Event No.2, "Supreme Court Overturns Genetic Fingerprinting on Privacy Grounds" is another event in the genre of Events 7 and 5. This event, as demonstrated by its negative impact value of 8, is the greatest hurdle the issue has to leap. Though DNA fingerprinting is just a facet of genetic applications open to law enforcement, it is viewed as an underpinning to all subsequent evolutions of the technology. This event draws fuel from the two prior events mentioned above. For example, in figuring cross impact value, Event No.2 was assessed a gain in probability of +5% when Event No.7 (NAACP) had occurred. The same type of analysis can be observed

with the effect of Event No.7 (NAACP) on Event No.5 (Legislation). Event No.5 received a boost in probability of +10%, providing that Event No.7 had occurred.

Event No.1, "Genetic Data Base for Sex Offenders is Developed." is illustrative of a more technologically based event when compared to previously mentioned events 2, 5 and 7. Event No.1 when confronted with Event No.7 (NAACP), loses probability potential by a value of -10%. When confronted with Event No. 5 (Legislation passed), the fortunes of Event No.1 suffers slightly more at a value of -20%. Event No.2 (Supreme Court) also weighs negatively against the probability of Event No.1, but does so at a level slightly less than Event No.5, (-15%). The reason for this is that a privacy issue challenge to DNA fingerprinting is not a direct attack on the maintenance of a genetic data base for sex offenders. In this sense, Event No.1 takes a glancing blow. A more direct blow to this event came in the form of Event No.5 on the point of information restriction.

An example of technical versus technical cross-impact can be viewed by examining Event No.1,"Genetic Data Base for Sex Offenders" and Event No.3, "TRW for Genetics is Developed." The cross impact group felt that the chronology of the events would entail the development of a sex offender data base before the more extensive step to a TRW system. In any case, both events have positive outcomes on the other in the estimation of the group. Event No.1 realized a +20% from Event No.3; Event No.3 realized a +10% from Event No.1.

An example of a political/social event in cross impact can be seen in the result of Event No.5 (Legislation Passed) and Event No.6, "FBI Sets Up National Genetic Crime Information Center (NGCIC)." In this scenario, Event No.5 (Legislation Passed) was estimated to have a negative value of -25% on the development of "NGCIC." The inverse of this negative effect, is the positive effect that Event No.6 (NGCIC) would have on the probability of Event No.5 (Legislation Passed). Legislation restricting the use of genetic information seemed to gain momentum when an event like Event No.6 occurs. The group held that governmental enterprises in the

area of genetic information; i.e., NGCIC, will stoke legislative and political action. Ultimately, Event No.5 (Legislation) experiences as +10% increase when confronted with the passage of Event No.6 (NGCIC).

After deliberating and assigning cross-impact values to the 90 incidents, the figures were entered in the computerized cross impact matrix program, "X-MPACT."[41] The program then determined final probabilities. The final probabilities were then noted and entered into a scenario generating program, "SIGMA."[42]

A copy of the "X-MPACT" evaluator matrix is presented on the following page.

---

[41] Copyright of the Policy Analysis Company. Washington D.C., 1993
[42] ibid. 1992

CROSS-IMPACT MATRIX

NGT Probability	%	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6	Event 7	Event 8	Event 9	Event 10	Final Probability
Event 1	50%		Δ- -15 P2 X Δ- -8	Δ- 20 P3 X Δ- 8	Δ- 25 P4 X Δ- 21	Δ- -20 P5 X Δ- -13	Δ- 50 P6 X Δ- 32	Δ- -10 P7 X Δ- -10	Δ- 0 P8 X Δ- 0	Δ- 5 P9 X Δ- 2	Δ- 0 P10 X Δ- 0	82%
Event 2	50%	Δ- 0 P1 X Δ- 0		Δ- 0 P3 X Δ- 0	Δ- 10 P4 X Δ- 9	Δ- 5 P5 X Δ- 3	Δ- 5 P6 X Δ- 3	Δ- 0 P7 X Δ- 0	Δ- -5 P8 X Δ- -4	Δ- 10 P9 X Δ- 4	Δ- 0 P10 X Δ- 0	65%
Event 3	38%	Δ- 10 P1 X Δ- 5	Δ- -15 P2 X Δ- -8		Δ- 15 P4 X Δ- 10	Δ- -15 P5 X Δ- -10	Δ- 25 P6 X Δ- 16	Δ- -15 P7 X Δ- -15	Δ- 0 P8 X Δ- 0	Δ- 35 P9 X Δ- 14	Δ- 30 P10 X Δ- 17	67%
Event 4	85%	Δ- 10 P1 X Δ- 5	Δ- -20 P2 X Δ- -10	Δ- 20 P3 X Δ- 8		Δ- -20 P5 X Δ- -13	Δ- 10 P6 X Δ- 6	Δ- -20 P7 X Δ- -20	Δ- 10 P8 X Δ- 8	Δ- 0 P9 X Δ- 0	Δ- 0 P10 X Δ- 0	69%
Event 5	65%	Δ- 5 P1 X Δ- 3	Δ- 10 P2 X Δ- 5	Δ- 20 P3 X Δ- 8	Δ- 10 P4 X Δ- 7		Δ- 10 P6 X Δ- 6	Δ- 10 P7 X Δ- 10	Δ- -20 P8 X Δ- -16	Δ- 20 P9 X Δ- 8	Δ- 0 P10 X Δ- 0	96%
Event 6	63%	Δ- 30 P1 X Δ- 15	Δ- -20 P2 X Δ- -10	Δ- 20 P3 X Δ- 8	Δ- 25 P4 X Δ- 15	Δ- -25 P5 X Δ- -16		Δ- -20 P7 X Δ- -20	Δ- 10 P8 X Δ- 8	Δ- 10 P9 X Δ- 4	Δ- 10 P10 X Δ- 6	72%
Event 7	100%	Δ- 5 P1 X Δ- 3	Δ- -10 P2 X Δ- -5	Δ- 15 P3 X Δ- 6	Δ- 10 P4 X Δ- 4	Δ- -10 P5 X Δ- -7	Δ- 15 P6 X Δ- 9		Δ- -20 P8 X Δ- -16	Δ- 15 P9 X Δ- 6	Δ- 0 P10 X Δ- 0	100%
Event 8	78%	Δ- 20 P1 X Δ- 10	Δ- -5 P2 X Δ- -3	Δ- 15 P3 X Δ- 6	Δ- 5 P4 X Δ- -25	Δ- -10 P5 X Δ- -7	Δ- 15 P6 X Δ- 9	Δ- -10 P7 X Δ- -10		Δ- -25 P9 X Δ- -10	Δ- 0 P10 X Δ- 0	49%
Event 9	40%	Δ- 10 P1 X Δ- 5	Δ- -50 P2 X Δ- -25	Δ- 30 P3 X Δ- 11	Δ- 20 P4 X Δ- -50	Δ- -40 P5 X Δ- -26	Δ- 50 P6 X Δ- 32	Δ- -10 P7 X Δ- -10	Δ- 50 P8 X Δ- 39		Δ- 25 P10 X Δ- 14	30%
Event 10	55%	Δ- 10 P1 X Δ- 5	Δ- -10 P2 X Δ- -5	Δ- 25 P3 X Δ- 9	Δ- 25 P4 X Δ- 12	Δ- -25 P5 X Δ- -25	Δ- 10 P6 X Δ- 6	Δ- -10 P7 X Δ- -10	Δ- 0 P8 X Δ- 0	Δ- 10 P9 X Δ- 4		52%

Table No. 3

SCENARIOS

Scenarios depicting what the future may hold for the Human Genome Project and the applications that might be available and undertaken by law enforcement have been analyzed through forecasting and research techniques. The research to this point has suggested that myriad genetic discoveries will occur as a result of the mapping efforts within the Human Genome Project. Many of the anticipated discoveries are expected to have direct relevancy to the delivery of law enforcement services in the new millenium. The genetic applications can be broadly theorized through all facets of the criminal justice system. From the use of medical criteria by police agencies to select and deselect personnel, to the development of crime prevention programs that target genetically "at risk" youths, law enforcement is facing a profound technological and social range of possibilities resulting from the work at the Human Genome Project. Through scenario illustration, plans and strategies can be developed to successfully manage law enforcement to a desireable outcome at the conclusion of the issue period.

The following fictional accounts will address three different themes of the future. The three themes are: 1) An extension of the past, a relatively surprise free future. 2) A future that is better than the past, desirable and attainable. 3) A future that is a worsened extension of the past, somewhat turbulent and undesirable.

Scenario events were determined by computer after final probability values for each event were calculated. The author was unable to print the scenarios as presented by the Sigma program. This particular version of Sigma was defective in that any attempt to print the material, defaulted the program and erased all data. All data compiled in this section of the exercise was copied by hand from each of 30 scenarios generated by Sigma.

The author and a fellow classmate collaborated in this effort. The scenarios were evaluated for theme similarity and separated into groups that reflected the scenario descriptions described above.

Optimistic Scenario

THOSE THINGS THAT DID HAPPEN:

"GENETIC DATA BASE FOR SEX OFFENDERS IS DEVELOPED"
-February 3, 1994

"OFFICER INVOLVED IN HIGH PROFILE EXCESSIVE FORCE CASE (I.E. RODNEY KING II INCIDENT) TESTS POSITIVE FOR PRESENCE OF AGGRESSOR GENE"
-August 30, 1995

"LEGISLATION PASSED TO RESTRICT THE USE OF GENETIC INFORMATION"
-November 22, 1996

"GENETIC TESTING REQUIRED AS PRE-EMPLOYMENT CONDITION FOR PUBLIC SAFETY JOBS"
-May 25, 1998

"SUPREME COURT OVERTURNS GENETIC FINGERPRINTING ON PRIVACY GROUNDS"
- April 1, 1999

"NAACP ANNOUNCES OPPOSITION TO ANY NON-MEDICAL USE OF GENETIC INFORMATION"
- May 1, 1999

"TRW FOR GENETICS IS DEVELOPED"
-November 30, 2002

THOSE THINGS THAT DID NOT HAPPEN:

"NATIONAL DNA TRACKING SYSTEM IS DEVELOPED"

"FBI SETS UP NATIONAL GENETIC CRIME INFORMATION CENTER (NGCIC)"

" MEDICAL SMART CARD DEBUTS AND CONTAINS ALL OF AN INDIVIDUALS PERSONAL GENETIC INFORMATION"

The FBI announced that it has made operational a data base that will maintain the genetic histories of persons convicted of certain sex offenses. This development follows a rash of child abductions and murders committed by convicted sex offenders. According to Assistant FBI Director Charles Stewart, this computer system will compile and make available to law enforcement, the genetic profile of convicted rapists, molesters and pedophiles for reference in emerging investigations. This FBI effort is enhanced by rapid advances occurring within the research laboratories of the Human Genome Project. The Human Genome Project is a 15-year program devoted to the complete mapping of the human genome. Though the FBI program seems to be well received by many in the current administration, presidential spokesperson Helen Kelly cautions that the program must not develop into a witch hunt of paroled or rehabilitated sex offenders each time a heinous criminal offense occurs. Such abuses she cautions, could result in a withdrawal of all funding and an abolition of the program.

A medical test was performed last week on each of the four police defendants charged in the beating of a black motorist. The attorney representing accused Officer Robert Van der Brook, announced that his client had tested positive for the presence of an aggressor gene during this test. Van der Brook's attorney, James Wilson Jr., stated that he will defend his client's actions based on genetic predisposition toward violence. A spokesperson for the prosecution indicated that the evidence of an aggressor gene is not an alibi for pummeling a confused and fearful motorist. Van der Brook and 3 other officers are charged in the beating of

a motorist who had driven his electric car into a roadside drainage ditch. This incident has prompted a call from "CAPA" (Criminals Against Police Abuse) for genetic screening of police officers for the so-called aggressor gene. CAPA spokesman Charles Manson stated that technical revelations from the Human Genome Project now enable society to check for "soft" conditions that contribute to various types of aberrant behavior. Manson told reporters that public safety demanded that such tests be considered for police officers everywhere. Manson added that if time permitted, San Quentin prison guards should also take the test. Manson posited that San Quentin guards are heavily doused with the aggressor gene.

Doctor Leroy Hood of Lawrence-Livermore Labs responded to the latest developments in the motorist beating case. Doctor Hood is a supervising scientist within the Human Genome Project and is currently coordinating the computer programming efforts that are used to collate HGP mapping discoveries. Doctor Hood states that scientists have identified some areas on chromosome 7 that correspond to neurochemical deficits that may lead to uncontrollable violence. Hood cautioned that these developments are still preliminary and warrant more intense research. Hood stated that genetic screening of law enforcement officers is still some time away. Hood did publicly invite Charles Manson to provide a sample of his blood for analysis by the Human Genome Project. Manson has yet to respond.

Congress passed and sent to the president legislation aimed at narrowing the use of personal genetic information. In response to several radical discoveries made by the scientists at the Human Genome Project, congress moved to block the use of this information by law enforcement and private industry. Rules will require law enforcement and industry to secure court approval or consent to use certain types of genetic information. Law enforcement was given greater leeway in their access to this information provided that an exigency or that a great threat to public safety existed.

The League of Cities announce that a genetic screening test will now be a condition of pre-employment for public safety jobs. Reacting to the development of accurate tests for certain types of cancer genes and genes relating to aggression, the League announced that it is in the public's best

interest to conduct such testing. The technology for this type of screening comes in large part from the Human Genome Project which is approximately 50% completed in the task of mapping the entire human genome. Doctor Christopher Williams cautioned the league during his presentation, that mere presence of a particular "bad" gene does not conclusively determine the expression of the gene or the development of a related condition. Williams went on to explain that the role of the environment in the triggering and confluence of genetic conditions is significant.

The Supreme Court ruled that DNA fingerprinting is generally inadmissible evidence based on fifth amendment grounds. Using a doctrinal approach reminiscent of the Court's Miranda ruling, the opinion held that DNA is inherently private and coveted and cannot be used to establish personal identity. Jose Rivera, spokesman for the World Police Chiefs' Association, downplayed the decision by stating that most defendants voluntarily give up their right to privacy and allow the use of their genetic information already. Rivera added that criminal defendants routinely give up their right to remain silent even in the face of the country's age old Miranda decision. The Supreme Court did uphold the FBI's genetically based sex offender information system which had come under fire for the manner in which it collects and disseminates genetic information regarding criminals. The Court held that evidence samples supplied by most of the concerned criminals were handled over voluntarily to authorities. The FBI was found to be lawful in it's distribution of genetic information to other concerned law enforcement agencies.

Reacting to recent discoveries by the Human Genome Project, the NAACP announced today it's opposition to anything but medical use of genetic information. Just a month after the Supreme Court acted to narrow the use of DNA evidence, the NAACP condemned the use of genetics and hereditary by government and industry. Spokesperson Al Smith, stated that the direction of the Human Genome Project is away from medicine and towards eugenics. Smith predicts increased levels of racism and discrimination based not on color but ultimately directed at people of color. Smith agreed that technical knowledge gleaned from the Human

Genome Project should be used to make society safer, but he thought the brunt of such new enforcement approaches would be borne on the backs of young black men. Referring to the resurgence in eugenic debate, Smith stated that forced sterilization of genetically flawed men and women of minority status was a step away from realization.

In reaction to the announcement by the NAACP, the American Association of Retired People urged the government to step up it's effort to completely map the genome. The AARP which is steadily gaining in membership and political influence, believes that hidden within the genome is the fountain of youth and other life extending discoveries. AARP spokesman George Carter remarked that ,"the NAACP has nothing better to do than carp at innocent governmental programs that can bring a higher quality of life to all Americans." Carter suggested that recent taxes enacted to balance the national health care program, should instead be used by the National Institutes of Health to fund more conferences on researching criminality and it's relationship to genetics. Carter also called for the federal government to fund "medical smart card" technology which would contain all of an individuals personal medical and genetic information. "Leftover monies should be then devoted to identifying the fountain of youth genes before time runs out," quipped Carter.

TRW announced that they have christened a new information system to assist creditors and insurance companies in managing the deluge of genetic information spawned by work at the Human Genome Project. TRW will act as a clearing house for genetic information pertaining to clients who are applying for insurance and credit. Law enforcement and government entities will not be allowed access to this private genetic data base. Several biotech firms immediately announced that they intend to market genetic credit repair systems for individuals with "bad genes." "Bad genes are all in the eye of the beholder" said Kelly Di Luigi, president of ChromoFix. ChromoFix is one of several companies claiming that they can help repair bad genes and bad gene interpretations.

EVENTS DEVELOPED BY THE SCENARIO GENERATION

2 - 94	1 GENETIC/DBASE
8 - 95	8 RODNEY KING II
11 - 96	5 LEGISLATION PASSED
5 - 98	9 GENETIC TESTING
4 - 99	2 SUPREME COURT OVERTURNS
5 - 99	7 NAACP
11 - 02	3 TRW

Table No. 4

Extension of the Past Scenario

THOSE THINGS THAT HAPPENED:

"GENETIC DATA BASE DEVELOPED FOR SEX OFFENDERS"
- February 27, 1994

"OFFICER INVOLVED IN HIGH PROFILE EXCESSIVE FORCE CASE (I.E. RODNEY KING II INCIDENT) TESTS POSITIVE FOR PRESENCE OF AGGRESSOR GENE"
-March 17, 1994

"LEGISLATION PASSED TO RESTRICT THE USE OF GENETIC INFORMATION"
-April 15, 1994

"NATIONAL DNA TRACKING SYSTEM IS DEVELOPED"
-January 3, 1995

"NAACP ANNOUNCES OPPOSITION TO ANY NON-MEDICAL USE OF GENETIC INFORMATION"
-January 16, 1997

"SUPREME COURT OVERTURNS GENETIC FINGERPRINTING BASED ON PRIVACY GROUNDS"
-January 23, 1998

"FBI SETS UP NATIONAL GENETIC CRIME INFORMATION CENTER"
-September 3, 2001

"MEDICAL SMART CARD USED CONTAINING ALL OF AN INDIVIDUAL'S PERSONAL GENETIC INFORMATION"
-December 10, 2001

"GENETIC TESTING REQUIRED AS PRE-EMPLOYMENT CONDITION FOR ALL PUBLIC SAFETY JOBS"
-June 17, 2002

THOSE THINGS THAT DID NOT HAPPEN:

"TRW FOR GENETIC INFORMATION IS DEVELOPED"

The Federal Bureau of Investigation announced that it has undertaken the responsibility of managing the growing amount of genetic information pertaining to convicted sex offenders. Mounting congressional criticism over the lack of standards and control in local and state data systems seems to have prompted the FBI in to this action. The data base as run by the FBI will be used for the comparison of evidence samples and cross matched against certain *modus operandi.*

Officer Lex Lawrence, the centerpiece of the infamous electric car motorist beating incident, submitted in court documents today a request that evidence of a genetic flaw predisposing him to violence be admitted in his upcoming trial. This flaw was recently discovered using newly developed techniques gleaned from the Human Genome Project. Lawrence's lawyer insinuated that the tragedy of this case is that the incident would have been avoidable had Lawrence been subjected to some form of aggression screening prior to his hiring as a highway patrol officer.

Congress today enacted legislation that attempts to curtail the burgeoning uses and applications of genetic information. This action followed a bizarre twist in the California electric car beating case where both the assaulting officer and the victim motorist fenced in court over the meaning of genetic evidence. The legislation also addresses the military's attempt to identify potential homosexuals, drug addicts and spies in an effort to preclude them from military service. Bay area representative Roger Davis said, "We had to nip this in the bud; the Pentagon and the police were going to have a field day with this stuff, that's all we need right now,

genetics Gestapo." An administration official was quick to add however, that this legislation may impinge on the president's ability to keep costs down under the proposed national health care program. A presidential veto of the legislation was left as a possibility.

Almost a year after the president vetoed legislation restricting the use of certain types of genetic information, the National Institutes of Health (NIH) announced the development of a National DNA tracking system. In conjunction with the Center for Disease Control, the NIH will be monitoring the genetic profiles of newborn children throughout the country. Correlation's between various DNA profiles, disease and geographic variables will be maintained by the NIH. Patterns of disease and the transmutation of inherited disorders will be closely monitored Under the rules of the newly enacted national health care program, NIH will be able to acquire samples of DNA from patients seeking care for certain genetically linked conditions.

The NAACP today voiced great concern over developments in the government's use of genetic information. The watch dog group claimed today that government run programs like the "NIH DNA Tracking System" are nothing but a ruse for the continuing discrimination perpetrated against blacks. The NAACP urged the president to enact guidelines that will ensure that information will be used for medical use only. The alleged plans by the FBI to expand the sex offender data base into a national genetic library was assailed. The so-called National Genetic Information Center was criticized for its race based evaluation system. The FBI denied that any such program was under discussion. A spokesman did admit that the FBI was evaluating a number of recent discoveries of the Human Genome Project and how they can be applied to criminal investigations and crime control strategies.

While American society expands its knowledge of human genetics and heredity, the Supreme Court moved to restrict the use of DNA evidence by the police. The Court held that DNA fingerprinting is a matter of privacy commensurate with the right against self-incrimination. Though the decision limits the introduction of DNA fingerprinting as evidence, the

technology used to establish identity was held as scientifically and legally valid.

The FBI announced today that the National Genetic Crime Information Center (NGCIC) is on-line and available to police agencies that are able to understand and use the information. A poorly held secret for the last several years, the FBI has admitted that individual genetic profiles are maintained at the NGCIC to assist law enforcement officers in the investigation of crime. In addition to the early sex offender files, the new system will profile genetic samples for such idiosyncrasies as the addiction gene and the aggression gene. Certain other genetic patterns corresponding to particular criminal enterprise are under study. The Human Genome Project was cited as being the impetus which brought NGCIC into being,

With the proliferation of genetic information spawned by the Human Genome Project, the government has announced that individual genetic profiles will now be entered into the smart "National Medical Health Card." The card will contain a history of family inherited diseases and other markers that may suggest pre-symptomatic disease. According to officials at the Health and Human Services Administration, the information from this card is only readable from government installed computers utilized in the national health care system. Officials guarantee the "smart card" to be leak proof. Personal genetic information they assert, is safe from tampering by government representatives.

The Association of Los Angeles Deputy Sheriff's hailed today's decision by the Sheriff Cynthia Alvarez to begin pre-employment screening for certain genetically identifiable disorders. Genetic panels that check for indicators of violence, addiction, dishonesty and patience are at the heart of this issue. "The public has a right to feel confident that their law enforcement officers have been thoroughly screened and rigorously tested before they are placed on the street," said Sheriff Alvarez. The Sheriff indicated that all current personnel will also undergo similar testing during annual medical exams. Those personnel with questionable readings, will be sent for genetic counseling through department medical services. "No personnel will lose their job because of a bad test," added Alvarez.

EVENTS DEVELOPED BY THE SCENARIO GENERATION

2 - 94	1 GENETIC/DBASE
3 - 94	8 RODNEY KING II
4 - 94	5 LEGISLATION PASSED
1 - 95	9 NATIONAL DNA
1 - 97	2 NAACP
1 - 98	2 SUPREME COURT OVERTURN
9 - 01	6 NGCIC
12 - 01	10 SMART CARD
6 - 02	9 GENETIC TESTING

Table No. 5

Unfavorable Extension of the Past

THOSE THINGS THAT HAPPENED:

"GENETIC DATA BASE FOR SEX OFFENDERS IS DEVELOPED"
-January 31,1994

"LEGISLATION PASSED TO RESTRICT THE USE OF GENETIC INFORMATION"
-January 1, 1995

"SUPREME COURT OVERTURNS GENETIC FINGERPRINTING ON PRIVACY GROUNDS"
-February 15, 1997

"NAACP ANNOUNCES OPPOSITION TO ANY NON-MEDICAL USE OF GENETIC INFORMATION"
-May 22, 2000

"GENETIC TESTING REQUIRED AS PRE-EMPLOYMENT CONDITION FOR ALL PUBLIC SAFETY JOBS"
-September 27, 2000

"FBI SETS UP NATIONAL GENETIC CRIME INFORMATION CENTER (NGCIC)
-January 6, 2001

"OFFICER INVOLVED IN HIGH PROFILE EXCESSIVE FORCE CASE (I.E. RODNEY KING II INCIDENT) TESTS POSITIVE FOR PRESENCE OF AGGRESSOR GENE"
-January19, 2002

THOSE THINGS THAT DIDN'T HAPPEN:

" TRW FOR GENETIC INFORMATION IS DEVELOPED"

" NATIONAL DNA TRACKING SYSTEM IS DEVELOPED"

" MEDICAL SMART CARD DEBUTS AND CONTAINS ALL OF AN INDIVIDUALS PERSONAL GENETIC INFORMATION "

The FBI announced today that the DNA analysis unit started in the mid-80s has been charged with development and operation of a data base containing DNA samples of convicted sex offenders. The announcement drew the ire of a civil rights consortium who have been closely watching the evolution of genetic discoveries and their subsequent applications. These groups successfully lobbied the National Institutes of Health last year to cancel an NIH conference exploring the links between genetics and criminality. This announcement seems to have struck the same note with the group, who announced that they would lobby Congress in an effort to legislate restrictions on government uses of genetic information. This development may delay the use of genetic information by law enforcement agencies across the country.

Effective New Years Day, federal law will impose restrictions on the use of genetic information for other than medical purposes. The legislation was heavily lobbied by civil rights groups who feel that genetic diagnostics will ultimately cause greater oppression of minority groups and selective prosecution by law enforcement. The bill which was signed into law by President Morrow still allows law enforcement access to genetic information. The bill does require a separate legal proceeding for government agents in order to obtain permission to access genetic medical records. The bill also sets forth conditions under which insurance companies can obtain and use genetic information. Certain activists have vowed to continue lobbying to further restrict use and access of this information. The ACLU has stated that they will challenge the legitimacy of genetic evidence to the Supreme Court.

The Supreme Court issued an opinion which essentially precludes the use of DNA fingerprinting in many criminal trials. At the behest of the ACLU, the Supreme Court elevated DNA evidence to the level of a right against self-incriminating testimony. The case did not deal with the scientific validity of DNA fingerprinting and let stand the "Frye" principal governing the use of scientific tests. The United States Attorney General Robert Fitch downplayed the importance of the decision and noted that the legitimacy and integrity of DNA fingerprinting has been left intact. The decision is expected to have a chilling effect on biotech firms specializing in DNA testing. Ian Murphy, President and CEO of AMGEN a DNA testing firm in San Diego, said that incentives to push new equipment to market and to refine current testing techniques have been setback. Murphy went on to say that he hoped private industry would make better use of some of the techniques that his company and others have developed. Murphy said that the era of urine tests and breath tests will soon be surpassed by very precise genetic screenings. Because of the research done at the Human Genome Project, Murphy predicts a widespread capability to test for dozens of genetically identifiable conditions in the next 3-5 years. Murphy stated that he had hoped that AMGEN services would be relied upon in criminal justice circles but lamented that law enforcement in general was technologically ill-prepared to begin using and applying genetic related information.

The NAACP reacted today to news that AMGEN of San Diego was about to market a genetic screening test for business. The AMGEN process claims that it can detect the genetic markers for certain types of uncontrollable aggression, attention deficit and criminality. Additionally, the AMGEN process can identify certain genetic markers for the presence of genes associated with several dozen forms of cancer. In discussing the AMGEN process, the NAACP vehemently protested against the use of this type of genetic information in any area other than direct medical care. The NAACP put forth a statement which cautioned that genetic screenings can lead to red lining against certain races and ethnic groups.

California Governor Johnson announced that all aspiring California law enforcement officers will undergo a new battery of screening tests targeted

at identifying people who are at high risk for certain types of undesirable behaviors. The governor described a testing process originally developed by AMGEN of San Diego. Though many are critical of the "big brother" aspect of AMGEN's process, the Governor said that the people of California have a clear right to know what is in the background of the men and women hired as police officers. Governor Johnson's revelation caught law enforcement officials by surprise. Reacting to this news, California Association of Chiefs of Police spokesperson Natalie Howell said that most police departments in the state lack the technical understanding and expertise necessary to comply with the Governor's order. Howell said that AMGEN was recognized as a company on the front line of genetics research, but it was not believed to have developed any information relevant to the hundreds of police and sheriff's departments that dot the state. Howell stated that this information will send law enforcement agencies scurrying for technical guidance in complying with the Governor's administrative order.

The FBI unveiled it's National Genetic Crime Information Center (NGCIC) for the public. NGCIC is an information center patterned after it's decade old National Crime Information Center (NCIC). NGCIC is expected to handle the information generated by the Human Genome Project for applications within the criminal justice system. The Human Genome Project has nearly completed the mapping of the human genome. As a result numerous genetic profiles corresponding to certain types of criminal behavior have been developed. These profiles are then held and cross matched against inquiries made from local law enforcement agencies. Individual genetic records will be maintained by NGCIC. Local and state law enforcement agencies will be granted access to NGCIC for a modest yearly access fee, once they have been certified by the FBI as competent in the area applied genetic forensics.

A defendant officer in the electric car beating case, announced today that he tests positive for the "Aggressor A-2" gene. As a result, San Arboles Officer Bill Edison said that he was unavoidably violent on the now infamous morning where he beat an innocent motorist with a supposed "less than lethal" weapon. This situation illustrates the difficulty in applying

genetic tests to pre-symptomatically check for behaviorally based traits. Edison successfully passed AMGEN's public safety genetic screening two years ago. Since then, a newly identified mutation of "Aggressor A-1" has been identified.

San Arboles city officials announced today that Officer Bill Edison has been placed on temporary medical leave from his duties with the police department. The San Arboles City Attorney stated that Edison would not be terminated from the force since his genetic disability was probably defined under the terms of the Americans with Disabilities Act of 1992. Officials were not quite sure where Edison would be assigned following his temporary leave. Officials with the police department were seeking professional guidance in evaluating the results of Edison's condition. The San Arboles officials are concerned that many newly discovered genetic defects will ultimately find protection under this act.

EVENTS DEVELOPED BY THE SCENARIO GENERATION

1 - 94	1 GENETIC/DBASE
1 - 95	5 LEGISLATION PASSED
2 - 97	2 SUPREME COURT OVERTURN
5 - 00	7 NAACP
9 - 00	9 GENETIC TESTING
1 - 01	6 NGCIC
1 - 02	8 RODNEY KING II

Table No. 6

Scenario Commentary

The scenarios chosen for writing all had a common theme. The development of technology followed by the protest of the public was virtually assured. This is a trend that seems to be accelerating as it applies to biotech discoveries. Earlier in this paper the ten nominated trends of the NGT panel were evaluated. One of the more important trends to the issue is the response of the public and special interests to some of the applications of big science technology.

The "optimistic" scenario built heavily on the concept of public awareness and linkage of genetic research to positive developments within law enforcement. This scenario was one of a genre that placed the "Rodney King II" electric car motorist beating incident early on in the chronology. This incident, though damaging to law enforcement, was an opportunity to propel the genes issue to the forefront. In the original analysis of events, the positive impact of the Rodney King II incident outweighed the negative. This panel finding represents the belief that in a genetic sense, an instance like this can be a building block; the most important building block for ultimate acceptance of genetic screening for police personnel. It was this particular event that followed some 3 years after the Rodney King II incident. The event is dependent of course on the ability to detect the aggressor gene. The gene that codes poorly for "MAOAI" was eluded to in the introduction. This gene which is found on the X chromosome has already been identified. Within another year and a half, society can expect further clarification on the point by the Human Genome Project and other research geneticists. Moving further through the optimistic scenario, we experience some legislative and Supreme Court interference. The two events (2&5) were present in almost every scenario that was generated. In the optimistic scenario, the events were sufficiently spaced so that they did not become confluential. The NAACP which is ubiquitous in the scenarios, was also downplayed in the fiction. The NAACP came along later in this

scenario, mid-1999, a point at which the NAACP is posited to have lost political influence.

In evaluating an "extension of the past" scenario, a representative was picked from the group which put forth a more tedious process of events and occurrences. This account starts in much the same way as the optimistic scenario. However the directions taken after the Rodney King II incident differ. Legislation restricting the use of genetic information occurred very early in the scenario and it got bound up with some other developments like the issue of gays in the military and the proposed national health care program. Complicating the situation was the development of a DNA tracking system by the Center for Disease Control. This event of course caused a great reaction from the NAACP and a follow-on limiting decision of the Supreme Court. Overcoming the slow downs in evolution, comes next the NGCIC and genetic screening. The genetic screening issue occurs late in the scenario at a time when Human Genome Project mapping should be winding down. The pre-employment genetic screening event comes as the last and final act in the drawn out play of ups and downs.

In an "unfavorable extension of the past," things have become more rowdy. As was noted in all scenarios, the Genetic Data Base lead off. It was followed almost immediately by legislation aimed at limiting the use of genetic information. Viewing this as an attempt to nip the whole process in the bud, the scenarios becomes flustered. More chaos is injected with an unfriendly Supreme Court decision which follows immediately after restricting legislation is enacted. Trying to emerge out of all this is the high tech angle to the Human Genome Project work product. A biotech firm (AMGEN) tries to hit the scene with it's scheme for work place employee screening. AMGEN's proposal is rebutted by the NAACP. The NAACP injects great vitriol into the debate. The show does go on. Significant achievements occur as seen in the ordering of pre-employment gene screenings for law enforcement and the start-up of the National Genetic Crime Information Center (NGCIC). In a bittersweet conclusion to this raucous scenario is the Rodney King II aggressor gene episode. The officer in this fiction was originally screened and given a clean bill of

genetic health. Unfortunately, a mutation developed that led to the emergence of a genetically traced "aggressive incident." Curiously, there is some discussion as to the status conferred to those who have some type of genetic lesion. Would such individuals be at such a deficit label that they could be considered disabled? If the Americans with Disabilities Act currently protects recovering drug addicts and alcoholics, should it not naturally extend protection to those who test positive for the underlying genetic marker? A riddle for the future.

CONCLUSIONS

The Human Genome Project and the applications from this extensive genetics mapping effort loom as a disconcerting unknown to much of society. As for medicine, work has begun to prepare physicians and other health care providers for the arrival of genetic science into day to day clinical settings. In addition to the technical developments that are implied in human genome mapping, there are myriad other related concerns such as legal, ethical and social impacts. Doctors and other health care providers have already started to prepare for that day when Human Genome Project information is available to them in their daily practices The same cannot be said of law enforcement at present. As an industry, law enforcement is ill-prepared to make the most desirable future a realistic outcome. As esoteric as the Human Genome Project might seem, there will be issues that evolve from it that will cause law enforcement to react to it.

Throughout the futures research a wide range of expectations were uncovered in the minds of experts as it related to human genome mapping. There was however, universal agreement that the HGP and resultant applications will have impact law enforcement services. Be it in the medical selection of police personnel or in the investigation and prevention of criminal acts, there will be technical aspects of genetics that can be applied in the industry of law enforcement.

The issue and the defining sub-issues of this paper were frequently alluded to in the various scenario pieces. In each of those scenarios, the Human Genome Project and its work product was played out on a nationwide stage. In answering the issue and sub-issue questions, the most vivid portrayal of HGP impact is seen in a national or statewide perspective. Distilling the issue down to applications within a smaller agency scenario was also portrayed. On both the macroscopic and microscopic stage, the HGP was portrayed in its potential futures.

Unlike many other high technologies in use within law enforcement; i.e., communications and information management, human genetic information has a very small history to build upon. Like the medical doctor described above, law enforcement will be faced with the management of a whole new area of science. Besides the criminal justice experiences with DNA fingerprinting, there is little in the way of experience to help guide law enforcement to the most desirable future. To get to that point, law enforcement will need to adopt a far reaching strategy that embodies a plan that is flexible and usable by all the hundreds of law enforcement agencies allied in California. It is obvious that California law enforcement will not be steering a course toward a desirable future by itself. Federal and law enforcement agencies from other states will face much the same predicament.

The most feasible approach for dealing with strategy and planning is to address the law enforcement of California in conglomerate fashion. Though broken down into many small and autonomous organizations, California law enforcement must be linked together to competently manage this issue and its future as has been identified through futures research.

In the following section, which deals with planning, such an approach will be taken to address the issue: What Impact Will the Human Genome Project Have on Law Enforcement by the Year 2004.

Strategic Plan

California: Vehicle to the Year 2004

To prepare a plan and strategy for management of the Human Genome Project's impact on law enforcement, particularly in the parameters established by the sub-issues, law enforcement needs to concentrate attention on the criminal justice in a macroscopic fashion. This discussion will target the whole of California law enforcement for examination and planning. This approach places state agencies, local agencies and prosecutors into one large law enforcement organization. This "organization" is presently interconnected in many ways which make it a viable planning platform for the future. With California Department of Justice (Cal DOJ) as the switchboard for the exchange of information and microscopic inter-organization networking, law enforcement will be analyzed so as to devise a plan capable of attaining a desirable future state.

The "Optimistic Scenario" from the previous futures research section will be used and applied against this all inclusive California law enforcement system. This optimistic picture was generated by a scenario generator, SIGMA. This scenario depicted a future state where various aspects of genetic science had crossed over from the laboratory into applied criminal justice work. Unlike the other scenarios, law enforcement was positioned in such a way that allowed the "organization" to work with genetic developments as they occurred as opposed to being worked over by an onslaught of alien yet undeniably important science. In this scenario, this large, all encompassing organization was not the victim of a technological "sucker punch." The metamorphosis of genetics from hypothetical science to applied science was taken in stride by this organization. It was evident that this organization was postured in such a way so as to receive, evaluate and apply relevant genetic science as it emerged. This "bite sized"

management of the technology avoided last minute, crisis type reactions to a technology that suddenly crashes with full weight on the organizational scene. Based on the futures research, it is the author's opinion that the organization must be scientifically vigilant so as to allow it to digest evolving genetic technology in small pieces and determine what, if any, applications should be undertaken.

Given this future state and mindful of the trends that underlie the future, the author's future California law enforcement "organization" is found in this condition:

- The various large and small police and sheriff's departments within the organization freely and quickly exchange information of all types.

- The organization has adopted controls, standards and training regimens for the understanding and use of applied genetic science.

- The organization has the capability of open dialogue with the community it serves, especially on issues of great moral and legal magnitude.

- The organization is networked with federal agencies, other state agencies and foreign law enforcement agencies on technological issues of mutual concern.

- The organization has access to technology banks that can be tapped for professional help in the determination of how complex scientific can be used in the delivery of law enforcement services.

- The organization is secure in its funding for the research and development work necessary to ensure legal, ethical and practical uses for complex scientific issues like human genetics.

Mission Statement

The following mission statement was written by the author based upon experiences, research and interviews that were conducted in the futures research section. This mission statement was developed so as to serve as guidelines and objectives for the California law enforcement organization in attaining an effective plan and strategy for dealing with the use of human genetic information. The establishment of a mission statement is crucial to establishing a direction and a vision for the management and utilization of cutting edge genetic information developed in the new millennium.

The statement of mission is as follows:

•Develop and maintain an environment of interagency cooperation and support in the quest to evaluate and implement cutting edge scientific and genetic developments within the delivery of law enforcement services.

•Insure that our scientific competency is maintained at a level necessary to properly address the complex issues stemming from current and future issues in genetics and microbiology.

•Guarantee the highest levels of personal and professional integrity in the uses of human genetic and microbiologic information in the enforcement of the law.

•Maintain strict levels of security in the use and applications of information derived from genetic and microbiologic data bases.

•Evaluate options and be open-minded to networking and sharing of technical information with allied agencies engaged in enforcement of the law.

•Understand and allow for the diversity of thought and debate that will occur with the future applications of genetic and microbiologic science.

•Continually evaluate the policies and procedures pertaining to the way genetic and microbiologic evidence is collected, stored and used by law enforcement agencies.

Environmental Analysis

The State of California law enforcement community moves toward the future of genetic and microbiologic renaissance at a time of great change and challenge. Through necessity, state government and all allied municipal governments are groping through the process of "re-invention". A first impression of this process is disquieting. There are however, great opportunities strewn about the minefield that law enforcement will plod through into the new millennium. This subsequent analysis will examine the external environment that confronts the State law enforcement community. This examination will be undertaken using the "STEEP" model of issue identification and then applied within the context of WOTS-UP analysis. In this analysis, the author consulted previous NGT panel members Gary Schram of the Los Angeles County District Attorney's Office and forensic chemist, J. Raymond Wells, Los Angeles County Sheriff's Department.

Social Environment

Opportunities: The citizens of California have reached a point of agitation with crime that has opened them to the consideration of new ideas in the battle against crime. The recent "three strikes you're out" legislation is illustrative of this change in public sentiment. The shock value of genetic applications in law enforcement could be mitigated by the seemingly unstoppable rise in violent crime. Since 1982, violent crime in California has risen 113 percent.[43] Trends such as this have softened the public

[43]Los Angeles County, *California Criminal Justice Profile*, 1991, p.5

reaction to previously unmentionable crime control proposals. The public seems willing to dispense with convention and try something new.

Threats: The march toward genetic enlightenment is likely to rekindle protests that were heard during the turn of the century during the failed eugenics movements that occurred both in America and in Europe. Already law enforcement has had a glimpse of the reaction to the debate of genetics and the role it plays in human behavior. A genetics symposium looking at the links between genes and criminal behavior had to be cancelled recently when special interest groups protested that the speculated findings would pit society against minority groups. Without even knowing the scientific facts of the situation, these minority groups assumed the data was skewed so as to paint minority populations as the primary source of the nation's crime problem.[44] Adding to the fear of the unknown is the issue of "right to privacy". The public's concern over this issue runs deep. Several events nominated in the NGT portion of this project's futures analysis dealt with the uses of genetic information by insurance companies and credit bureaus. One of the final ten events in fact was: TRW for Genetic Information is Developed. The very thought of this can quickly turn the public sour on the uses of Human Genome Project information.

Technological Environment

Opportunities: For the past 15 years, American law enforcement has been quietly forging ahead in the technological refinements in the use of DNA typing. This process of scientific evolution has laid the groundwork for further uses of genetically based information in law enforcement. The profound improvements in computer technology add to the technological capabilities needed to make sense of genetic information. Human Genome Project researchers themselves have identified the recent developments in information processing as indispensable to the success of genetic decoding. Law enforcement is no stranger to the rapidly developing information processing market. The speculation on the structure and access to the national "Information Superhighway" gives rise to hope that

---

[44]"Violence Research: NIH Told to reconsider Crime Meeting", *Science*, Volume 262, October 1993, p.23

government agencies, especially law enforcement may have easy "on-ramp" rights. If so, the technological apparatus necessary for the use and exchange of genetic information may be already in place.

Threats: The future of genetics in state law enforcement is somewhat dependent on the technical largesse of the Federal government. The transfer or scientific sharing of this type of highly technical material is dependent upon the technological infrastructure found in the Federal government. The State in a hardware sense, is inferior to the Federal government. It is the Federal government in the form of the National Institutes of Health and the Department of Energy, that funds the Human Genome Project. The Federal government will have to form the scientific bridge for state and local uses of this information, a dubious ally in times of economic, social and political uncertainty.

Economic

Opportunities: The good news on the economic front is hard to come by. The flat economy of California by all forecasts is likely to persist and lag behind the continuing national recession recovery. The one bright spot for the California economy was the passage of Proposition 172 in the fall of 1993. Proposition 172 codified the temporary sales tax imposed following the Bay Area earthquake of 1989. According to law the monies collected from this tax must ultimately fund public safety efforts in the state. It is hoped that the passage of Prop. 172 will stymie the erosion of law enforcement funding which started during the 1991 recession.

Threats: The perception of California as anti-business seems to continue unabated. The recent gubernatorial and senatorial campaigns in California witnessed pledges by the various candidates to cut red tape and make California more business friendly. Nonetheless, there are frequent reports of companies closing operations or relocating to other parts of the country. This trend exacerbates an already weakened economy and portends overall lower funding levels for governmental agencies that are

dependent upon taxes.[45] Big ticket government programs are also in a position of weakness. Even programs with a great deal of bi-partisan support will have difficulty the hurdles of finance in upcoming years.[46]

Environmental

Opportunities: Opportunity in an environmental sense lies in the fact that environmental issues have little to do with this particular area of genetic and microbiologic applications. That is not to say that such an issue can not arise. Through the NGT process and the interviews held with Human Genome Project scientists, the author was unable to identify any reasonable environmental concern that bore on the issue. Considering the current and likely future state of environmental sensitivity in California, this situation can be viewed as opportunistic.

Threats: None as postulated above.

Political

Opportunities: Macroscopically, political support for issues such as the Human Genome Project and the uses of human genetic information can be viewed vis-a-vis the level of government funding for big science projects. Overall funding levels have remained steady when adjusted for inflation. This trend is suggestive of steady political support for the issue through the rest of the decade.[47] Despite the cancellation of the national Supercollider Project, the Human Genome Project seems to enjoy steady support.

California politics suggest that the use of "big science" technology in law enforcement is quite probable. When coupled to reasonable crime initiatives, the political establishment seems open-minded to the use of high technology. The California DNA typing experience is an example of how such cutting edge scientific programs are accepted in a rather volatile

---

[45] James Gerstenzang, "Feds Forecast for California Bleak," *Los Angeles Times*, 11 March 1993, sec. D5
[46] ibid.
[47] *USA Today*, 2 Feb 1993, sec A, source: Batelle memorial Institute

political environment. The link of genetics to the proliferation of certain more odious crimes like rape and child molestation, would mute political opposition to its use in investigating and preventing crime of the future.

Threats: State politics, unlike Federal politics, can be waged in various forms. The initiative process, for instance, is an avenue for voters to pursue should they not find satisfaction in the performance of their elected officials. The initiative process is a much used alternative for many special interest groups who lack leverage inside the halls of the State capitol. It is the political capability of special interest groups that spell trouble for this mission, should a furor erupt over some of the more controversial points in the uses of human genetic information. As identified in the Nominal Group Technique exercise, politics has the ability to stop what might seem as an unstoppable scientific juggernaught.

The potential for legal action in the form of adverse court decisions is also a potential threat of a political nature. Supreme Court action is also a possibility given the myriad privacy and search issues that surround genetics and the legal uses of personal genetic information. Law suits and injunctions are almost a sure bet considering the litigious society law enforcement must work in. Whether or not these challenges stand on viable grounds remains to be seen.

Organizational Analysis

In order to evaluate the strengths and weaknesses of the California state law enforcement system, the writer interviewed several managers in organizations that articulate in the California justice system. Some of these individuals comprised the author's earlier NGT panel. Those assisting in this assessment were:

Gregory Cowart, Director, Division of Law Enforcement, California Department of Justice.

Cois Byrd, Sheriff, Riverside County, California

Curtis Hazell, Supervising Deputy District Attorney, Los Angeles County

Joseph Latta, Lieutenant, Burbank Police Department

J. Raymond Wells, Supervising Criminalist, Los Angeles County Sheriff's Department

The writer's own experiences in dealing with local, State and federal bureaucracies contributed to the ultimate evaluation as well. This evaluation focuses on two dimensions of California law enforcement: the strengths and weaknesses of California law enforcement and the receptivity to change demonstrated by the State wide law enforcement system.

The following page depicts a table which estimates the State wide law enforcement system's capabilities and capacity for performance in dealing with the issue question. The individuals identified above aided the author in making the assessments indicated on the table. The table is partitioned into a variety of categories that have great bearing on the process of dealing with the issue and sub-issues. The rating choices range from Superior to Crisis. A legend accompanies the table for reference.

Table No.4

INTERNAL CAPACITY ANALYSIS TABLE

Strategic Needs Capability

CATEGORY	RATING				
	Superior	Above Avg.	Average	Improve	Crisis
Level Scientific Fluency				X	
Research & Development Capability		X			
Interagency Cooperation		X			
Information Management			X		
Communication Infrastructure		X			
Technological Capacity	X				
Training Capacity		X			
Interagency Political Consensus			X		
Political Influence		X			
Legislature Support				X	
Public Support			X		
Attorney General Support		X			
Line Level Support		X			
Labor Union Support		X			
Budget					X
Leadership		X			
Central Coordination				X	
Technical Independence		X			

*Median Ratings, N=5

Legend

Superior	Better than anyone else, Beyond present needs.
Above Average	Better than average. Suitable. No problem.
Average	Acceptable. Equal to other agencies.
Improve	Not as good as it should be. Must be improved.
Crisis	Real cause for concern. Action must be taken now.

Organizational Strengths:

As an amalgam of numerous law enforcement agencies, the California law enforcement system has abundant resources and skills that will facilitate the mission it faces with the use of genetic information spun from the Human Genome Project. The California system inherits each strength and weakness brought to the table by participant agencies throughout the state. The Department of Justice (Cal-DOJ) is at the head of this organization, and as such has accepted the responsibility for the research and development of many cutting edge technologies and techniques.Cal-DOJ is looked to by many smaller agencies for assistance on issues that outstrip local expertise. On the specific point of genetics and microbiology, Cal-DOJ scientists and criminalists have already been exposed to the nuances of DNA typing. This experience has prepared them in some fashion for the next wave of information that is likely to come at or near the end of the issue question in 2004 or 2005. The role that Cal-DOJ has evolved into, has put the agency in a leadership role for dealing with the new and usual. How Cal-DOJ reacts to this type of responsibility seems to hinge somewhat on what role, if any, is played by the FBI. There are multiple examples of FBI technological leadership that was adopted by Cal-DOJ and put to use in this state. In any case, the state does benefit from a superior level of scientific capacity that allows it to deal with new technologies. California is one of the few states that is capable of forging ahead into new scientific endeavor without total reliance on the FBI for guidance or assistance.

A pivotal strength for California law enforcement is the capability to inter-communicate and disseminate information within the law enforcement community. The Commission on Peace Officer Standards and Training (POST), for instance, is a classic example of how important information and training gets shared in the state wide system. POST reflects the superior technological capacity the system is described as having in the above section. This type of centralized training authority has boosted the levels of statewide inter-agency cooperation. The rapid proliferation of regional task forces llustrates California's knack for inter-agency

cooperation on an array of levels. This particular strength is critical to successful state-wide coping with burgeoning genetic applications.

There are second order strengths that will bear directly on the issue question. California's "de facto head" of law enforcement is the Attorney General (AG). The AG is an elected official who is elected every four years. Despite the fact that the office is partisan, the state has benefited from strong AG support over the past 10 years. An attorney general with a clear view point will be crucial to the mission. California's experience with the AG can be considered a strength. In conjunction with the politicking of the AG, comes the political influence waged by the various labor unions and chiefs organizations throughout the state. Though the viewpoints of the organizations vary widely on issues like salary and compensation , there is general agreement on the more parochial issues dealing with the enforcement of the law and related tactics. The political elections of the past 10 years have highlighted the political influence and support these groups can bring to bear. When one rolls these groups into one, they are viewed as an organizational strength for California law enforcement.

Within the rubric of California law enforcement, the public can find the most professional police personnel located anywhere in the world. This observation applies to all levels of the organization from the line level up to the upper echelons of management. Generally, the system enjoys significant line level support in meeting new challenges. Despite the public relations problem of the Rodney King incident, law enforcement personnel are still positively motivated and devoted to the system. This leadership potential increases the odds that difficult or unusual circumstances will be dealt with honestly and intelligently.

California law enforcement is further strengthened by the alliances and inter-cooperation of many professional associations and orders. Groups such as the California District Attorney's Association (CDAA) link important sibling criminal justice organizations with the greater whole of California law enforcement. Similarly, the California Association of Chiefs of Police and the California Association of Sheriffs network individual

organizational executives and constructively add to a team spirit within the California law enforcement organization.

Organizational Weaknesses:

In meeting the issue of Human Genome Project applications within law enforcement one of the foremost organizational weaknesses is the overall level of scientific competency found within the ranks of law enforcement officers. Notwithstanding criminalists and chemists, the organization is devoid of significant scientific fluency. Though the system is absorbing more college graduates into its ranks, most of those individuals sport degrees in non-science disciplines. This situation has set the system up with a certain scientific skill deficit. The technological emergence of personal computers bears some analogy to the situation law enforcement will ultimately face with this particular issue. Fortunately, the computer industry facilitated "on the job training" by designing user friendly devices that could be exercised at home. Even so, law enforcement still lags behind where it should be in the field of information management technologic literacy. Lacking a grounding in biologic sciences and mathematics, our scientific capabilities are degraded. This situation needs to be improved should the organization adequately meet the mission of dealing with emerging genetic and microbiologic science.

The budget status and funding of California law enforcement is in crisis. Though special funding for law enforcement was enacted with Proposition 172, the financial future of most law enforcement agencies is quite dubious. Local governments and their police agencies seem to be existing on a day to day budget basis. The condition of state government funding is not much better.

Reception to Change Analysis

Law enforcement in California has become an adaptive industry. The state system has been conditioned and has a bias toward change. Much of change can be described as experimentation. As a direct result of social and

gtechnological experimentation, California law enforcement in the systemic sense is receptive to change.

Table No. 5

Reception to Change Analysis					
CATEGORY	**I**	**II**	**III**	**IV**	**V**
TOP MANAGERS					
Mentality/Personality/Vision				X	
Skills/Talents					X
Knowledge				X	
ORGANIZATION CLIMATE					
Culture/Norms			X		
Rewards/Incentives			X		
Power Sructure			X		
ORGANIZATION COMPETENCE					
Structure-Organization			X		
Resources		X			
Middle Management			X		
Line Personnel		X			
Median Rating N=5					

I. Custodial, Rejects Change
II. Adapts to Minor Changes
III. Seeks Familiar Change
IV. Seeks Related Change
V. Seeks Novel Change

The chart (Table No.5) portrayed above, summarizes the state wide law enforcement machine's capability for change. The assessments were made by the previously identified panel of law enforcement professionals Gregory Cowart, Cois Byrd, Curtis Hazell, Joseph Latta, Raymond Wells. and the author. The overall level of change capacity as illustrated, seems satisfactory for the challenges of the required change. Specifically, top management is evaluated as having a disposition towards change that bodes well for dealing with the challenges posed by the issue and sub-issues.

Stakeholder Analysis

Stakeholders are those people or groups of people who are concerned about the issue. Each individual stakeholder or stakeholder group will have specific assumptions regarding the issue and how it is

defined through the three delineated sub-issues. These assumptions are not always expressed, but are nonetheless deep-rooted and basic values held by the individual or groups of individuals. The stakeholders and their perceived assumptions are listed below. These assumptions are then plotted on the Strategic Assumption Map according to 1) the author's certainty of the assumption and, 2) the importance of the assumption to the issue. The stakeholder identified as a "snaildarter" (SD) is an individual(s) who might unexpectedly impact strategy and plans in unanticipated ways.

The author was aided by the following individuals in the identification and establishment of stakeholders and the development of the corresponding assumptions:

Gregory Cowart, Director, Division of Law Enforcement, California Department of Justice

Cois Byrd, Sheriff, Riverside County, California

Michael Post, Captain, Glendale Police Department

Joseph Latta, Lieutenant, Burbank Police Department

Susan Hackwood, Dean, Bourns College of Engineering, University of California at Riverside (UCR).

	Stakeholder	**Assumptions**
1.	California Department of Justice	A. DOJ will be technology broker. B. Cost will be excessive.
2.	California Attorney General	A. Will consider subject political and inflammatory. B. Will be concerned with numerous legal challenges.

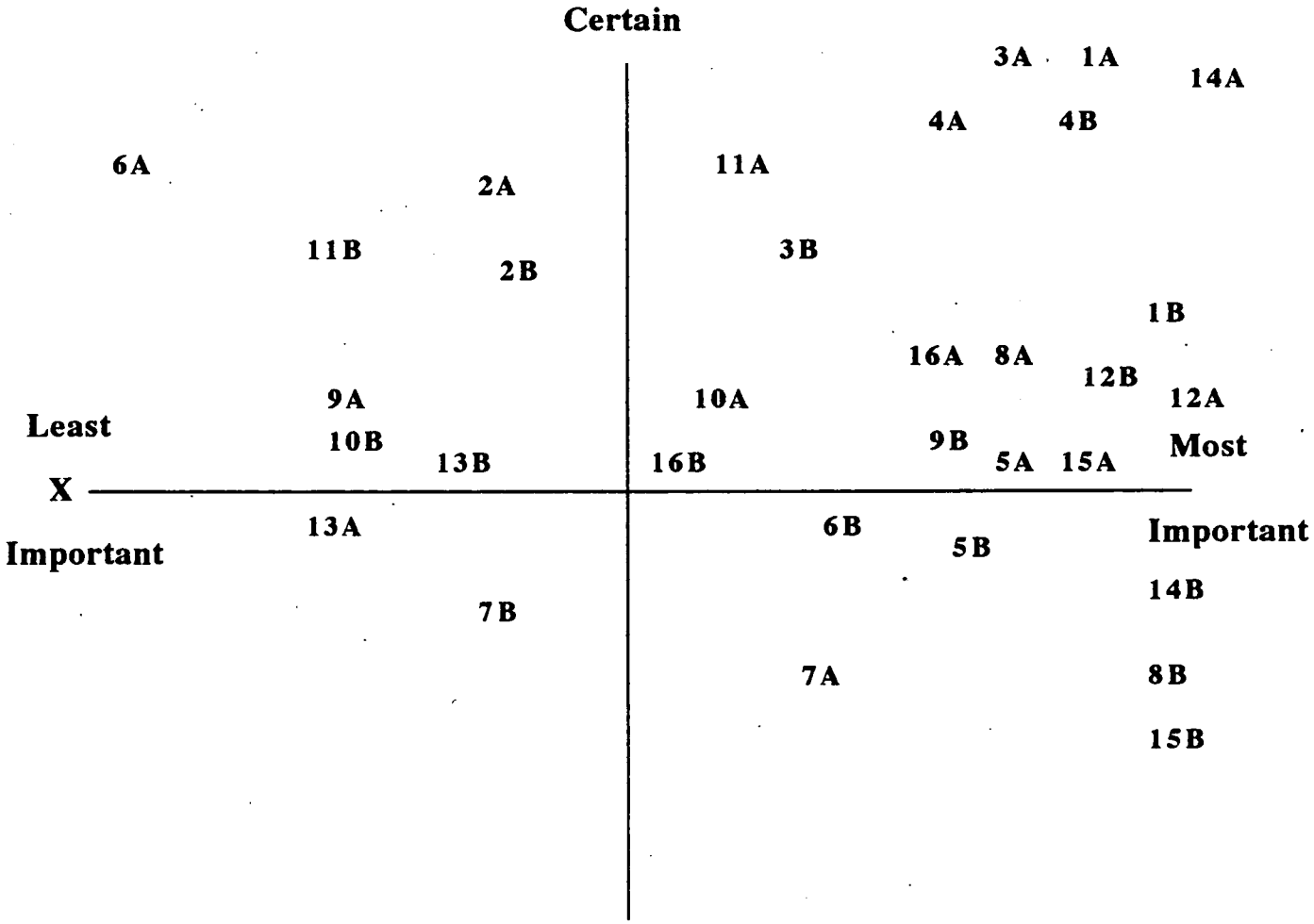
3.	California Chiefs and Sheriffs	A. Genetic exploration like this is necessary B. Line level will be leery of the technology.
4.	Prosecutors	A. Complicates the job but will support. B. May have great evidence potential.
5.	Police Unions/Associations	A. Too technical to understand but will support in criminal applications B. Can be used against them in job actions
6.	Defense Lawyers	A. Will make criminal defense more difficult B. Can be challenged just like fingerprinting.
7.	Insurance Industry	A. A bonanza of information, i.e.. TRW of genetics. B. Will be very difficult to obtain this information.
8.	The National Association for the Advancement of Colored People (NAACP)	A. Will ultimately be used unfairly and in biased way towards their constituency. B. The courts will be on their side.
9.	California State Legislature	A. A political bomb no matter what stand they take. B. Strong public support for use against criminals.
10.	Religious Groups	A. Will undermine religious views and teachings to some extent. B. Have the moral obligation to protect immoral uses of good and bad science
11.	American Civil Liberties Union	A. Information will be used for illegal purposes. B. Will be relied upon to bring suit in appropriate cases.

12.	California Citizens	A. Too complex to personally research B. Great if used to catch crooks. Not so great if it effects personal job or insurance.
13.	The Courts	A. Likely to cause great debate and challenge. B. Will end up like DNA fingerprinting, it's there, but not used a lot.
14.	Criminalists	A. Will get stuck with all the work. B. Inordinately complicates the job.
15.	Federal Equal Employment Opportunity Commision thru the Americans with Disbailities Act (ADA)	A. New classifications of disabled might develop. B. Have authority to step in an control how information is used.
16.	Genome Researchers **(Snaildarter)**	A. Information will be used by unscrupulous people for nefarious purposes. B. No one but they really understands what it all means.

Assumption Map

On the following page, the various stakeholders and their assumptions are plotted on an axis that measures the degrees of certainty and importance that are attached to each of the assumptions. Each of the assumptions and the corresponding stakeholder(s) are listed in the legend that is situated at the bottom of the chart.

Assumption Map



Legend:

1A	DOJ will be technology broker;	1B	Cost will be excessive (CAL DOJ)
2A	Issue will be political & controversial	2B	Uses will be legally challenged (Attorney General.)
3A	Generic exploration is necessary	3B	Line level leery of the issue (Chiefs & Sheriffs)
4A	Makes job more complex, but will support	4B	Great evidence tool (District Attorneys)
5A	Too complex, will support criminal uses of tech.	5B	Could be used against in job actions (Unions)
6A	Will make criminal defense more difficult	6B	Can be challenged just like DNA (Defense Bar)
7A	Information bonanza possible here	7B	Info difficult to obtain (Insurance Industry)
8A	Info. will be used prejudicially against blacks	8B	Courts will favor their side of issue (NAACP)
9A	Political time bomb	9B	Public want info used to fight crime (State Legislature)
10A	Threat/undermines religious beliefs	10B	Feel responsibility to maintain God's province (Religious)
11A	Info. will be used illegally	11B	Will be called upon to bring legal challenges (ACLU)
12A	Too complex to be fully understood	12B	Will support unless it effects jobs & insurance (Public)
13A	Will initiate great debate & challenges	13B	Will be evaluated using DNA typing standards (Courts)
14A	Will bear the brunt of all the extra work	14B	Complicates the job (Criminalists)
15A	Can create new class of disabled	15B	Has legal authority to act in this area (EEOC via ADA law)
16A	Will be used for immoral purposes	16B	Only ones who fully understand the material (Scientists)

Graph No. 21

Assumption Analysis

The assumptions that are held by the various stakeholders are diverse. The assumptions seem to run in veins that relate to the stakeholder's role in society. As developed through the NGT process, it is quite clear that many civil rights groups will be poised ready to strike when this type of technology is introduced. The religious groups of course hold assumptions that underscore their concern for the erosion of divine authority. The courts and its various officials wait for the tsunami of legal activity that will follow this issue. Law enforcement, as represented by chiefs/sheriffs and rank and file, hold a more tentative wait and see posture in the assumptions they hold. Politicians of course, view the issue as a bombshell, one that they really cannot avoid. In the NGT process, the insurance industry was identified as a buzzard that sits perched waiting for scraps of information that they can put to work. Their assumptions reflect the trouble that privacy creates for their industry.[48]

The snaildarter was identified as scientists allied with the work done at the Human Genome Project. Their viewpoint has traditionally been expressed by the National Academy of Sciences. Their assumptions reflect the altruism that they believe permeates their work. They are very suspicious of everyone on the outside who applies it. Their viewpoint is reminiscent of the government scientists who were assigned to the Manhattan Project several decades ago. Scientists involved in this line of work are a mercurial group.

---

[48] Denise Gellene, "Insurer Uses Unproven Cancer Test," Los Angeles Times, 10 October 1992, sec. D2

Alternative Strategy Development

A group of police managers from the Los Angeles and San Diego areas were convened in a Modified Policy Delphi. Comprising this group in addition to the author were the following individuals:

Dan Watson, Commander, Los Angeles Police Department
Eric Lillo, Captain, Los Angeles Police Department
Joseph Latta, Lieutenant, Burbank Police Department
Bill Mc Clurg, Lieutenant, El Cajon Police Department
Commander Willie Pannell, Los Angeles Police Department

This group generated a number of alternate strategies that would be capable of meeting the objectives of the mission statement proposed earlier in this study. The Modified Policy Delphi incorporated oral discussion and voting techniques that were used to structure a list of 8 preferred strategies. The group produced a "top three" strategy list following the extensive discussion and subsequent voting. This vote was accomplished through silent ballot submission. A "run off" deliberation was held because of the closeness in the initial vote. This "top three" group contained the two most popular strategies as well as that proposal that generated the greatest range in voting.

The final three strategies were evaluated by the author and discussed with several consultants outside of the Modified Policy Delphi group. These consultants aided the author in arriving at the adoption of a preferred strategy. Those interviewed for their opinions of this issue and the posited alternative strategies:

Curtis Hazell, Supervising District Attorney, Los Angeles County District Attorneys Office

J. Raymond Wells, Supervising Criminalist, Los Angeles County Sheriffs Department

Rev. Fr. George Horan, Associate Pastor, Archdiocese of Los Angeles Detention Ministry

The criteria used by the Modified Policy Delphi group in evaluating and voting on the various proposed strategies were: **Cost, Social Feasibility, Political Feasibility, Desirability, Stakeholder Support and Legality.**

Based on these criteria, the following strategies were selected by the Modified Policy Delphi group. The "top three" strategies are at the head of the list and are indicated in bold:

1. Convene a task force of law enforcement, special interest groups (i.e.. NAACP, ACLU and religious groups), and legal representatives who can evaluate the information spawned by the Human Genome Project and develop a blueprint for a proper and agreeable use of the information in the public sector.

2. Task POST with the setting of scientific, ethical and training standards necessary for the use of genetic and microbiologic information by law enforcement. POST's work in this regard, would serve as a road map for the appropriate use of genetic information as it is rapidly enters the realm of government service.

3. Through the auspices of an organization such as California Peace Officers Association (CPOA) or Cal-Chiefs, lobby for the enactment of legislation that will facilitate and fund in advance, the use of genetic information in limited areas of government and criminal justice.

4. Propose to the Federal government that they co-manage a technical advisory panel (TAP) with Cal-DOJ to monitor and presage the uses of genetic information for all law enforcement.

5. Petition the California State Legislature for the commissioning of a bi-partisan committee to evaluate and then strategize the uses of genetic information spawned by the Human Genome Project.

6. Through POST and statewide training academies, mandate a standard of scientific fluency necessary for all law enforcement personnel so that they can competently evaluate and use genetic information within the criminal justice system.

7. Invite private industry interests and research universities into a joint venture to explore and then identify the proper uses of genetic information in the public sector. This strategy would be inclusive of the insurance industry, health care and related groups who would likely benefit from the uses of genetic information on a daily basis.

8. Petition the legislature for a special appropriation to seed a DOJ genetics "delivery" team. This "special project team" would be kept small to ensure the timely identification of training, rules and procedures for the use of genetic information by all law enforcement.

After the voting established the above list and hierarchy, discussions were held in regards the relative pros and cons of the selected strategies. Advantages and disadvantages were solicited from panel members in round-robin form. Discussion of the proposed pros and cons commenced after considerable brainstorming. The advantages and disadvantages of each strategy contained in the "top three" was analyzed.

<u>Strategy Number One</u>: ***California Department of Justice to convene a consortium of groups consisting of special interests such as the ACLU, the NAACP along with religious, law enforcement, scientists, legal representatives (i.e. courts, prosecutors and defense bar) and political scientists to shape the policy for the uses of genetic information gleaned from the Human Genome Project. This policy could then be used as a blueprint for a consensus use of this information in the public sector in the future.***

Advantages:

•This approach could substantially reduce the amount of political and social resistance to the uses of genetic information that would occur at some later point in time. By involving some of the more pertinent stakeholders into a preemptory policy development team at the start, the issue may face much less conflict and acrimony as it moves down the road.

•The cost of this particular strategy is relatively low. This group is formed for the limited purpose of discourse and policy development in future uses of genetic information. No great financial obligation is necessary to get this process going.

•This strategy also serves to lessen the amount of public anxiety over the issue. This tact will introduce a highly technical area of science to a public that may lack a proper grounding for understanding the technicalities and nuances of this particular science.

•The approach allows law enforcement a leadership role in the issue, a position which guarantees some element of control over the direction of the consortium. Pursuit of this strategy insures that criminal justice is not a last minute addition to a policy development group.

Disadvantages:

•The strategy could backfire in an attempt to find consensus. The reverse could occur and drive a wedge between groups that would necessarily have to cooperate together on an issue of such great importance.

• The strategy could be very time consuming and still potentially produce nothing more than an agreement to disagree among some of the more ideologically opposed who comprise this group.

•This strategy divulges law enforcement's specific interests to a group that has historically opposed many criminal justice programs of the past. This situation may cause a quagmire for law enforcement that could prevent them from emerging with any credible plan for the preparation and use of genetic information from the Human Genome Project.

Strategy Number Two: ***Appoint POST as the lead agency to develop scientific, ethical and training standards necessary for the use of genetic and microbiologic information uncovered by the Human Genome Project for law enforcement. POST's work would serve as the template for the use of this type of information by individual agencies throughout the state.***

Advantages

•Creates a set of standards that can be broadly applied throughout the criminal justice community for the use of genetic science as defined in the areas of project sub-issues.

•This strategy appoints a credible body to an important and profound task that will effect law enforcement for years to come. Credibility being a critical feature to any future acceptance of a plan for the management of this information and it's use in varying applications.

•This plan will serve to reduce rivalries amongst the various law enforcement entities that have significant roles to play in the issue.

•This strategy creates a clearinghouse that allows for "one stop" genetic information shopping for criminal justice agencies that operate in the large California law enforcement system.

•The strategy would hopefully lessen some of the political meddling that could occur with this issue as it evolves more completely in the next 10 years.

Disadvantages

•This strategy may be developing parameters and standards for training of law enforcement officers that could change overnight with new discoveries in genetics. Additionally, it is questionable as to whether or not POST can stay connected to genetics beyond the intitial period necessary to develop standards and guidelines. Long term technologic monitoring will be necessary in what will likely be an ever changing science.

•The strategy has a narrow scope in terms of stakeholder involvement. The plan would require POST to identify stakeholders and bring critical players together to fashion a workable arrangement for all involved. This is a tremendous burden for an agency that is already carrying a full load of duties and responsibilities.

•The strategy places a heavy scientific and intellectual burden on an agency that is already strapped for manpower and resources to meet it's basic mission.

•The strategy may become mired in the morass of bureaucracy found in state and local government. This situation could consume valuable time that will be necsessary to stay abreast of scientifc developments.

•May impose unrealistic training standards on the criminal justice system. The mandates may outstrip technological competencies of the various sibling organizations in the state law enforcement system.

Alternative Strategy Number Three: ***Prompt a major politically active police organization such as California Peace Officers Association (CPOA) or equivalent to lobby for early legislation that would facilitate and fund the use of genetic information in limited areas of government and criminal justice.***

Advantages

•This strategy brings the issue to the forefront in a hurry. By injecting the issue into the public debate, discussion can begin quickly.

•The legislative branch could fund the further research and development of public policy. Financial assistance will be crucial for productive work on the issue.

•The policy flushes snaildarters at an early point in issue development. The process could obviate the need to deal with such surprise players at some later more critical point in the issue.

•This strategy floats an early trial balloon that can test the waters for future discussions and work in the area. Reactions to this early exposure would help guide future policy setting.

Disadvantages

•The strategy could backfire and cause fear and confusion within political ranks. The message, if distorted, could cause great fear in the minds of the public. An early grave could be dug for the issue.

•The strategy relies on a delivery system that has been hampered by a weak economy and a lack of political will in the form of the California legislature. The issue could be left at the roadside for some other more politically expedient matter.

•The strategy lacks home control. Once injected into the political arena, control of the issue can be wrested away from law enforcement. Law enforcement could lose input on the ultimate decision made in regards to the issue.

Preferred Strategy:

After consultation with the previously identified group of "outside" consultants, the writer has opted for a hybrid strategy that blends aspects of strategies two (POST) and three (CPOA etc.) along with some other modifications into one grand strategy. This choice is a logical approach to what will soon be one of the most vexing issues ever to face California and the criminal justice system. As the stakeholder process illustrated, there is a diverse set of concerned organizations and individuals who will ultimately wade in on this issue. The selected strategy pursues a path of least resistance in meeting the demands of the mission. This preferred hybrid strategy consists of the following component parts:

1. CAL DOJ, POST and CPOA as partners in the identification of genetic applications, training standards and policy setting for the California law enforcement community. This arrangement notes that there will be a heavy reliance on Cal-DOJ for scientific leadership in the process.

2. CPOA, as the voice of the larger law enforcement community in the attempt to attract legislative support and finance for the development of criminal justice programs that can use applied genetic technology in the areas defined by the sub-issues.

3. POST, through CAL DOJ to oversee; CPOA to publicize the efforts of early genetic training for sibling sub-organizations within the California law enforcement body.

4. CPOA to confront the public relations concerns that will continue to emerge as the issue matures.

5. POST and DOJ to be the doorway for new scientific data that bears on the future developments in the issue. DOJ's relationship with the FBI and the Center For Crime Control at the University of California at Riverside (UCR) is crucial to steering relevant science to the rest of the organization for use in the areas defined in the sub-issues.

6. POST and CAL DOJ to share responsibility for feedback and education during the rapid growth phase of genetic information as the issue gains maturity. This point of strategy, again, relies heavily on Cal-DOJ's networking ability with unique institutions like the FBI and the Crime Control Center at UCR for assistance.

This strategy identifies CPOA as the lead professional organization in the development of the issue. There are however, other organizations with significant political and leadership power that would be prompted and expected to cooperate with the CPOA efforts. Organizations such as the California District Attorney's Association and other groups representing chiefs and sheriffs, criminalists and line level units would be called to participate.

Implementation Plan

The preferred strategy in broad form, can be distilled into a plan that allows for a sensible implementation during an extended period of time. This plan should be flexible and panoramic. The plan should be capable of making adjustments and overcoming minor bumps in the road that are bound to occur along the way. An implementation plan for the strategy is proposed in the following manner:

1. Under the aegis of CAL DOJ, POST to bring CPOA and other law enforcement political power brokers together for a 2-3 day technology summit. At this summit, presentations regarding the state of genetic discovery, potential applications and ethical issues can be discussed. The technology summit is not designed as a one time affair, but rather a periodic conference that can shape the development of policy through scientific understanding. As illustrated in the selected strategy, CAL DOJ should access resources such as the Crime Control Center at UCR to ensure academic guidance on the road to the future state. As the organization deals with and applies this particular form of high technology, institutions like the Crime Control Center will be invaluable.

2. Following the technology summit the findings are to be codified into an executive summary that can be read and evaluated by all sibling criminal justice agencies that comprise the organization. An instrument should accompany the summary that measures the interest and need each agency anticipates as the organization moves towards the future state.

3. Based on feedback, Cal-DOJ, POST, CPOA et. al, can go about setting training standards and timetables necessary to meet the evolution of the technology and the applications within areas defined by the sub-issues. This stage in implementation may require a revisit to Step 1 in the implementation plan. Process monitoring and evaluation can be viewed through periodic reconvention of summit participants and concerned others within the California justice system.

4. Concurrent with Steps 2 and 3, is a move by CPOA to engender legislative support for further funding to meet the costs incurred in attaining the desired future state. This step in the plan will require work on both the state and national level. Both the California Legislature and the United States Congress will have to be approached and lobbied for assistance. Additional funding may be available through the auspices of the Crime Control Center at UCR.

5. POST will develop scientific training standards for relevant law enforcement personnel that will enable them to understand and deal with genetic and microbiologic science as the organization moves toward the desired future state.

Implementation Plan Analysis and Post-Script

This plan is an encompassing proposal that attracts several large units in the California law enforcement organization into a consortium that will evaluate and then apply genetic technology as prompted by the Human Genome Project. The consortium needs a visible leader and coordinator. This role has been bestowed on The California Department of Justice primarily through the Division of Law Enforcement. The Director of the

Division of Law Enforcement then becomes the "de facto" executive who oversees the plan.

The author interviewed and consulted with the current director, Gregory Cowart. It is Cowart's opinion that CAL DOJ is best suited for the central coordinating role called for in the preferred plan. Cowart believes that genetic technology and other forms of cutting edge science should be evaluated through an academic filter before the organization begins flirting with applications. Cowart believes that the Center for Crime Control at the University of California at Riverside is an obvious candidate for this role.

The author interviewed and consulted with the Dean of the College at UCR where the crime control center is currently housed. Dean Susan Hackwood of the College of Engineering, believes that the college is suited for aiding the organization in the manner described above. Hackwood described the college's current efforts in facilitating the transference of robotics and digital technology into applied law enforcement settings. Hackwood opined that genetic science could also be incorporated into the college's crime control efforts. Hackwood stated that UCR has the resources in the College of Biological Sciences necessary to help in the assumption of genetic research, evaluation and application responsibilities.

The costs of this plan do not appear to be overly significant. The initial phases of the plan call for the monitoring and application study of Human Genome Project generated information. If in fact UCR, through DOJ, takes the lead in the scientific areas related to the issue, the costs to the organization are minimal. As the Human Genome Project reaches conclusion and genetic science is applied in the sub-issue areas, the costs will probably rise.

Transition Plan

The proposed strategy in this paper deals with the issue of changing organizational culture and conceptual focus for the organization that has been described as California law enforcement. The strategy requires that law enforcement shift from its historical reputation as a front line responder to a level of sophistication that is capable of understanding and evaluating the cutting edge of biological science. The unveiling of the information age has served notice that society and the workplace will be undergoing great fundamental changes that are driven by significant scientific achievements. These developments now pressure law enforcement to devote more time and energy in the areas of high technology, quite possibly at the cost of time and training spent in other more traditional areas. As much as law enforcement abhors the "technocrat" or "techno-geek", these individuals will be indispensable to the success of police systems in the desired future state.

To facilitate a change that embraces the development of high technology scientific applications such as human genome genetics, the conglomerate of California law enforcement must undergo significant change. At present, there is almost a lopsided emphasis on traditional skills within sub-organizations within the California law enforcement organization. Traditional emphasis on shooting and arrest techniques illustrate the blind eye that has been turned towards the approaching wave of information and scientific developments headed toward the organization. Very few managers are aware of the demonstrable change that will occur when these technologies are applied. Changes not only in the way business is conducted but also the change experienced in the culture of police departments, sheriff's offices and special agents that comprise the overall law enforcement organization of California.

For the California law enforcement organization to be a functional system in this upcoming scientific age, it must become capable of exploiting the

newest technologies and information that spring forth from scientific exploration like the Human Genome Project.

This period will be doubly shocking for law enforcement. In addition to having to contend with the rapid developments in genetic research, the organization must grapple with the emergence of such things as interactive multimedia, the emergence of digital technology, the "information superhighway" and robotics. These challenging developments will require the organization to better balance priorities between the maintenance and delivery of traditional services and the incorporation of new technologies into day to day operations. These requirements effect all agencies that make-up the consortium of the California law enforcement system that is the organization working towards the desired future state.

The first step in the process of change will involve the coming together of The Commission on Peace Officer Standards and Training (POST), California Department of Justice (Cal-DOJ), and the California Peace Officers Association (CPOA) as partners in the identification of potential genetic applications and the resultant training and policy standards necessary to functionally utilize the technology as defined by subissue parameters. As put forth in the strategic planning section, CAL DOJ would work through the activities of an academic institution like the College of Engineering at University of California at Riverside (UCR).

The second step requires CPOA to involve itself as the legislative spokes piece to attract support for the funding of on-going genetics related study and applications that will be uncovered through activities at institutions like UCR.

The third step involves DOJ through CPOA and POST, in the task of selling the need for genetic training to sibling organizations within the California law enforcement system. At this stage of the process, associations such as 'Cal-Chiefs" and "Cal-Sheriffs" will be enjoined for their important assistance. Professional organizations representing other constituent groups in the California law enforcement system such as the California District Attorney's Association (CDAA) and groups

representing criminalists will also have important roles to play in the process as well.

The fourth step requires CPOA to maintain public and government relations necessary to deal with controversial new genetic issues, by helping to deflect public concern about the development of a "Manhattan Project "within the ranks of local police departments who make up the California law enforcement organization.

The fifth step is a crucial one that requires CAL DOJ and POST to act as a clearinghouse for technical information that will be developed by the genome project that has potential application within the law enforcement environment. This step will necessarily involve an institution like UCR for academic guidance. The Bureau of Forensic Services of the California Department of Justice (BFS) will have a support role within DOJ as an additional source of expert advice and opinion on subsequent uses of genetic information uncovered by the Human Genome Project.

The sixth step requires DOJ, POST and CPOA to share responsibilities for evaluating the state of genetic evolution and the applications relevant to law enforcement. The methodology for this step can be accomplished through close cooperation with an institution such as UCR. Through UCR, the organization can "one stop shop" for academic guidance in all the various areas related to application of the technology. The institution has resources in areas that range from engineering to public policy. A catalyst for this particular step in the process, is the involvement of the professional organizations eluded to previously. From "Cal-Chiefs" to California District Attorney's Association; these groups will serve as mouthpieces for the many individual members that comprise the California law enforcement system.

In the strategic planning process, the following individuals and organizations were identified as the major stakeholders:

1. Director, California Department of Law Enforcement
2. California Attorney General

g

3. President, Organizations of California Chiefs and Sheriffs
4. President, California District Attorneys Association (CDAA)
5. President, California Organization of Police and Sheriffs COPS)
6. Chairperson, California Bar Association
7. Representatives of the Insurance Industry
8. President, NAACP
9. Leaders of the California Assembly and Senate
10. California Religious Leaders
11. Director, ACLU
12. The Public
13. The Municipal, Superior, Appeals and Supreme Courts of California
14. Professional society ofcriminalists and criminal justice technicians
15. The Federal EEOC
16. Researchers allied in the Human Genome Project (Snaildarter)

Of these individuals and organizations identified as stakeholders or snaildarters, and in analysis of other possible key players, the author developed a group of individuals as players within the critical mass. The author was assisted in the development of this critical mass group by:

Cois Byrd, Sheriff, Riverside County, California.
J. Raymond Wells, Supervising Criminalist, Los Angeles County Sheriff's Department.
Gregory Cowart, Director, Division of Law Enforcement, California Department of Justice.

1. The California Director of Law Enforcement (DLE).
2. The California Attorney General (AG).
3. President, California Peace Officers Association (CPOA).
4. Executive Director, Commission on Peace Officer Standards and Training (POST).
5. President, California Police Chiefs Association (CAL CHIEFS).

6. President, California Sheriff's Association (CAL SHERIFFS).
7. President, California District Attorneys Association (CDAA).
8. Chief, California Department of Justice, Bureau of Forensic Services(CAL DOJ-BFS).

The following charts describe and display the commitment profile of each of these individuals and the organizations that they represent. Narrative follows that will explain what each respective plot represents and how each actor fits in to the overall process. The first Chart (No.5) will present the process of "commitment planning," the second Chart (No.6), the "readiness and capability of individuals critical to the change effort.

Commitment Planning Chart No.5

Actors in Critical Mass	Block Change (Level I)	Let Change Happen (Level II)	Help Change (Level III)	Make Change (Level IV)
California Attorney General			XO	
President- Calif. Peace Officers Association		X ——→	O	
President- Calif. Police Chiefs Association		X ——→	O	
President-Calif. Sheriffs Association		X ——→	O	
President-Calif. District Attorneys Assoc.			XO	
Director- Calif. DOJ Div. of Law Enforcement		X ——→		O
Commission on POST			XO	
Chief, Calif. DOJ Bureau of Forensic Services	X ——→		O	

Will Cause Failure if Acts Against

Will Achieve Success if Acts in Favor

LEGEND

X= Current Position

O= Where You Want Them

—> Work/Movement Required

Readiness/Capability Chart

The following chart lists the individuals who are critical to the change effort. Each is ranked (high, medium or low) according to their readiness and capability with respect to the change

Chart No.6	Readiness			Capability		
Players in Critical Mass (Readiness/Capability)	High	Medium	Low	High	Medium	Low
Attorney General		X		X		
President, California Peace Officers Association		X			X	
President, California Police Chiefs Association		X			X	
President, California Sheriffs Association		X			X	
President, California District Attorney's Assoc.		X			X	
Director, Division of Law Enforcement (Cal DOJ)			X	X		
Commission on POST	X				X	
Chief, Bureau of Forensic Services (Cal DOJ-BFS)			X	X		

Director, California Department of Justice, Division of Law Enforcement: The Chief for the Division of Law Enforcement is a pivotal player in the execution of the plan. The Chief's organization pulls in with it, sibling organizations that are comprised in critical mass. Groups such as POST and the Bureau of Forensic Services have significant ties to this individual. So immersed is this person in day to day management responsibilities within DOJ, he has a relatively low level of readiness for the onset of the project. It is necessary for this pivotal player to move from a level of low readiness to high readiness. This player's capabilities are evaluated as significantly good. It is believed that once he is postured properly for this change to occur, he will be extremely competent in his role as a change agent. Much of the effort needed to make this commitment change comes from subordinates and respected colleagues who need to identify the significance of genome research and applications within the subissue areas.

The author has personally met and discussed this issue with California's current DLE. The DLE was recently reassured that he will remain as California's director based on the 1994 reelection of the California Attorney General. The DLE is poised as the individual in the critical mass who can influence shifts on the part of other mass members. Having been apprised of the author's research, the DLE directed the author to the University of California at Riverside in attempt to establish assistance from academia. At the time of this writing, the Fall of 1994, the DLE is interested and determined to secure a genetics component in the crime control work done at UCR. The DLE is fully cognizant of his role and accepts the responsibility as the head for the apparatus that will take the organization towards the desired future state

As represented in Chart No.5 on page 134, DLE is in the process of moving from a level 2 to a level 4 position.

California Attorney General: The Attorney General's current position reflects a bent toward the future that places him in a position where he would be expected to provide a level of active participation in the implementation of the project. The Attorney General was recently

reelected to another four years in office. This development guarantees a degree of consistency through the transition period.

Although he may have only a superficial understanding of genetic technology and its potential applications within law enforcement, his visible presence in the movement of the plan will give great impetus to project success. As a politician, he is sensitive to any potential for political embarrassment. As the organization moves toward the future state there is a relative certainty that intense political and legal debates will occur regarding government use of genetic information. The futures analysis portion of this project was rich with the potential spin off for polemic social issues generated by the uses of genetic information. The Attorney General is a highly competent man with superior leadership and motivational skills. His high assessment in capability suggests that he will be a pivotal player in plan success. Should he take an adversarial role to the project, the plan would face a very uncertain future.

As a political entity, the Attorney General must steer away from potential political confrontations that might mire the issue. As a result, the Attorney General should be held to a level three commitment where he helps change happen, but avoids potential political friction by participating at the more cutting edge position in level four. Nonetheless, the Attorney General has to be seen as front line supporter for the application of human genome information within sub-issue parameters, regardless of his/her political affiliation. This move on his part, will encourage others in the political arena to take that step with him. His direct and active leadership will filter down through the California law enforcement organization's systems and positively effect some of the other critical mass players who are allied with him in the same organization.

The responsibility for influencing the Attorney General, rests with his appointed Director of Law Enforcement. The DLE as previously noted, is postured in such a way so as to make this happen.

President Of The California Peace Officers Association (CPOA): This individual and the organization that he/she brings to the issue plays a very important role. CPOA has emerged as the true professional spokes piece for the myriad issues confronting law enforcement today. The direction that CPOA heads becomes the navigation point for most of California law enforcement. Seen not so much as a labor organization, CPOA is viewed as a professional association that deals with the technical and future issues facing the professional law enforcement officer. The California law enforcement organization looks to CPOA for guidance on emerging issues such as that which is the subject of this research.

The president of the association serves a one year term after ascending through chairs of vice-presidency. This person would necessarily have to become more technology applications oriented in order to properly confront the issue. The president with all the various CPOA sub-committees could certainly find, or if need be christen, a group to maintain the liaison with the application side of the strategic plan. There is ample evidence in CPOA's past to suggest that this critical mass player is capable of fulfilling this role. Technically focused subcommittees have been commissioned within CPOA on numerous occasions in the past.

As pointed out previously, the CPOA is viewed as a very credible professional association that deals in law enforcement's most legitimate issues of the present and the future. As a result, it will be necessary to move CPOA from a level 2 to a level 3. In the end analysis, CPOA has the tools and reputation that is capable of helping this change to happen.

The DLE is identified as the catalyst to cause the appropriate shift on the part of CPOA. In the capacity of the DLE, the director has frequent contact with the leaders of CPOA. To set the change in motion, the DLE would use on of these frequent contacts to unveil the plan for attaining the desired future. In the alternative, the DLE could prompt a meeting for the presidents and directors of this organization and other critical mass players. In this forum, the DLE could then begin the process needed in transition to the future state.

The Executive Director, Commission on Peace Officer Standards and Training (POST): The Commission on POST is a very supportive critical mass player and is currently poised in a proper position in terms of commitment. Through its trademark programs such as the Command College and the Supervisory Leadership Institute, POST has assumed a significant role in the development of police organizations for the new millennium. POST has demonstrated a competency in the research and development end of interactive multimedia and the incorporation into law enforcement circles of digital technologies. In order to fulfill the role of facilitator or assistant, POST would more than likely have to expand in size and mission complexity.

President, California Association Of Chiefs Of Police: The president of "Cal-Chiefs" and the organization that this player represents, is another member crucial to the proper execution of the plan. The constituencies of this organization represent myriad sibling organizations in the large California law enforcement system. The organization carries political and professional influence that can help change happen. This group and the similarly structured "Cal- Sheriffs" are both currently poised in positions where they would be likely to allow change to happen. The shear complexity of the issue makes it vital that this group moves up from level 2 to level 3 commitment in the transition to the future state. This group will need to assertive in order to make desirable change happen. Collaborative efforts between sibling groups such as "Cal-Chiefs" and "Cal-Sheriffs" will be an important activity likely to increase the overall success of the plan.

The Director of Law Enforcement will be the agent to cause the shift from level 2 to level 3. As posited in the previous analysis of CPOA, the DLE can accomplish this on an informal or formal basis.

President, California State Sheriffs Association: There are great similarities between this person and the president of "Cal-Chiefs." An interesting difference between these two groups lie in the fact that county sheriffs are elected officials, police chiefs are not. This possibility of

political influence causes some concern as to long stay commitment on the part of this critical mass player. It is believed that most political heat will be generated at the higher level of political exchange, i.e. attorney general and not so much at the level of a professional organization like Cal-Sheriffs. As mentioned previously, both these organizations need to be moved from level 2 to level 3.

The DLE is called upon again to influence this shift from level 2 to level 3. Previously identified methods of causing this shift apply in this instance as well.

President, California District Attorneys Association (CDAA): This critical mass player and his constituent group are one of two critical mass players that are properly positioned to make the transition to the future state. The CDAA is an organization that has emerged as a bridge between some of the natural impediments that keeps prosecutors distantly apart from the delivery side of law enforcement services. Since the applications of human genetic information have already arrived in the courtroom, these individuals will be relied upon for support and legal direction through the transition management period. This group does not follow dictates of any other group or elected official, but they do cooperate well in ventures of mutual interest in the criminal justice system. CDAA's technical assistance in the development of DNA legal processes identifies a past history that portends success in future microbiologic ventures in the criminal justice system. CDAA will be necessary in the role of helping change happen.

This player would also be targeted for influencing by the DLE. Though no substantive change in commitment is necessary at this point, long term buy-in and commitment to the process is important to the transition. Like other cases of shift influencing, the DLE can select a strategy based on the level of professional comfort the DLE has with this player.

Chief, California Department Of Justice, Bureau of Forensic Service (Cal-DOJ BFS): This critical mass player represents the best known scientific resource belonging to the California Department of

Justice. This group is accountable to both the DLE and the Attorney General. The BFS is generally recognized as an ultimate authority in most scientific processes available to California at the time of this writing. Since genetic applications obviously require scientific processes and standards, it becomes evident that this player will be a crucial participant in the critical mass. As a leader and authority in criminalistics, this member wields influence that stretches across the immense organizational geography of the California law enforcement system used in this study.

In evaluating capabilities and readiness, it is obvious that BFS scientific competency is at a very high level. BFS has been assessed as currently postured in a position of blocking the plan. This evaluation is made based on a historical tendency for criminal justice scientific processes to move slowly. This type of reaction is often nothing more than the use of proper caution in the implementation of newer science. This situation in the context of the desired future state constitutes virtual blockage of the plan unless changes are made.

BFS will be looked to by other critical mass players for guidance as the organization moves through the transition period. Though the plan cites the use of University of California at Riverside as a scientific sounding board, BFS has the experience and the point of view to properly analyze emerging science that might be used by the organization. This calls for BFS to emerge from the traditional practitioner role and assume more of a research and development player. As the subject organization moves towards the future state, BFS will be looked to for increasing levels of leadership and guidance.

The influencing of this shift rests again with the DLE. It is fortunate that BFS is organized under the DLE. As a result, the DLE will a greater opportunity for influence with this player as opposed to some other members of the critical mass.

Management Structure

The structure selected to perform the management function of this plan is a hybridization of several different configurations. In this scenario, the California Attorney General functions as the chief executive. As such, he becomes the executive manager. The Attorney General is one of the original stakeholders in this project and is a member of the critical mass. As the chief law enforcement executive officer in the state he enjoys the respect of most law enforcement officers, and most of all, he has good personal relationships with all the "critical mass" players. The Attorney General is the nominal boss for the Director of Law Enforcement, the individual identified as possessing the "make change happen" role in this project. The Attorney General can appoint the Director of Law Enforcement as the true project manager. This results in the maintenance of the politically vulnerable Attorney General at a level three and inserts the less political DLE in the role of project manager. This opening step in the construction of the management structure maximizes the political clout of the Attorney General and the more personal executive and operative relationships enjoyed by the DLE.

The author has interviewed the DLE regarding this relationship and the roles assumed by the DLE and the Attorney General. The DLE has expressed a firm confidence that this type of relationship would be proper and succesful for proper management of the transition.

For several reasons that include the development of ownership, the stimulation of interest, the maintenance of academic inquiry and the solicitation of valuable stakeholder input, other structures must be used as well. In this project of human genetic information exploration called the Human Genome Project, a "constituent representative" style will be used. The DLE should accomplish through the auspices of Crime Control Center at the University of California at Riverside (UCR) or similar program at an institution of higher learning. At the direction of the DLE and through UCR, a panel of users, scientific authorities and experts in other fields (i.e. social science, public policy and ethics) can be assembled. This group would be positioned in such a way so as to cooperatively evaluate evolving

microbiologic discoveries from the Human Genome Project and then convert them to appropriate uses within the areas delineated by the subissues. The "constituent representative" style should embody diagonal slice qualities as well. The DLE's panel should not represent just organizational management, but rather a cross section of those ultimately effected by the use of genetic in the criminal justice setting.

Technologies and Methods

The first step in the transition process will involve the assembly of a small team of players who are capable of gaining the commitment of a research institution like UCR to serve as the academic and theoretical springboard that the plan requires. The mechanism for this is partially existent at the point of this research, Fall-1994. Because of this situation, further discussion of methodology will focus solely on the use of UCR as the academic and research institution called for by this plan. This plan does not hinge on the utilization of any particular college or university as long as the role that UCR provides is fulfilled in all its facets.

A team building workshop prompted by the DLE, hosted at UCR, would be a proper method to initiate movement toward the desirable future. This group would group evaluate the most current state of the science associated with the Human Genome Project and discuss strategies pertinent to the on-going monitoring of genetic developments in the laboratory. From this point, the DLE, UCR and others can develop a rational basis for allotting the resources necessary to sustain the plan in the long term.

The DLE's next step in this process would be to convene a technology summit of critical mass players and relevant stakeholders from within the organization. In addition to introducing the concept and exploring the use of human genetics, this meeting would allow the DLE to introduce the novel use of UCR in the plan and solicit feedback from members whose viewpoint and stake be at odds with initial assumptions. The DLE would be most successful if the efforts for influencing commitment shifts were undertaken prior to this summit.

Following the summit, the DLE should identify those attendees/players who should be directly networked to the research institution for interaction through the transition period. This should result in the development of a task force of members who are united through UCR affiliation in a cooperative effort to meet the future state. At this stage it would be appropriate for the various task force members to agree on individual responsibilities and chart them for committee cohorts to see. UCR is in the process of appointing an executive director for maintenance of liaison with the law enforcement community. This person should be authorized by the DLE to provide on site direction under the aegis of the director and make decisions in his absence. The law enforcement liaison/executive director is anticipated to be a retired high ranking law enforcement official with state wide name recognition. If this is the case, this person should be tasked with the chore of responsibility charting by the DLE.

UCR, College of Engineering is on-line with dozens of bulletin boards and information services. This technology allows for task force members to maintain constant contact with developments being evaluated and worked on at the university. Notwithstanding this capability, the task force should schedule periodic meetings where members can convene and discuss developments and changes to strategy that may be required.

The DLE and to a lesser extent the AG, must be a visible part of this process. The DLE's active participation with task force members and the university ensures vitality and commitment to the process. Commitment is an extremely important commodity to the success of the plan and arrival at the future state. The Human Genome Project is an on-going scientific venture that could culminate early or extend beyond its projected finishing point late 2004 or early 2005. The futures study identified some of those developments that could push the project either way. In either case, the plan will require the organization's project team to be prepared for a long haul exercise.

The current (Fall-1994) DLE carries the extra burden of ultimately passing the leadership mantle to another attorney general and possibly a replacement DLE. As a political appointee, the potential for replacement is

always present. To provide for maximum results that reach the future state described in previous chapters, the DLE must strive to make the task force and the university connection as perpetual as the project. This requires the DLE to market the task force and the University apparatus to the entire organization. The components for quick saturation of the system exist in the likes of the critical mass players. Through the journals, conferences and ad hoc meetings of the constituencies they represent, the critical mass players can suffuse the rest of the organization with information regarding the services being performed at the University. This activity perpetuates interest and draws the rest of the organization into an "in the know" status.

Timetable

In the first year of the plan, the following steps should be achieved and goals attained:

1. The DLE to meet with small cadre of inside "players" and UCR to gain University commitment to the plan.

2. The DLE convenes a team building workshop to be held at the University for the academic personnel and critical mass players, or their appointed deputies.

3. The DLE to convene a technology summit of critical mass players, their deputies and expansion group of relevant stakeholders.

4. The DLE under the auspices of the Attorney General appoints the organizational task force for work in conjunction with the University.

In the second year of the plan, the following steps should be achieved and goals attained:

5. UCR (or equivalent) goes "on-line" with the task force and the process of Human Genome Project monitoring, assessment, feedback and application begins.

6. UCR and task force meet at least twice for periods commensurate with the level of discovery within the Human Genome Project.

7. Activities at UCR are publicized to all aspects of the organization for use as a resource in the application of genetics within the subissue areas.

8. UCR and the task force go "on-line" with the rest of the organization as a one stop resource for genetics related questions and guidance.

In third year of the plan, the following steps should be achieved and goals attained:

9. The task force and University are fully functional in the discipline of monitoring, evaluation and application of genetic discovery as a result of the Human Genome Project.

10. The task force and the University meet at least twice for periods commensurate with the level of discovery within the Human Genome Project.

Conclusions

What will be the Impact of the Human Genome Project on Law Enforcement by the Year 2004?

1. What impact will the Human Genome Project have on the selection, assignment and promotion of the law enforcement officer of the future

2. What impact will the Human Genome Project have on crime prevention and incarceration strategies for criminals by the year 2004

3. What impact will the Human Genome Project have on criminal investigations by the year 2004?

In the Fall of 1994, the author went to the University of California at Riverside to chair a symposium on the Human Genome Project and its effect on law enforcement as defined by the sub-issues. In attendance were professors and graduate students from the College of Engineering, the College of Biological Science (Departments of Neurochemistry and Biochemistry) and the College of Public Policy. The discussion was quite interesting. The engineers were quick to theorize potential applications in a real life setting for law enforcement. The biochemists were cautious in their estimations of what the project would ultimately unveil and quite concerned that government might use this information for less than altruistic purposes. The public policy experts were quick to express their feelings about the legality and public reaction to government uses of human genetic information. The neurochemists silently nodded and smiled as if to acknowledge that some great booty lay in the human genome which would tell law enforcement why people are bad. All agreed however that law enforcement needs help and guidance in making sense of what can and cannot be done with human genetic information that evolves from the Human Genome Project.

This experience sums up many of this study's findings. As much as science seems to learn about the human genome, the more complex and confusing the technology becomes. As uncovered in the futures research, many genetic scientists have opposing views on the extent to which the Human Genome Project will effect law enforcement. The most tempering and balanced view in answering the issue and sub-issue questions in the estimation of the author was Christopher Wills Ph.D..of the University of California at San Diego. Wills expressed very cautious optimism that genetic discoveries will give us clues as to why people act in particular sociopathic and criminal ways. The genetic markers linked to these behaviors though is a long ways from proving that someone is predestined to act in a particular way. The genetic information obtained from the Human Genome Project begins to answer these questions, but it will not be a clear crystal ball at all. Nonetheless, there is ample evidence to suggest that information will be uncovered that will allow for pre-symptomatic identification of conditions that contribute to aberrant behavior. Additionally, the genetic indicators for many serious medical disorders will be located. As of this writing there are in excess of 300 significant proven genetic landmarks for various maladies known to afflict mankind. These discoveries having been made during the first trimester of Human Genome Project study.[49] As research has indicated this number will be significantly added to by the conclusion of the HGP.

The Human Genome Project will have an impact on how law enforcement goes about its business in the new millennium. As to whether or not genetic information will serve as the basis for selection, assignment and promotion of the future law enforcement officer, that is unlikely. It is possible however that information will evolve to allow law enforcement to identify some medical conditions that may make some employees unsuitable for assignment in environment where genetic triggers may exist. For instance, those with markers for a particular type of cancer, would not be assigned to locations where known carcinogens may be proliferate. Some notorious mental conditions might well be identified genetically. Should that occur, that information will be promptly used barring legal complications. The

[49] The Journal of NIH Research, *Landmarks of the Human Genome, 2nd edition,* 1994

final answer to this particular question is yes, but as to the extent of the yes, more time and study must first occur.

As to crime prevention and incarceration strategies, the same qualified yes answer is given. As Chris Wills has pointed out frequently, a genetic defect requires a series of environmental situations to pass before a condition actually expresses. So it is unlikely that a criminal will be selectively incapacitated because of "bad genes." What the Human Genome Project is likely to uncover are markers for conditions that may contribute to criminal tendencies. To the extent that the gene map can do that, early childhood intervention and later adult treatment may be possible in conditions correlated to criminal behavior.

As to criminal investigations, the Human Genome Project is a definitive yes. As cited in the study, all Project work revolves around the ubiquitous molecule, DNA. The understanding of DNA fingerprinting and the technology used to establish it will undeniably benefit from human genome mapping. The trend to maintain DNA data bases was shown as a likely future. As the genome is completely mapped, the understanding and uses of DNA will accelerate. Large data bases logging individual genetic blueprints is a realistic expectation.

Looming still, is all that which is unknown about the human genome. The law enforcement agency model used in this study has no option but to take steps early on in order to properly manage the ultimate application of what the HGP produces. The study disclosed there is cause enough for the adoption of a plan and strategy that positions the organization to "catch" the information as it evolves, analyze it and then apply it for the maximum good of those the organization serves: The Public. This approach secures that desired future. A future where the organization is not chasing the technology from behind. Rather, a future that has been managed, bit by bit, following thoughtful research, careful analysis and ethical utilization of the technology.

Bibliography

Kevles, Daniel, *In the Name of Eugenics*, University of California Press,1986.

Kevles, Daniel and Hood, Leroy, *The Code of Codes: Scientific and Social Issues in the Human Genome Project*, Harvard Press, 1992.

Wills, Christopher, *Exons, Introns and Talking Genes; The Science Behind the Human Genome Project*, Basic Books, 1991.

--------*DNA Technology in Forensic Science*, National Research Council, National Academy Press, 1992.

Brown, T.A., *Genetics: A Molecular Approach*, Second Edition, Chapman and Hall Publishers, 1992.

Ferrar, Arthur J., *Will There be a Future Use of DNA Technology in California Law Enforcement?* POST Command College Project, Number 11-0203, 1990.

Neal, Timothy P., *A Law Enforcement Plan to Manage Genetic Information,* POST Command College Project, Number 13-0252, 1992.

Watson, James D. "The Human Genome Project- Past, Present and Future." *Science* , April 1990: 248

Bishop, Joseph and Waldholz, Michael, *Genome: The Story of the Most Astonishing Scientific Adventure of Our Time-The Attempt to Map All the Genes in Our Body*. Simon and Schuster, 1990.

Horgan, J, "Eugenics Revisited", Scientific American, June 1993: 121-132 .

Durham, William H., *Coevolution: Genes, Culture and Human Diversity*, Stanford Press, 1993.

Cuticchia, Jamie A.,"Managing All Those Bytes: The Human Genome Project", Science, October 1, 1993: 47-48.

Davis, Bernard D., *The Genetic Revolution: Scientific Prospects and Public Perceptions*, John Hopkins University Press,1991.

"The Human Genome Project", Phi Kappa Phi Journal, Spring 1993.

Kimbrell, Andrew., *The Human Body Shop: The Engineering and Marketing of Life,* Harper San Francisco Press, 1993.

Neel, James V., " The Detection of Genetic Carriers of Hereditary Disease," American Journal of Human Genetics, March-1949: 19-36.

President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research: "Splicing Life," Washignton D.C.: U.S. Government Printing Office, 1982.

U.S. Congress, Office of Technology Assessment, Mapping Our Genes--the Genome Projects: How Big, How Fast? Washington D.C.: U.S. Government Printing Office, 1988.

Lewontin RC, Hartl DL. "Population Genetics in Forensic DNA Typing," *Science*. 254: 1745-1750, 1991.

Cavalli-Sforza LL, Bodmer WF. *The Genetics of Human Poulations*, San Francisco: W.H. Freeman, 1971.

Deka R, Chakraborty R, Ferrell RE. "A Population Study of Six VNTR Loci in Three Ethnically Defined Poulations," *Genomics,* 11: 83-92, 1991.

Gaenselen RE, "Sourcebook in Forensic Serology, Immunology and Biochemistry," Washington D.C.: U.S. Government Printing Office, 1983.

Kirby, LT., *DNA Fingerprinting: An Introduction,* New York: Stockton Press, 1990.

Kolata, G. "Scientists Discover Way of Altering Genes Passed to Offspring." Los Angeles Daily News, 22 November 1994

Lan, NC. "Human Monoamine Oxidase A and B Genes Map to Xp 11.23 and are Deleted in a Patient with Norrie Disease.", Genomics, May 1989: 4.

Bassett, AS. Chromosome 5 and Schizophrenia: Implications for Genetic Linkage. Schizophrenia Bulletin, 1989: 393-402

Rechsteiner, MC. "The Human Genome Project: Misguided Science Policy." , Trends in Biochemical Sciences, December 1991: 455, 457, 459.

Whittaker, LA. "The Implications of the Human Genome Project for Family Practice.", Journal of Family Practice, September 1992: 294-301.

Grimsby, J. " Human Monoamine Oxidase A and B Genes Exhibit Identical Exon-Intron Organization", Proceedings of the National Academy of Science of the United States of America, 1991: 3637-3641.

Jackson, R. " Promote DNA Technology, Panel is Urged." Los Angeles Times, 19 November 1994.

Carey, J. "The Genetics Doctors Roll Up Their Sleeves." Business Week, 30 March 1992: 78-82.

Maugh, T. " Researchers Inject Genes in Two Fights Against Disease." Los Angeles Times, 10 June 1992.

Brownlee, S, and J. Silberner. "The Age of Genes." U.S. News and World Report, 4 November 1991: 65-76.

Maugh, T. "Cluster of Genes Linked to Common Type of Diabetes." Los Angeles Times, 8 September 1993.

Brownlee S, and G Cook. "Tinkering with Destiny." U.S. World and News Report, 22 August 1994, 59-65.

Jacobs, B. "Serotonin, Motor Activity and Depression Related Disorders." American Scientist, Sept-Oct 1994: 456-463.

Maugh, T. "Research Shows a Link Between Age, Cancer Risk." Los Angeles Times, 13 September 1994.

Ingram, C. " Panel reccomends Creation of State Post to Oversee Technology." Los Angeles Times, 16 Spetember 1994.

Maugh, T. " Discovery of Breast Cancer Gene Called Major Advance." Los Angeles Times, 2 November 1994.

Schrage, M. "Secrets of Life Might Be Revealed in a Digital Format." Los Angeles Times, 6 June 1994.

Kolata, G. "Doctors Say Gene Therapy Shows Hope." New York Times, 22 October 1993.

Stolberg, S. " Researchers Link Gene to Aggression." Los Angeles Times, 22 October 1993.

Courteau, J. "Genome Databases." Science, 11 October 1991: 201-207

Durham, William H. *Coevolution: Genes, Culture, and Human Diversity,* Stanford University Press: 1994

Ruthen, R. " Revealing the Hidden Sequence; Profile of Frederick Sanger." Scientific American, October 1993: 30-32.

Lattin, D. "Secret Files on Americans' Genes.", San Francisco Chronicle, 17 Feb. 1992.

Carey, J. "The Genetic Map Will Lead to a Pot of Gold." Business Week, 2 March 1992: 74

Lattin, D. "Gene Research Starts Ethics Debate." San Francisco Chronicle, 9 December 1991.

Pollack, A. " Gene Therapy Gets the Go-Ahead." New York Times, 14 February 1992.

Maugh, T. "Genetically Enginered Hemoglobin Tested in Humans." Los Angeles Times, 19 March 1992.

Kolata, G. "Should Children be Told if Genes Predict Illness?" New York Times, 26 September 1994.

Newton, J. "Simpson Case Heightens Stakes in DNA War." Los Angeles Times, 7 August 1994.

Capecchi, M. "Targeted Gene Replacement." Scientific American, March 1994: 52-59.

Capecchi, M. "The New Mouse Genetics: Altering the Genome by Gene Targeting." Trends in Genetics, March 1989: 70-76.

Stolberg, S. "Insurance Falls Prey to Genetic Bias." Los Angeles Times, 27 March 1994.

Blum, D. "Violent Past Spurs Study of Biological Origins of Crime." Los Angeles Daily News, 20 March 1994.

Cook-Deegan, R. "Private Parts." The Sciences, March/April 1994: 18-23.

GLOSSARY OF GENETIC TERMS

allele	-	One of several alternative forms of a gene occupying a given locus on the chromosome.
autosome	-	A chromosome not involved in sex determination. The human genome consists of 46 chromosomes: 22 pairs of autosomes and 1 pair of sex chromosomes.
chromosome	-	A rodlike structure composed of proteins and the cellular DNA that contains the linear array of genes. The backbone of the chromosome is a very long molecule of DNA.
DNA	-	Deoxyribonucleic acid; the molecule that encodes genetic information. DNA is a double-stranded chain of nucleotides held together by weak bonds between base pairs.
DNA fingerprinting	-	Analysis of a DNA from one individual to create a unique genetic profile.
double helix	-	The coiled conformation of two complementary and antiparallel chains of nucleotides.
gene	-	The fundamental physical and functional unit of heredity. A gene is an ordered sequence of nucleotides located in a particular position on a particular chromosome.
gene expression	-	The process by which a gene's coded information is converted into the structures present and operating in the cell.
gene therapy	-	The transference of a normal gene to dysfunctional tissue cells to correct an inherited or acquired defect.
gene mapping	-	Determination of the relative positions of genes on a DNA molecule and of the distance between them.
genome	-	All the genetic material in the chromosomes of a particular organism.

linkage	-	The proximity of two or more genetic markers on a chromosome; the closer together the markers are, the lower the probability that they will be separated during DNA repair, replication, or recombination and hence the greater the probability that they will be inherited together.
locus	-	The position on a chromosome of a gene or other chromosome marker.
neo-eugenics	-	A term often used to describe current methods of fetal-characteristic determination to purge defective genes from the gene pool and reduce or eliminate commonly perceived, socially "unacceptable" human attributes.
oncogene	-	A gene that is associated with cancer. Oncogenes are normally involved in controlling the rate of cell growth.
phenotype	-	The physical properties of an organism that are produced by the interaction of the genotype and the environment.
recessive	-	Pertaining to an allele that is expressed only when present in two copies, one on each member of a pair of chromosomes.
X chromosome, Y chromosome	-	The sex chromosomes; normal human females have a pair of X chromosomes in each somatic cell, and normal human males have one X and one Y.
X linkage	-	The location of a gene or marker on the X chromosome. Recessive, abnormal genes located on the X chromosome will be expressed in more males than females because males lack the second copy of the X that might have carried the dominant copy of the gene.

Command College NGT List for Events

1. NASA Disbanded
2. Law passed requiring prenatal genetic screening
3. President diagnosed with "aggressor"gene
4. Schedule of propensities for expressed behaviors developed
5. Genetic data base for sex offenders is developed*
6. Supreme Court overturns genetic fingerprinting on privacy grounds*
7. Nuclear disaster in the Mideast
8. Government liability found in negligent retention of genetically flawed employee who does harm
9. TRW for genetics information is developed*
10. Science community destroys results of HGP
11. Master Race enclave discovered
12. Racial identity now equates to genetic pool profile
13. Supreme Court validates pre-employment genetic screening
14. Penal system eliminated
15. National DNA tracking system developed*
16. Legislation passed to restrict use of genetic information*
17. Genetic plastic surgery occurs
18. Counterfeit genetic material is seized
19. First cloned human being
20. Riots occur in protest of genetic manipulation and human cloning
21. ADA is rewritten to encompass all genetic defects

22. Super Academy Class of genetic superstars gets underway

23. Genome Project Mapping technique is found to be seriously flawed

24. Public Educational system restructured to match students assigned on the basis of genetic profiling

25. FBI sets up National Genetic Crime Information Center (NGCIC)*

26. First genetic alibi used

27. NAACP comes out in firm opposition to any non-medical use of genetic information*

28. The institution of law enforcement has been abolished

29. Police union sues on basis of bias due to genetic background

30. Study proves that genetically selected officers better reduce crime

31. Darwin's Theory disproved

32. Officer in high profile "Rodney King II" case tests positive for aggressor gene*

33. Sterilization mandated for certain genetically deficient individuals

34. Genetic testing required as a pre-employment condition for all public safety jobs*

35. Certain inter-racial relationships banned from breeding

36. The Human Genome Project is a financial flop, ie. significantly unable to deliver within budget

37. The genetic marker for homosexuality discovered

38. Creation of certain genetic classes in society

39. Warfare involving the use of genetic material

40. World War III

NGT for Trends

1. California crime rate*
2. Level of DNA fingerprinting of sex offenders
3. Level of police recruitment based on genetic screening*
4. Level of union activism in the area of recruitment and promotion
5. Funding level for big science projects*
6. Abortion rate
7. Level of nationalized policing efforts
8. Level of public concern over privacy issues*
9. Level of public and private access to genetic information*
10. Level of national drug use
11. Amount of law enforcement collection of genetic related evidence samples
12. Public's acceptance of hyper-technologies
13. Public's fluency in hyper-technology issues
14. Religious and special interest group activity in radical science*
15. Number of eugenics groups in American society
16. Ability to detect the aggressor gene(s) in law enforcement officers*
17. Level of world-wide democracies
18. Quality of genetic forecasts*
19. Level of IQ banded public education programs
20. Amount of crime controlled through genetic based therapies*
21. Level of public's need for police

22. The level of genetic lesions discovered in minority populations
23. Level of genetic treatment mandated for criminal defendants
24. Number of genes positively identified by the HGP
25. Number of private health plans
26. Number of diseases positively linked to genetic markers
27. Ratio of crime caused by those with pertinent genetic deficiencies
28. Number of drug cures for genetic defects
29. Level of government regulation of genetic information
30. Level of genetic therapy required as a component of the sentencing of criminal defendants
31. The level of profitability in the private market effected through the use of genetic screening of employees
32. The level of genetic counselling
33. The number of diseases found socially acceptable by the public
34. The level of Supreme Court hearings on genetic related issues*

*selected as top ten item

TREND NO. 1

PARTICIPANT	IMPORTANCE	CRIME RATE 5 YEARS AGO	CRIME RATE 5 YEARS FROM	CRIME RATE 10 YEARS FROM
SCOTT	50	90	120	150
DE POMPA	75	50	125	150
POST	69	80	130	180
HOEFEL	75	90	115	125
SHOPENN	100	90	120	130
WELLS	80	90	105	120
SCHRAM	60	95	125	150
KAMLAN	100	90	110	120
HIGH	100	95	130	180
LOW	50	50	105	120
MEDIAN	75	90	120	130
AVERAGE	76	84.3	118.75	140.6

TREND NO. 2

PARTICIPANT	IMPORTANCE	GENETIC SCREEN 5 YEARS AGO	GENETIC SCREEN 5 YEARS FROM	GENETIC SCREEN 10 YEARS FROM
SCOTT	60	100	100	110
DE POMPA	50	100	100	125
POST	72	100	110	140
HOEFEL	70	100	100	105
SHOPENN	50	100	100	120
WELLS	80	100	100	125
SCHRAM	85	100	110	130
KAMLAN	100	100	100	125
HIGH	100	100	110	140
LOW	50	100	100	105
MEDIAN	70	100	100	125
AVERAGE	71	100	102.5	122.5

TREND NO. 3

PARTICIPANT	IMPORTANCE	FUNDING LEVEL 5 YEARS AGO	FUNDING LEVEL 5 YEARS FROM	FUNDING LEVEL 10 YEARS FROM
SCOTT	70	80	110	150
DEPOMPA	90	100	150	200
POST	68	90	120	125
HOEFEL	100	80	125	150
SHOPENN	100	75	120	120
WELLS	80	125	100	100
SCHRAM	70	110	110	150
KAMLAN	90	90	110	120
HIGH	100	125	150	200
LOW	68	75	100	100
MEDIAN	80	90	110	125
AVERAGE	83.5	93.75	118	139

TREND NO. 4

PARTICIPANT	IMPORTANCE	PUBLIC CONCERN 5 YEARS AGO	PUBLIC CONCERN 5 YEARS FROM	PUBLIC CONCERN 10 YEARS FROM
SCOTT	75	100	120	130
DE POMPA	75	100	150	175
POST	67	110	90	130
HOEFEL	70	95	100	105
SHOPENN	85	100	100	175
WELLS	75	85	150	200
SCHRAM	55	100	150	175
KAMLAN	90	95	105	110
HIGH	90	110	150	200
LOW	55	85	90	105
MEDIAN	70	100	100	130
AVERAGE	74	98	120.6	150

TREND NO. 5

PARTICIPANT	IMPORTANCE	INFO ACCESS 5 YEARS AGO	INFO ACCESS 5 YEARS FROM	INFO ACCESS 10 YEARS FROM
SCOTT	75	100	120	130
DE POMPA	100	100	125	150
POST	71	50	115	120
HOEFEL	90	10	150	200
SHOPENN	75	25	150	100
WELLS	85	100	100	125
SCHRAM	65	50	125	150
KAMLAN	90	100	115	135
HIGH	100	100	150	200
LOW	65	10	100	100
MEDIAN	75	50	120	130
AVERAGE	81.3	66.9	125	138.7

TREND NO. 6

PARTICIPANT	IMPORTANCE	RELIGIOUS ACT 5 YEARS AGO	RELIGIOUS ACT 5 YEARS FROM	RELIGIOUS ACT 10 YEARS FROM
SCOTT	75	110	120	120
DE POMPA	45	50	120	150
POST	70	70	150	190
HOEFEL	70	80	115	150
SHOPENN	25	100	150	250
WELLS	90	50	150	200
SCHRAM	75	90	125	175
KAMLAN	50	100	110	150
HIGH	90	110	150	250
LOW	25	50	110	120
MEDIAN	70	80	120	150
AVERAGE	71.2	61.5	130	173

TREND NO. 7

PARTICIPANT	IMPORTANCE	AGGRESSOR GENE 5 YEARS AGO	AGGRESSOR GENE 5 YEARS FROM	AGGRESSOR GENE 10 YEARS FROM
SCOTT	50	100	100	110
DE POMPA	75	100	100	125
POST	66	20	110	150
HOEFEL	90	90	110	125
SHOPENN	100	0	175	225
WELLS	75	100	100	150
SCHRAM	90	50	115	150
KAMLAN	70	100	100	175
HIGH	100	100	175	225
LOW	50	0	100	110
MEDIAN	72.5	95	105	150
AVERAGE	77	82.5	113.7	151.2

TREND NO. 8

PARTICIPANT	IMPORTANCE	QUALITY PREDICT 5 YEARS AGO	QUALITY PREDICT 5 YEARS FROM	QUALITY PREDICT 10 YEARS FROM
SCOTT	80	100	110	120
DE POMPA	100	75	125	185
POST	75	10	125	160
HOEFEL	90	50	130	180
SHOPENN	100	25	150	200
WELLS	100	50	150	200
SCHRAM	90	70	150	200
KAMLAN	80	100	125	175
HIGH	100.00	100.00	150.00	200.00
LOW	75.00	10.00	110.00	120.00
MEDIAN	85.00	60.00	125.00	182.50
AVERAGE	89.38	60.00	133.13	177.50

EVENT NO. 1
Sex Off. Genetic
Data Base

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	80	5	40	80	8	0
DE POMPA	75	5	15	50	10	7
POST	68	3	20	50	5	0
HOEFEL	80	3	10	70	10	1
SHOPENN	75	3	25	50	10	5
WELLS	90	5	10	50	10	5
SCHRAM	75	5	25	45	7	2
KAMLAN	100	3	25	75	10	1
HIGH	100	3	40	80	10	7
LOW	68	5	10	45	5	0
MEDIAN	77.5	4	22.5	50	10	1.5
AVERAGE	80.37	4	21.25	58.75	8.75	2.62

EVENT NO. 2
Supreme Court
Overturns

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	90	5	40	80	8	0
DE POMPA	100	3	35	50	3	10
POST	67	1	25	30	0	8
HOEFEL	90	4	5	20	1	2
SHOPENN	100	5	100	100	2	2
WELLS	100	4	25	50	2	10
SCHRAM	85	5	100	100	3	8
KAMLAN	100	4	5	20	5	5
HIGH	100	1	100	100	8	10
LOW	67	5	5	20	0	0
MEDIAN	95	4	30	50	2.5	8
AVERAGE	91.5	3.87	41.87	56.25	3	5.42

EVENT NO. 3
Genetic TRW

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	80	7	0	35	5	5
DE POMPA	90	5	20	45	10	10
POST	74	7	0	40	10	3
HOEFEL	60	8	0	30	8	5
SHOPENN	40	8	0	25	1	10
WELLS	75	6	0	40	10	8
SCHRAM	60	7	0	30	7	5
KAMLAN	75	5	30	60	8	8
HIGH	90	8	30	60	10	10
LOW	40	5	0	25	1	3
MEDIAN	74.5	7	0	37.5	7.5	6.5
AVERAGE	69.25	6.62	6.25	38.1	7.3	6.75

EVENT NO. 4
National DNA Tracking

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	90	3	60	90	8	0
DE POMPA	90	3	50	90	8	5
POST	72	5	0	75	8	2
HOEFEL	100	3	20	80	10	1
SHOPENN	75	8	0	90	8	2
WELLS	100	3	30	100	7	3
SCHRAM	75	10	0	30	7	5
KAMLAN	35	3	15	55	8	3
HIGH	100	3	60	100	10	5
LOW	35	10	0	30	7	0
MEDIAN	82.5	3	17.5	85	8	2.5
AVERAGE	79.62	4.75	21.87	76.25	8	2.62

EVENT NO. 5
Legislation Restriction on Genetic Use

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	90	3	70	90	5	5
DE POMPA	65	1	75	100	5	5
POST	69	2	50	70	5	5
HOEFEL	90	2	10	60	2	8
SHOPENN	100	2	50	100	8	2
WELLS	75	3	50	65	5	7
SCHRAM	90	5	25	50	4	6
KAMLAN	90	1	100	100	7	7
HIGH	100	1	100	100	8	8
LOW	65	5	10	50	2	2
MEDIAN	90	2	50	65	5	5.5
AVERAGE	83.62	2.37	53.75	79.37	5.12	5.62

EVENT NO. 6
FBI Starts NGCIC

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	90	3	60	90	10	0
DE POMPA	65	8	0	50	7	5
POST	75	3	10	40	10	0
HOEFEL	80	3	15	90	10	1
SHOPENN	75	3	15	100	8	5
WELLS	65	7	0	40	10	3
SCHRAM	70	5	25	75	10	3
KAMLAN	90	8	0	20	6	2
HIGH	90	3	60	100	10	5
LOW	65	8	0	20	6	0
MEDIAN	75	4	12.5	62.5	10	2.5
AVERAGE	76.25	5	17.5	63.12	8.87	2.37

EVENT NO. 7
NAACP Activism

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	60	2	80	100	2	9
DE POMPA	60	2	75	100	4	8
POST	66	1	20	50	0	5
HOEFEL	70	1	20	95	1	10
SHOPENN	35	2	75	100	2	9
WELLS	50	3	50	100	5	5
SCHRAM	50	3	50	100	4	7
KAMLAN	20	4	15	50	4	2
HIGH	70	1	80	100	5	10
LOW	20	4	15	50	0	2
MEDIAN	55	2	50	100	3	7.5
AVERAGE	51.37	2.25	48.12	86.87	2.75	6.87

EVENT NO. 8
RK II Officer Gene

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	90	4	50	100	5	5
DE POMPA	90	3	35	75	8	8
POST	71	3	20	80	7	3
HOEFEL	100	2	25	80	8	1
SHOPENN	100	3	20	65	10	10
WELLS	85	5	25	50	10	10
SCHRAM	100	7	0	50	8	2
KAMLAN	95	3	75	100	9	9
HIGH	100	2	75	100	10	10
LOW	71	7	0	65	5	1
MEDIAN	90	3	25	77.5	8	6.5
AVERAGE	91.37	3.75	31.25	75	8.12	6

EVENT NO. 9
Genetic Pre-Hiring

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	80	5	20	80	5	5
DE POMPA	75	5	10	30	2	10
POST	70	5	10	40	6	4
HOEFEL	90	7	0	40	8	2
SHOPENN	75	5	50	100	9	6
WELLS	100	4	25	50	4	5
SCHRAM	85	5	10	40	8	2
KAMLAN	95	8	0	40	9	4
HIGH	100	4	50	100	9	10
LOW	70	8	0	30	2	2
MEDIAN	82.5	5	10	40	5.5	4.5
AVERAGE	83.75	5.5	15.62	52.5	6.37	4.75

EVENT NO. 10
Med Smart Card

PARTICIPANT	IMPORTANCE	1ST YR	5 YR PROB	10 YR PROB	POSITIVE	NEGATIVE
SCOTT	60	5	30	60	8	2
DE POMPA	90	5	20	45	10	10
POST	73	2	20	50	9	1
HOEFEL	80	3	25	75	8	5
SHOPENN	100	5	30	100	7	9
WELLS	75	3	25	60	10	8
SCHRAM	50	3	20	75	9	3
KAMLAN	35	3	20	40	10	2
HIGH	100	2	30	100	10	10
LOW	35	5	20	40	7	1
MEDIAN	74.5	3	20	55	9	4
AVERAGE	70.37	3.62	23.75	63.12	8.87	5