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Background Essay

In 1983, a report on genetic screening by the U.S. President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research predicted that before the end of the century genetic testing and counseling would become major components of both public health and individual medical care (I. United States. President’s Commission 1983). Ten years after celebrating the sequencing of the human genome, this grand prediction has not yet come to pass (I. Varmus 2010). Improvements in “genetic medicine” — using knowledge about single genes to improve treatment of single-gene disorders — have paved the way for advances in “genomic medicine,” attempts to understand the interactions between genomic and nongenomic factors for the development of “…new diagnostic and therapeutic approaches to common multifactorial conditions” (I. Feero et al. 2010). While significant advances have been made in several areas, including drug development for cancer and macular degeneration, the consequences for clinical medicine “…have thus far been modest” (I. Collins 2010). Still, the question of whether or not to undergo genetic testing has become a matter of common concern, and raises questions concerning the complexity of risk and concepts of a “good life” (VI. Boenink and van der Burg 2010).

Genetic Testing

The purpose of genetic testing is to determine if there are alterations in a person’s genes or in the structure of a gene’s proteins. There are three types of genetic tests: gene tests involving short lengths of DNA or RNA, chromosomal tests in which whole chromosomes or very long lengths of DNA are tested, and biochemical tests in which protein levels and/or enzyme activities are tested (I. NHGRI 2011).

Areas of focus in genetic testing include: 1) prenatal diagnosis; 2) newborn testing; 3) carrier testing; 4) forensic DNA testing; and 5) direct-to-consumer tests.

1) Prenatal diagnosis testing determines whether a fetus is at risk for various identifiable genetic diseases or traits. Since prenatal screening began in 1966 (I. U.S. President’s Commission 1983), the number of metabolic defects and genetic disorders that can be screened for or diagnosed prenatally has expanded greatly. Prenatal diagnosis is made using amniotic fluid, fetal cells, and fetal or maternal blood cells obtained during amniocentesis. Other methods of prenatal screening or diagnosis include: alpha fetoprotein assays, chorionic villus sampling, and ultrasound tomography, which creates fetal images on a screen. Another method, known as fetoscopy, uses a camera on a needle inserted in the uterus to view the fetus (V. Wieacker and Steinhard 2010). In preimplantation genetic diagnosis (PGD), an embryo biopsy is performed to test a single cell for genetic disease (V. Bredenoord et al. 2008). Non-invasive prenatal testing (NIPD) using a maternal blood sample for cell-free fetal DNA/RNA (cffDNA/RNA) as early as four weeks into gestation is currently being tested and may become possible within the next few years (V. DeJong 2010). While testing for PKU and other conditions has been generally successful, cystic fibrosis has proved difficult to diagnose definitively since it can be caused by many different mutations (V. Goetzinger and Cahill 2010).
2) **Newborn testing** involves the analysis of blood or tissue samples taken in early infancy in order to detect genetic diseases for which early intervention can avert serious health problems or death. Newborn genetic testing first came into use in the early 1960s with the ability to test newborns for a rare metabolic disease, phenylketonuria (PKU), which causes mental retardation and can be prevented by following a special diet. Two other examples of newborn screening, in place since the 1970s, are the testing of African-American infants for sickle cell anemia and Ashkenazi Jews for Tay-Sachs disease (V. Fernhoff 2009). Current ethical issues in neonatal testing include the lack of sufficient information provided to parents before obtaining informed consent for testing, and resource allocation decisions regarding societal and individual costs. (V. Levy 2010).

3) **Carrier testing** is performed to determine if an individual has a genetic mutation for a disorder inherited in an autosomal recessive or X-linked recessive manner. Carriers themselves do not have symptomatic disease. Individuals are tested if they have family members with a genetic condition, or if they belong to ethnic or racial groups known to have a higher carrier rate for a genetic disease than the general population (I. GeneTests 2011).

4) **Forensic testing**, the use of DNA evidence in legal cases, has captured the public imagination. Generally, DNA evidence is accepted as reliable, and is admitted as evidence in court. However, the accuracy of DNA fingerprinting is controversial given that “…the result will always be in the form of a probability value” (III. Varsha 2006). The “CSI effect”—an uncritical acceptance of forensic DNA as consistently correct—has been fostered by popular television shows and reinforced by a cultural fascination with technology generally (III. Shelton et al. 2009). The myth that DNA evidence is foolproof undercuts concerns about the potential problems in storing DNA profiles in national police databanks (III. Thompson 2008, Van Camp 2008). “Familial DNA identification”—utilizing a partial match obtained from a DNA database to apprehend criminals—is a new investigative technique that raises serious questions about privacy (III. Dresser 2011). Another new development is molecular autopsy in which an examination of tissue is done post-mortem, particularly to diagnose sudden cardiac death caused by arrhythmia (III. Elger 2010).

5) **Direct-to-Consumer (DTC) genetic testing** is an increasingly important issue. A proliferation of companies now market whole genome testing kits to the general public. The results of these tests may not be reviewed with a healthcare provider or genetic counselor (VII. Annes 2010). The Institute of Medicine and the National Research Council held a workshop in 2009 to develop models for regulating DTC companies and for educating the public about the disadvantages of these tests (VII. Fraker and Mazza 2010).

**Disease-Specific Genetic Testing**

In 1990, the BRCA1 gene mutation was identified as a gene linked to breast cancer by researchers in Berkeley, California. While half of all monogenically determined carcinomas of the breast and ovary are due to a BRCA1 (or BRCA2) mutation (VI. Meindl et al. 2011), the National Cancer Institute reports that monogenic inheritance is “…estimated to account for no more than 5% to 10% of breast and ovarian cancer cases overall” (VI. National Cancer Institute 2011). While genetic testing for BRCA mutations has been available commercially since 1996, the results of an evaluation done by the Centers for Disease Control and Prevention (CDC)
indicated that population-based screening "...is not recommended because of the complexity of test interpretation and limited data on clinical validity and utility." (VII. CDC 2004) In 2005, the United States Preventive Services Task Force concurred with the CDC and recommended that only women with a family history of breast and ovarian cancers be referred for BRCA mutation testing (VII. United States Preventive Services Task Force 2005). Educational materials about gene tests and international directories of clinics and laboratories providing genetic testing services can be found on the Web site GeneTests sponsored by the U.S. National Institutes of Health’s National Center for Biotechnology Information, as well as on MedlinePlus: Genetic Testing located on the U.S. National Library of Medicine's Web site.

As a greater proportion of the U.S. population lives beyond 85 years of age, interest in genetic testing for end-of-life conditions such as Alzheimer Disease (AD) continues to grow. Practice guidelines for assessing genetic risk for AD, a genetically complex disorder, have been developed by the America College of Medical Genetics and the National Society of Genetic Counselors (IV. Goldman et al. 2011). Building on the results of the REVEAL Study, the first randomized control trial to investigate the effect of receiving a "risk curve" on adult children of persons with AD (VI. Roberts et al. 2005), these guidelines aid clinicians with assessing their patients’ risk for developing AD and with counseling them appropriately.

The interpretation of genetic testing results is a complex process. A person’s genotype (complete genomic sequence), acting in concert with environmental influences, creates the phenotype (the observable physical and/or biochemical characteristics). Complex traits are influenced by many genes. If a difference in a gene is found, it could be a disease-causing mutation, or a polymorphism (a natural variation in a gene that has no adverse effect), or an unknown entity that has not yet been reported (I. Feero et al. 2010).

Oversight of Genetic Testing

General guidelines for genetic testing were issued by the NIH Task Force on Genetic Testing in 1997 (I. NIH Task Force 1997). In response to a further recommendation of the Task Force, the Secretary's Advisory Committee on Genetic Testing (SACGT) (1998-2002) was established in June, 1998, by the Department of Health and Human Services to provide oversight of all aspects of genetic testing. SACGT's report on oversight issues was published in July, 2000 (I. SACGT 2000). In 2002, the Secretary’s Advisory Committee on Genetics, Health and Society (SACGHS) was established and was charged with, among other things, (1) providing a forum for expert discussion, deliberation, advice, and recommendations on the medical, ethical, legal and social issues raised by new technological developments in human genetics; and (2) assisting the Department of Health and Human Services with exploring issues raised by the development and application of genetic technologies. In 2008, the committee published the U.S. System of Oversight of Genetic Testing: A Response to the Charge of the Secretary of Health and Human Services, which identified gaps and critical action steps to be taken in the regulation, oversight, and transparency of clinical laboratory quality and validity of genetic tests. In addition, SACGHS made recommendations that would increase the level of current knowledge and interpretation about the clinical usefulness of genetic tests and their results for both health professionals and their patients. The charter for SACGHS expired on February 28, 2011.
After thirteen years of debate in the United States Congress, the Genetic Information Nondiscrimination Act (GINA) was passed and signed into law on May 21, 2008. The law prohibits health insurers or employers from denying coverage or employment on the basis of genetic information. While many states already had laws protecting against genetic discrimination, GINA provides all Americans with a baseline level of protection. The Coalition for Genetic Fairness provides a survey of what GINA does, and more importantly, does not do (VIII. Coalition 2008). One major criticism of GINA is that it protects only asymptomatic individuals – those who have tested positive for a genetic mutation but have not developed the condition. Under GINA, insurance companies would be able to deny coverage once an individual became ill (VIII. Rothstein 2009). The health care reform provisions in the Affordable Care Act preventing denial of claims for pre-existing conditions will complement GINA when they go into effect in 2014 (VIII. Steck 2011).

This annotated bibliography is organized as follows:

I. Overview
II. Privacy/Discrimination
III. Forensics
IV. Counseling
V. Prenatal Diagnosis/Minors
VI. Predisposition
VII. Direct-to-Consumer Genetic Testing
VIII. GINA: Genetic Information Nondiscrimination Act
IX. Search Strategies for Genetic Testing

I. Overviews


Noting the wide impact of genetic testing, Andrews discusses patient self-concept, reproduction decisions, confidentiality, discrimination in health insurance and employment, the need for competent counseling, and the regulations she deems important to help solve dilemmas arising from the ramifications of genetic testing. She delineates the advantages and disadvantages of the three models utilized when discussing genetic testing: the medical model with physician gatekeepers, the public health model with educational and economic benefits, and a fundamental rights model with an emphasis on individual decision-making.


Saying that women are particularly affected by the proliferation of genetic information, Asch and Geller cover three areas: the history of genetics research; a feminist analysis of autonomy, biological determinism, community, and women's moral reasoning in regard to genetic testing; and specific discussions of pre-symptomatic breast cancer testing, prenatal diagnosis and provider-patient relations.


Burgess, from the Centre for Applied Ethics and Department of Medical Genetics, University of British Columbia, argues that genetic testing raises issues beyond those usually associated with informed consent. He discusses the “indeterminate nature of risk” as well as effects on “non-consenting persons.”


Burke and Psaty contend that "...genetic risk information can prevent disease only if it improves the use of behavioral or medical interventions." They argue that true "personalized medicine" begins with a clinician’s intimate knowledge of an individual patient over time.


Collins, current director of the U.S. National Institutes of Health (NIH) and former director of NIH’s National Human Genome Research Institute (1993 – 2008), reviews the scientific accomplishments in genomic medicine since the completion of the Human Genome Project. While genome-wide association studies (GWAS) have discovered a number of common DNA variations important to understanding the development of
common diseases such as heart disease, diabetes, and cancer, Collins reports that “…the consequences for clinical medicine …have thus far been modest.” Advances in clinical medicine include the development of new cancer drugs, breast cancer chemotherapy protocols, macular degeneration treatments, and drug responses for over a dozen drugs. Notwithstanding these accomplishments, “…the Human Genome Project has not yet directly affected the health care of most individuals.”


The Council of Europe updated its protocol on genetic testing to include provisions on informed consent, disclosure of results to family members, the right to know and the right not to know, molecular autopsy, and public health genetic screening programs.


The Council of Europe’s Working Party delineated 13 principles to guide policies on genetic testing covering: 1) informing the public; 2) quality of genetic services; 3) counselling and support; 4) equality of access/nondiscrimination; 5) self-determination; 6) non-compulsory nature of tests; 7) insurance; 8) data protection; 9) professional secrecy; 10) separate storage of genetic information; 11) unexpected findings; 12) supervision; and 13) handling of data.


This report reviews the ethical issues involved in expanding genetic testing from questions of predisposition to rare disorders to risk for chronic diseases in the general population.


Based on 25 recommendations made by an expert panel convened by the European Commission, this report covers such topics as "genetic exceptionalism", counseling for genetic conditions, biobanks and confidentiality, and population screening. A conference for citizens and stakeholders was held in Brussels on May 6-7, 2004 to discuss the implementation of the recommendations contained in the report.

To illustrate the current “state of the art” for applying genetic advances to clinical medicine, the authors present the case study of a woman who develops breast cancer even though she has tested negative for BRCA1 and BRCA2 mutations. Genetic-expression profiling of the tumor indicates a high risk of recurrence so the patient is prescribed tamoxifen and is cancer-free after five years. This is an example of going beyond “genetic medicine”—the use of single genes to improve the diagnosis and treatment of single-gene disorders—to ‘genomic medicine’ in which understanding the interactions between the entire genome and nongenomic factors results in new diagnostic and therapeutic approaches to multifactorial conditions such as cancer. The authors conclude with an overview of genetic concepts such as gene regulation and genomic variation.


In this classic article by Hastings Center scholar Gaylin, the author deplores the paternalism used to justify withholding information from those choosing to undergo genetic testing.


Sponsored by the U.S. National Institutes of Health’s National Center for Biotechnology Information (NCBI) this web site provides a definition of carrier testing along with case studies of clinical quandaries that arise such as: 1) whether or not DNA testing is the primary method for determining carrier status; 2) does carrier identification enable or inhibit reproductive choices; 3) when should molecular genetic testing to determine disease-causing mutations be recommended; and 4) when should risk assessment for members of racial and ethnic groups known to be carriers for certain conditions be suggested.


Grosse and Khoury discuss the clinical utility of genetic testing as "the balance of benefits to risks.” Four levels of impact are identified: diagnostic thinking, therapeutic choice, patient outcome, and societal impacts. In addition to clinical utility, the authors posit that the concept of social utility be promoted.


The authors hold that genetic research creates the concept of “genetic determinism” which in turn serves a conservative policy agenda that blames ill health on individuals
rather than on environmental and/or social conditions. They stress the threat to privacy and civil liberty that can result from simplistic forms of genetic prediction.


This report contains recommendations about "acquiring and using genetic information in health care in a manner that respects the autonomy of individuals." The committee notes the legal ramifications of rights to genetic information and that this report "should not be interpreted as creating a set of legal guidelines." The committee recommends a "significant increase in genetics education " for both health personnel and the public, and "centralized oversight to ensure that new genetic tests are accurate and effective, that they are performed and interpreted with close to `zero-error' tolerance, and that the results of genetic testing are not used to discriminate against individuals in employment or health insurance."


Divided into six chapters, the first two provide an overview of genetics, the genome, and the gene pool. The next two discuss human dignity and genetics from an international viewpoint and from that of the Canadian Charter of Rights and Freedoms. The final chapters present material on genetic determinism and naturalism, genetic discrimination (including workplace, insurance, and reproductive testing), genetic justice, and ethical considerations and principles. The document contains a glossary as well as tables of Canadian and American cases, statutes, treaties, and international agreements.


The Foundation commissioned Louis Harris and Associates to poll the public to learn more about its knowledge of genetic testing. It found that significant minorities of Americans are opposed to taking genetic tests and express a measure of fear, but that the majority of those polled would undergo genetic testing. Interestingly, 41 percent said that they or their family have some form of genetic or inherited health problem.


The authors studied three groups: the first was screened and found to be carriers of the Tay-Sachs gene; the second was screened and did not have the Tay-Sachs gene; and the third was a control group, which was not screened. All viewed their present and past health in the same manner, but the carrier group was less optimistic about the future. The
authors urge study of people's screening experience before undertaking any mass genetic screening programs.


The author discusses ten factors that characterize the social context of contemporary genetics, considering "two presumptions that usually are unquestioned: first, that more choice is always better; second, that what can be improved should be improved." Saying that genetic screening and testing can be an ambiguous good as prenatal genetic testing grows longer, he says the tests offer "no way to distinguish between significant disease and parental whim...Genetic technologies increasingly will challenge the troubled distinction between therapy and enhancement."


This early classic in the field of genetic screening provides an ongoing framework to study the prospects, history, and development of principles, legislation, and program guidelines applicable to genetic testing aims, methodology, and education. Ethical aspects are presented from the view of a "perfect" screener, who would have all relevant facts to provide both error-free testing and effective counseling; possess a strong sense of the thoughts and emotions of those screened; be as free as possible from self-interest and inappropriate emotionalism; and apply principles consistently.


This web page describes the scientific basis for various forms of genetic testing, the information provided by each test, as well as its purpose. Information on direct-to-consumer genetic testing also is included.


The Task Force reviewed both the operational and ethical issues raised by the commercial availability of genetic testing. Its final report includes discussions of genetic testing validity, of informed consent for genetic counseling, and of the relationship between evidence-based medicine and genetic screening. It contains the Task Force's recommendations on quality assurance measures for laboratories performing genetic tests and on the need for a national body with the authority to review genetic testing practices.
In his preface to the report, chairman Sir Patrick Nairne says that genetic research differs from many medical advances because of the speed of its development; its effect on individuals, families and the general society; and also the "...fear it arouses that it may be interfering with the basis of life itself." He highlights features included in the report: the difficulty assessing individual health risks exposed by screening, affecting both insurance and employment; the complexity of maintaining professional patient confidentiality; the demands on resources and quality; and need to "safeguard against potential eugenic abuse." The comprehensive report discusses genetic counseling, informed consent, disclosure to individuals and family members, confidentiality, employment, insurance, public policy and ways to implement programs in place in the United Kingdom.

The purpose of this supplement to the 1993 Report of the Nuffield Council on Genetic Screening is to bring the original report up to date. Contents include: advances in genetic technologies; whole population genetic screening programs; access to genetic screening services; consent; confidentiality; and implications of genetic screening for employment and insurance. The Council recommends that "genetic counseling should be concentrated on those conditions that threaten life or have a serious impact on the ability to live life fully."

This classic article describes the first experience in carrier testing in the United States. Testing programs for the sickle cell trait in the early 1970s were governed by poorly conceived state laws. A federal law corrected the problems and offered funding to state programs that respected privacy, provided counseling, and were voluntary. A better 1970s community screening program was devised to identify the Tay-Sachs disease gene. Today about 25,000 Ashkenazi Jews in the United States are tested each year, and the number of children born with this disease is about one-tenth that of the pretesting time. Reilly recommends pilot testing and counseling projects be put in place for cystic fibrosis.

Based on an extensive public consultation process involving the general public, health care professionals, and religious leaders, Singapore's BAC issued recommendations covering both clinical genetic testing and genetic research. Special attention is given to preimplantation testing and counseling of vulnerable populations.
While noting that all patient decisions should take into account responsibilities to family members and to the community, the authors discuss the ways in which genetic testing highlights issues of autonomy and patient choice. Sommerville and English conclude by asking the question "Can genetic information be exclusively owned?"

Noting that the two most frequently cited objectives of genetic screening for recessive carrier state genes are to reduce prevalence and to inform individuals or couples at risk, the authors say that this "represents a paradigm shift in the philosophy of screening in that no preventive principle is involved." Information is regarded as worthwhile regardless of the outcome, and the authors draw "attention to the danger that a combination of technical capability, professional zeal, and consumer demand will override currently acceptable screening principles. In this event, future efforts to subject screening programs to rational evaluation could be undermined."

The author rebuts the argument that "...genetic information about oneself is also information about one's relatives," and asserts that individuals have the right to refuse to know the results genetic testing even when the request for testing is made for a pedigree study.

The paper reports the results of a nationwide survey of public knowledge and opinion about issues in science and genetics, particularly risk, gene therapy, and the future of such technology.

Commissioned by Surgeon General David Satcher, the SACGT focused on risks and benefits of genetic tests in the following areas: criteria for assessment, determining categories of tests, data collection issues, options for oversight, and level of oversight for each category of genetic test.

The President's Commission cautions about the "subtle interplay of social norms and individual choices required as genetic screening and counseling become increasingly important." The Commission's basic conclusion is that genetic screening is a valuable service when established with concrete goals and procedural guidelines founded on ethical and legal principles.


Varmus, writing as the director of the National Cancer Institute, holds that genomics remains aligned with modern science instead of with modern medicine a decade after the sequencing of the human genome. He supports the use of the term “personalized medicine” because it “…wards off claims that an overreliance on genotypes in medical practice is deterministic” and thus allows for integrating insights from genomic medicine with environmental, social and behavioral factors in the treatment of patients.


Looking at the emerging fields of genetic testing and counseling from the viewpoint of different ethical theories, Veatch discusses the impact of personal values on the concept of moral obligations to future generations.


Geared toward consumers, this book provides information to aid in the decision-making process concerning genetic screening. Specific questions, such as, "Am I at high risk for a disorder?" and cases are provided. The book contains a glossary of genetic terms and a brief introduction to genetics.


Positing that there is nothing essentially different about genetic information that requires special regulation, Zimmern acknowledges that "...fear and mistrust of DNA technology by the public requires that society act to regulate the technology itself."
II. Privacy/Discrimination


The authors decry the use of a universal electronic medical records owned by practitioners because of the risk for abuse. Furthermore, the authors assert that data-sharing begins with the participant and should be controlled by the participant who is the owner of the health record.


The ASHG statement outlines points to consider: the general rule of confidentiality, exceptional circumstances that permit disclosure, and the ethical duty to inform patients about familial implications. Background discussion includes: ethical frameworks for disclosure of otherwise confidential information, the duty to warn under law, and international trends and positions.


The author holds that the new genetics "raises virtually every major health care policy question as well as unique legal and ethical problems." Annas thinks that genetic information is "uniquely private and personal" for three reasons "it can predict an individual's likely medical future; it divulges personal information about one's parents, siblings, and children; and it has a history of being used to stigmatize and victimize individuals." Urging federal legislation to protect privacy, he offers a draft genetic privacy act "the core of which prohibits individuals from analyzing DNA samples unless they have verified that written authorization for the analysis has been given by the individual or his or her representative."


The authors say that genetic discrimination is based on a variation from the "normal" human genotype and that such discrimination already exists in the health and life insurance industries, citing denial of services or entitlements to persons found to be asymptomatic or to those who may never be impaired. They fear a new "social underclass" based on genetic discrimination and recommend changes in social attitudes, legal protection, and the health care system to prevent genetic discrimination from growing.
A young alcoholic asks his physician to determine whether his drinking is genetic. The authors comment on the case and its consequences for employment and health insurance.


The report examines how to "benefit from the potential of genetic technology without undermining our autonomy" and "spawning another nightmare in our surveillance society." Part I provides a description of the scientific fundamentals of genetic testing with present applications; Part II discusses privacy principles relevant to both the public and private sectors; Part III examines the Privacy Act's regulation of genetic testing; Part IV considers regulation of private sector genetic testing; and Part V draws conclusions. The appendix contains a summary of positions on genetic testing and privacy taken by other countries and rational organizations. Twenty-two recommendations are presented.


After contrasting the British and U.S. insurance industries, the authors describe the Association of British Insurers' voluntary moratorium on mandatory genetic testing and on weighted rate schedules based on genetic information.


Referring to Mapping Fate, Alice Wexler's account of her mother's diagnosis and death from Huntington's disease, Couser recommends personal narratives as "a reality check on the 'genohype' that has surrounded the Human Genome Project." Noting that our "...knowledge of genetics outstrips [our] understanding of it," the author posits that Wexler's book counters "the stigma associated with genetic disease...by demystifying her mother's illness and recuperating her as a subject with some agency, rather than a passive victim of a rogue gene."


Halldenius concludes that the regulation of genetic discrimination can be done in one of two ways: "through the provision of public health insurance or through restrictions on private health insurance." She also argues that genetic information is not exceptional in comparison to other sensitive non-genetic information such as HIV positivity.

Harper recounts the long history of the genetic study of Huntington's disease, including compulsory sterilization laws and the eugenic policies practiced in Nazi Germany. He thinks that serious abuse may evolve from computerized genetic registers or inappropriate testing and urges preparation to avoid future dangers.


Jonsen says that modern genetics points out the genetic commonalities that make all persons more alike than different and goes on to discuss confidentiality versus the obligation to reveal genetic information, and privacy and personhood versus the family's ownership of such information. Calling four features relevant, he describes the clinical transaction that generates information, the severity of the condition, the burden the patient is likely to experience, and the implications from having this diagnosis.

Kious, Brent M. **Genetic Nondiscrimination and Health Care as an Entitlement.** *Journal of Medicine and Philosophy.* 35(2): 86-100 April 2010.

Philosopher Kious argues that if a person’s interest in obtaining health insurance is more important than an insurance company’s interest in actuarial pricing, then it follows that health care is viewed as an entitlement.


As part of the Human Genome Education Model (HuGEM) Project of the Georgetown University Child Development Center and Alliance of Genetic Support Groups, 332 individuals were surveyed about their experiences with health insurance, life insurance, and employment. Of the respondents, 43% reported that they or members of their family have experienced genetic discrimination in one or more of the three areas. Since self-selection bias could apply, the authors suggest that a follow-up study be conducted using a random sampling of respondents from a clinic population.


Markel says that stigmatization and ostracism of those who are found to have “undesirable” traits after genetic screening could increase. He compares screening to quarantine, saying that healthy society separated itself from the “ill,” and addresses two episodes when genetics were applied to American social policy: the early 20th century eugenics movement and the 1970s screening programs for sickle cell anemia.


Saying that few laws explicitly regulate the treatment of genetic information, McEwen and Reilly indicate that the nation's legislatures have many such acts under consideration,
reflecting "a growing societal awareness that the uncontrolled dissemination and use of genetic data entails significant risks." Their broad 50-state survey provides information about law at the time and includes: statutes that call for informed consent and that protect the confidentiality of various types of genetic information; law that prohibits both insurers and employers from requiring or administering a genetic test; law that regulates or prohibits information reaching insurance companies; and law that prohibits genetic discrimination by life and disability insurers. The article includes specific citations to state laws.


The authors describe possible discriminatory uses of genetic tests by employers and insurance companies, and they note that instances have been reported. Federal and state statutes and court decisions that can be used for protection against such discrimination are cited. The authors predict that genetic discrimination will become more prevalent as genetic testing becomes more common. They think that current legislation adequately covers genetic discrimination in employment but that it does not prohibit discrimination by insurance companies.


Noting that "...from a policy standpoint, we have yet to decide the degree to which genetic information of relevance in medical settings should be available for use in other settings", this comprehensive overview of genetics and life insurance contains a comparison of international policies on DNA and underwriting, a discussion of justice and genetic prediction, and an analysis of antitrust law as it applies to insurers' rate setting. A survey questionnaire on genetic testing and life insurance is included as an appendix.


The Office of Technology Assessment (OTA) surveyed 1500 companies and unions and evaluated the use of genetic monitoring and screening in the workplace. The report examines the technologies utilized, analyzes the legal aspects, assesses the ethical issues, discusses the role of genetic counseling, and evaluates current and future uses. The main concern of employees and applicants is protection of their privacy, especially if results of genetic testing could be used to deprive them of a job, health insurance, or other benefits.


OTA surveyed commercial insurers (Blue Cross/Blue Shield plans and health maintenance organizations) to assess their views and practices toward reimbursement for genetic tests and their policies in using test results in underwriting

The task force recommends that health status information should not be used to deny health care coverage or services to anyone. They think that genetic services should be comparable to other health services and would include testing, counseling, and treatment. Health insurers should "consider a moratorium on the use of genetic tests in underwriting


Moving on from single-gene disorders, the author is concerned with complex genetic mutations where testing may indicate that more than one disease could develop. He asks whether patients being tested for one condition should be informed if another possible condition is found, and concludes that all information should be disclosed.


The authors' list of privacy and disclosure problems from genetic knowledge includes: six cases arising from genetic tests that disclosed false paternity to an unsuspecting husband; disclosure of a person's genetic make-up to a spouse; disclosure, against a patient's wishes, to relatives at risk; ambiguous test results; disclosure of unexpected nonmedical information such as fetal sex; and disclosure of genetic information to institutions, e.g. employers and insurers. The authors write about an ethics of responsibility to care for persons, and they develop such an approach in their case studies.


Wilkinson is a British writer who argues that specific groups should be considered when the decision to obtain a genetic test is being made. Those groups include persons with biological, emotional and financial claims. The proximity of those claims is also to be considered.


Wolf holds that the real potential harm with genetic testing is that people will be seen as their genes and that their genetic medical records will be perceived as "hidden truth." She calls this more insidious discrimination "geneticism," which uses genetic testing and
information to "create and reinforce power relationships in which some dominate and others are subordinated."

III. Forensics


Dresser relates the story of the “Grim Sleeper,” a serial killer who eluded capture for over twenty years but was finally apprehended through the use of a partial DNA match known as “familial DNA identification.” While removing a criminal from society is a major benefit of partial DNA matches, the author reviews the potential harms inherent in familial identification.


This article from Swiss researchers discusses molecular autopsy. Molecular autopsy is post-mortem genetic testing in the event of sudden unexpected death, particularly in a young person. Hereditary non-structural diseases such as long QT syndrome (a cardiac arrhythmia) can be diagnosed using this method. If testing is positive, relatives are at risk of also carrying the mutation. The authors discuss three options for notifying and counseling relatives.


In a discussion of the use of DNA material in court cases, Hoeffel says that juries often weigh statistical evidence differently and come to different conclusions depending upon presentation. She thinks that the government could easily move from databanks with criminal DNA profiles to larger databanks with DNA profiles of all citizens. She imagines that DNA profiles could be accessible not only to law officials but to insurance companies, employers, schools, adoption agencies, and other organizations.


An update to DNA Technology in Forensic Science (National Research Council 1992), this report proposes quality assurance standards for DNA fingerprinting laboratories, and criteria for insuring that the forensic use of DNA does not reaffirm racial and cultural stereotypes.

The authors argue that forensic DNA databases are not subject to individual concerns about privacy, but rather societal concerns for security.


The authors define the “CSI effect” wherein the public (and especially jury members) have an unrealistic concept of DNA forensic evidence as infallible. While they find that studies have not validated this popular concept, they posit that rapid technological advances in general (the “tech effect”) work together with media portrayals of forensic science to create an uncritical attitude toward DNA evidence.


Thompson challenges the notion of DNA evidence as a “gold standard” because “[e]rrors in DNA testing occur regularly.” He explains the genetic composition of a “DNA profile,” and enumerates the ways in which this profile can be compromised.


The OTA found that a Florida criminal conviction based on DNA typing greatly raised interest in using such tests and, at the same time, raised concerns about infringement of civil liberties. Linkage of information in public and private sources is seen as equivalent to creating a national database, raising issues of informational privacy. Questions of data security, quality, and reliability are discussed.


This overview contains a brief history of DNA fingerprinting technology and use. The term DNA fingerprinting is in fact a misnomer—the variable number of tandem repeats (VNTR) number obtained in the DNA analysis actually gives the probability of a match. A list of problems with DNA fingerprinting is included along with a list of cases solved by the technology.

The authors discuss the retention policies of forensic DNA samples in the member states of the European Union. The policies range from immediate destruction of samples to an unlimited time of retention. The authors argue for a uniform legislative framework in the European Union. They also raise concerns about genetic privacy for people whose DNA samples are retained.


Legal scholar Weiss discusses the competing interests of privacy versus law enforcement in the use of DNA databases. She predicts that DNA evidence could eventually be protected as a form of health information.

**IV. Counseling**


This chapter reviews the advantages and disadvantages of prenatal counseling. Of particular interest is a qualitative survey conducted with persons with disabilities such as Thalassemia, Cystic Fibrosis, Sickle Cell Disease, Spina Bifida, and Down Syndrome. Those surveyed indicated that the prejudice of and rejection by society were more debilitating than their medical condition. The author also discusses the role images play in “narratives of disability.” Alderson observes that extreme denial is a part of disability activists’ portrayal of themselves, while medical/scientific authorities only bring up images of severe disability during prenatal counseling.


The authors argue that in order for genomic research to be meaningful, uniform electronic health records must be used, ones that retain "large, complex genetic results.” Most genome-wide association studies use one of two time-consuming and costly methods: extensive collection at the beginning of the study ("deep phenotyping") or recontacting individual research participants ("targeted phenotyping"). Other methods protect privacy through closely controlled database access and informed consent, where the participant agrees to share information up front or can later withdraw from the study. Because Belmont and McGuire believe that the "vast majority of the individual genetic data will be latent,” they think that combining data on individual risk with evolving clinical practice guidelines will enhance the usefulness of genomic counseling.

The authors state that cystic fibrosis (CF) remains a clinical diagnosis based on sweat chloride determination. More than 1500 mutations have been associated with the CF transmembrane conductance regulator (CFTR) gene, “not all of which result in CF.” Mutations in the gene can present as a spectrum of illness from sinusitis in adulthood to life-threatening lung disease in infancy.


The authors propose guidelines for different aspects of genetic screening: mandatory screening (except for newborns with treatable disorders) is objectionable; test values should be demonstrated; children should not be screened although adolescent screening may confer benefits in reproductive choices and planning; screening information should be given to third parties only with the consent of the screened; and genetic information contained in public and private databases should be protected by state-of-the-art security.

Goldman, Jill S.; Hahn, Susan E.; Catania, Jennifer W.; LaRusse-Eckert, Susan; Butson, Melissa B.; Rumbaugh Malia; Strecker, Michelle N.; Roberts, J. Scott; Burke, Wylie; Mayeux, Richard; Bird, Thomas; American College of Medical Genetics, and the National Society of Genetic Counselors. Genetic Counseling and Testing for Alzheimer Disease: Joint Practice Guidelines of the American College of Medical Genetics and the National Society of Genetic Counselors. Genetics in Medicine 13(6): 597-605, June 2011. doi: 10.1097/GIM.0b013e31821d69b8

Given the increasing interest in genetic testing for Alzheimer Disease (AD), the American College of Medical Genetics and the National Society of Genetic Counselors developed this practice guideline to enable health care providers to assess a patient’s need for genetic testing, and to provide them with the essential information needed to understand the results. This article also provides a concise review of the genetics of AD, and discusses the results of the Risk Evaluation and Education for Alzheimer’s Disease (REVEAL) study of the genetic risk assessment of adult children of people with AD.


The authors (members of the Familial Cancer Unit, South Australian Clinical Genetics Service) describe a study of kindreds with autosomal dominant adult onset familial cancer syndromes. Included are familial breast/ovarian cancer, colorectal cancer, and Cowden Syndrome. Letters informing family members at risk for familial cancer were
sent beginning in 2001. Genetic status determination for this group was compared with that prior to 2001. In the baseline group, 23% of the relatives had their genetic status determined. After letters (a sample for which is included) were written to all possible affected persons, 40% of the relatives’ status was determined. The authors conclude with a discussion of autonomy and privacy in genetic counseling.


Containing statistics on genetic testing for cystic fibrosis, OTA reports that present testing misses 5 to 15 percent of the carriers. A survey of commercial insurers indicated that 90 percent of respondents would accept an applicant with a family history of cystic fibrosis at standard rates. OTA concludes that the value of the CF carrier test is the information it provides but that it cannot estimate what it means to individuals to know. The test sensitivity is in the 85 to 90 percent range; almost half of those surveyed thought that 95 percent sensitivity should be required before widespread CF carrier screening is offered.


Recommendations for genetic testing for Cystic Fibrosis are provided in this document. They include: adults with a positive family history of CF, partners of persons with CF, couples planning a pregnancy, and couples who seek prenatal testing. It is not recommended for the general public. Disclaimer on webpage: This statement is more than five years old and is provided solely for historical purposes.


Wertz and Fletcher report and discuss "a cross-cultural study of the approaches of medical geneticists to ethical problems in genetic counseling, prenatal diagnosis and screening." The authors surveyed 682 genetics professionals from 19 countries to obtain the widest possible views, and they note that all contacted "stressed the need to protect the privacy of tested people from institutional third parties, especially insurance companies and employers." Fourteen clinical cases about five different ethical situations were circulated to obtain views about full disclosure of sensitive information, access of family members and others to genetic information, prenatal diagnosis, fair access to genetic services, workplace disease susceptibility, access of information in the workplace, screening for cystic fibrosis, and presymptomatic testing for Huntington's disease. Fletcher reviews the survey in a final chapter on ethics and human genetics. Nations represented in the survey include: Australia, Brazil, Canada, Denmark, Federal

1) The American Academy of Pediatrics makes the following recommendations regarding genetic testing: Newborn screening protocols should be periodically reviewed for modification purposes
2) Newborn screening requires informed parental consent. Informed refusals are to be monitored.
3) The AAP does not recommend carrier screening or genetic screening for children
4) Testing for adult-onset conditions is not recommended in childhood.
5) Pediatricians need to counsel their patients on the limits of genetic knowledge. Geneticists and genetic counselors may be needed.
6) Practicing physicians, residents and medical students should receive additional education concerning human genetics.


In response to a 1999 request from the American Academy of Pediatrics for national newborn screening standards and policies, the U. S. Maternal and Child Health Bureau (MCHB) conducted a comprehensive review of the medical literature and surveyed experts in the field to develop recommendations. This analysis was used to delineate a minimum set of standards for state newborn screening programs, a resource allocation decision tree for testing options, and model policies and procedures for state MCHB offices to follow.


The report discusses the "...physician's role in promoting informed reproductive decisions and physician involvement in genetic selection and manipulation. In general, it would be ethically permissible to participate in genetic selection (abortion or embryo discard) or genetic manipulation to prevent, cure, or treat genetic disease. It would not be ethical to engage in selection on the basis of benign characteristics."
This article from Virtual Mentor (the online ethics journal of the American Medical Association) describes the Prenatally and Postnatally Diagnosed Conditions Awareness Act [known as the Kennedy-Brownback Act, 2008]. The federal act requires the distribution of current information on the “the range of outcomes for individuals living with conditions” diagnosed by genetic testing performed either before or after birth.

The authors, from the Center for Ethics at Yeshiva University, argue that the act has limitations. It mandates the provision of better patient education materials to women who have been tested and received positive results, but exclude the distribution of these materials to women who are considering having genetic testing. They argue that prenatal testing is often presented to women during pregnancy as “just another blood test.” Women should receive clear information and give informed consent prior to prenatal testing.


Baily and Murray argue for the evaluation of voluntary genetic screening of newborns with parental informed consent. They argue that the cost-benefit analysis of mandatory testing shows that it is not effective, and thus should not be performed since rising health care costs are an ethical issue.


This report focuses on the ethical, legal and social issues involved in prenatal testing and preimplantation genetic diagnosis (PGD). The social meaning of genetic difference affects parental decision-making, and “…the distinction between what is a ‘normal’ genetic variation and what constitutes a ‘disease’ is often not clear or agreed upon by society.”


The authors review fourteen guidelines on carrier testing in minors from U.S. and international organizations such as the Institute of Medicine, American Medical Association, European Society of Human Genetics, and Canadian College of Medical Geneticists. All guidelines are in agreement regarding: 1) carrier testing should not be performed in children, and 2) testing should be deferred until the child can give proper
informed consent to be tested. There were three areas in which there were variations in opinion: 1) exceptions to the general rule; 2) the communication of accidentally discovered carrier status; and 3) the role of genetic services in informing children of their carrier status when they are older.


Botkin argues for "legal and ethical limitations on the application of prenatal testing and screening technology," saying that for "some medical conditions, respect for the privacy and confidentiality of the fetus outweigh parental rights to information about the fetus."


The authors discuss the specific information that must been given to parents when obtaining informed consent for preimplantation genetic diagnosis (PGD) for mitochondrial DNA (mtDNA) disorders. In addition to discussing the difficulty in interpreting the results, the parents must understand that it is an experimental procedure.


Preimplantation genetic diagnosis of mitochondrial disorders is a complex procedure due to the heteroplasmy (mixture of more than one type of mitochondrial genome) in an individual’s cells. The inherent uncertainty of this procedure intensifies discussions of the ethical issues involved such as personal autonomy, selective abortion, the use of embryos in research, the lack of ideal genetic testing options, and the acceptance of a pregnancy when the outcome is unknown.


In this Commentary, the authors discuss the α-actinin-3 (ACTN3) gene which is marketed as the "speed gene." It has been suggested that being homozygous for this gene is advantageous for activities involving sprinting. The evidence is far from clear, however, and total lack of ACTN3 has not been shown to "preclude elite performance." Both Australian and American companies provide direct-to-consumer testing for the gene. "Marketing of these genetic tests has outpaced understanding about the complex genetic underpinnings of athletic performance." The authors provide action points for physicians addressing this topic with parents and youth.
The working party recommends predictive genetic testing of children when the condition occurs in childhood or when treatment can be offered. For adult onset disease, it advises against testing when the child is healthy and no medical intervention is useful although the family could discuss it and children could choose testing when they are "autonomous adults." The party urges further research when "there is insufficient evidence to know whether a diagnosis in childhood is helpful in the medical management of the possibly (not yet) affected child." Saying that testing children is for carrier status is more complex, the working party would make a presumption against testing except in certain specific circumstances. Adoptive situations also are discussed.


Clayton argues that there is room for substantial disagreement between parents and physicians about the appropriateness of genetic testing for children. She provides a series of cases, and concludes that there is room "to give increasing deference to the views of the child as the child grows older."


In this special issue about genetic testing and genetic counseling, guest editor Cohen examines the reluctance of genetics professionals to recommend genetic testing for children since the psychosocial harm may be greater than any benefits. The author lists a number of factors that should be considered in the decision-making process for when the child is mature enough to give consent along with her/his parents.


The authors express concern about informed consent for prenatal testing and possible ‘normalization’ of selective abortion. A review of prenatal testing methods is provided.


Washington University (St. Louis) Law professor, Rebecca Dresser, discusses the 2008 Prenatally and Postnatally Diagnosed Conditions Awareness Act (Brownback-Kennedy). Pro-choice, pro-life and disability advocates all supported this Act. The Act specifically names Down Syndrome as a genetic condition for which pregnant women and new parents need “…up-to date [and] evidence-based information.” Dresser finds that Brownback-Kennedy “…situates women’s choices about pregnancy within the standard
The author concludes that it may be possible for diverse groups to collaborate on policies that both preserve choice and promote nondiscriminatory perspectives on life with disability.


This review article on newborn screening provides a history of its development; an analysis of its implementation as a public health program; a long-term assessment of this program’s effectiveness; a vision for the future of newborn screening programs; and an overview of the ethical issues with newborn screening.


The authors provide a current look at cystic fibrosis screening. Cystic fibrosis is a monogenic, autosomal recessive disorder. It has proved difficult to diagnose prenatally because disease can be caused by many mutations.


Saying that state newborn-screening programs are the largest group of genetic tests in the country, the authors surveyed them to look at public and parental participation. They conclude that increased public participation would "result in more representative policy-making and could enhance the quality of services provided by newborn-screening programs."


The authors describe how screening programs are evaluated by the World Health Organization's Wilson-Jungner criteria. Screening for a single gene disorder like PKU is very different from screening for genetic susceptibility in a complex disorder such as type 1 diabetes. Ethical analysis is given for both examples.


This review article on newborn screening describes the 29 core disorders and 25 secondary disorders for which tests are performed. Current ethical issues include informed consent, mandatory participation, and individual and societal costs.

Malinowski's objectives are to present an "accurate portrayal of the practice of prenatal genetic screening; to analyze the opportunities it presents in the context of, and in contrast with, procreative liberty and abortion law; and to propose suggestions to ensure that the technology is welcomed, but with caution." He thinks that prenatal genetic screening is about "offering prospective parents difficult choices regarding the sacrifices they are willing to make to be parents...."


The Consensus Development Conference concluded that genetic testing for Cystic Fibrosis (CF) should be offered those with a family history of CF, partners of CF persons, couples planning a pregnancy and couples seeking prenatal care, but not to the general population or newborns. It urged further research and education, noting the need to protect privacy and to prevent discrimination or stigmatization.


The Council concludes that potential harms exceed potential benefits in mandatory newborn screening for diseases for which there is no current treatment. The Council recommends that mandated newborn screening be done only for diseases for which there is a current treatment. Pilot studies by the states for other genetic diseases are encouraged. Informed consent by the parents of each infant should be obtained for these pilot studies.


The collection examines issues in reproductive genetic testing, particularly the psychological, sociocultural, ethical, legal and political applications. The editors point out that "Potentially, the major risk associated with reproductive genetic testing may come in not knowing how to cope with the information obtained from these procedures, rather than with the procedures themselves." Sixteen authors discuss testing from various perspectives such as choice, consent, justice, the parent-child relationship, accountability, law, and care.


Imagining a level of quality control in procreation that could make baby farms possible, Rothman warns of the dangers of preimplantation genetic diagnosis and the high physical, psychological, and social costs to the prospective mother.

Two hundred nineteen parents were surveyed concerning their attitudes to pediatric genetic testing. They viewed the benefits of such testing to outweigh the risks of testing for common adult-onset diseases.


The authors write that “…genetic testing may offer medical or psychological benefits, but harm parent-child bonds or the child's self-concept.” They review the legal status of minors as patients; their ability to make their own choices to assent; informed consent; ethical and legal requirements for competence and disclosure of genetic information; and guidelines for genetic testing of children.


The authors review the literature on prenatal diagnosis, and provide an overview of procedures, guidelines and recommendations. They discuss the applications and limitations of the various techniques used to assess the embryonal/fetal chromosome set.

**VI. Predisposition**

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Saying that BRCA1 may be responsible for about 5% of breast cancer cases, the Society says direct and reliable testing could be offered to members of families with strong breast-ovarian histories. Further research is recommended to determine optimal monitoring and prevention and public and professional education is needed to gain a "responsible approach to genetic testing." The Society notes that it is premature to offer population screening.


Given the degree of accuracy of genetic testing for cystic fibrosis (CF), the Society recommends that carrier testing be offered to individuals with a family history of CF or with a blood relative who has been identified as a CF carrier. Screening of the general
population, on the other hand, should not be considered as the standard of care until quality assurance measures for laboratories are enforced and appropriate education and counseling options are developed.

Bekker, Hilary; Denniss, Gill; Modell, Michael; Bobrow, Martin; and Marteau, Theresa. The Impact of Population-Based Screening for Carriers of Cystic Fibrosis. Journal of Medical Genetics 31(5): 364-368, May 1994. doi:10.1136/jmg.31.5.364

The authors studied 637 women and 329 men aged 18 to 45 who agreed to be tested for the cystic fibrosis gene. Positive results caused anxiety, but it almost disappeared within three months. They conclude that population screening's greatest problem is one of "false reassurance" rather than anxiety.


The authors note that the motivation behind taking a predictive genetic test is often described as involving a “risk-benefit analysis,” a dualism that rarely accounts for the complexity of the issues under consideration. They argue for an enriched “environment of personal deliberation,” and provide several case studies of individuals whose decision-making process included a wide variety of factors.


Noting that the "...BRCA story illustrates the complexity inherent in the promise of genetically tailored health prevention,” Burke describes the "tradeoffs and uncertainties" resulting from the U.S. Preventive Services Task Force (USPSTF) recommendations for BRCA mutation testing.


The author agrees with certain hospital protocols that recommend that testing for Huntington's disease not be done if a patient is psychologically frail. Calling this view a principle of minimal paternalism, he provides ethical decision-making theory relevant to suicidal persons, alcoholics, schizophrenic or manic depressive persons, the extremely retarded, and autistic persons who might be excluded from genetic testing.

The authors point out the legal distinction between breaking patient confidentiality and the "legitimate sharing of information in a patient's interest or to prevent harm to a third party," saying that health professionals have a duty to disclose sufficient information for informed decisions while safeguarding patient data.


A total of 1,140 primary care physicians and psychiatrists, and 280 medical geneticists and genetic counselors responded to a questionnaire surveying the attitudes of these professionals to population-based carrier testing for the cystic fibrosis gene. Only 43.9\% of this group believed that such a test should be offered routinely, although 92\% indicated that a couple who asked could be tested with a test that detected 80\% of carriers. Those involved in genetic services were most opposed to routine screening based on the consequences of the 80\% detection rate.


Celebrating the launch of a Web-based tool (http://www.hhs.gov/familyhistory/) designed to help people archive their medical records as part of the U.S. Surgeon General's Family History Initiative, the authors describe the Initiative as an advancement in "genetic literacy" that will work hand-in-hand with technical developments in genetic screening.


The authors assert that predictive testing for genetic mutations should be guided by the ethical principles of respect for autonomy, beneficence, confidentiality, and justice. All persons should be given "current relevant information on the test to make an informed voluntary decision." "The right to decide to undergo testing rests solely with the individual concerned," and information obtained should not be given to others without the consent of the person or the guardian. They say that testing should be provided regardless of finances; that participants should be able to withdraw at any time, but should be encouraged to follow-up after the test result is known; and that counseling and support services should be in place before testing begins. Compliance with these guidelines should minimize "psychological, social, economic, and other harm that might result from predictive p53 testing." Nonetheless, the authors conclude that the benefits of testing cannot be assumed.

After completing a PubMed literature review on breast and ovarian cancer through December, 2010, the authors discuss the experience of the German Consortium for Heredity Breast and Ovarian Cancer in treating women with BRCA1 and BRCA2 mutations. Topics covered include prophylactic surgery, intensive risk-adjusted screening, and the development of associated carcinomas.


This summary provides descriptions of the major genes involved in breast and ovarian cancers, an overview of clinical management issues for BRCA mutation carriers, and a review of the psychosocial issues involved in predisposition to breast and ovarian cancers.


Oliveira, a researcher who has spent over 15 years studying genetic risk factors for Alzheimer Disease (AD), reports that “...laypeople are rarely well equipped to understand the often murky relationship between their genotype and phenotype.” The author opines that errors in understanding their testing results may lead individuals to “…make irresponsible lifestyle decisions or pursue unproven therapies” due to the inherent uncertainty of the test results.


Addressing the "emotional baggage" that accompanies decisions about genetic testing, Patenaude posits that "[t]herapists may help patients find deeper psychological acceptance of the realities and issues involved in genetic testing and may improve the likelihood that effective action will be taken and anxiety reduced." Chapters cover such topics as the clinical assessment of anxiety after disclosure of genetic testing results, prophylactic surgery for breast and ovarian cancers, family interactions and genetic testing, and a professional's duty to warn a client's family members if testing indicates the onset of a serious disease such as Huntington's.


Divided into four parts, this collection provides an overview of genetic research on Alzheimer Disease (AD), describes the difficulties involved in genetic counseling for AD based on APOE alleles instead of single-gene mutations, examines social issues such as
genetic test patenting and actuarial policies for confidential data, and explores the public's perceptions and misperceptions about the nature and use of genetic testing.


Using three cases to illustrate her point-of-view, Rhodes looks at an individual’s responsibilities to others in regard to genetic testing. She concludes that no one has a moral right to genetic ignorance, and that moral responsibility “…depends on a variety of factors including blood ties, social relationships, the history of interaction, and particular features of the situation and the individuals involved.”


As the first randomized controlled trial (RCT) to study the impact of genetic testing for apolipoprotein E (APOE) on adults whose parents had Alzheimer Disease (AD), the REVEAL Study developed risk curves showing the trial participants’ risk of developing AD compared with their relatives and the general population. The authors report on how this risk information affected the participants’ health and wellness practices and insurance purchases, and on the psychological impact of receiving personalized risk curves.


The authors review the effect of whole genome (also known as exome sequencing) studies on informed consent and autonomy in the clinic. Instead of focusing on single mutations, this technique not only may reveal one’s genetic predisposition to hundreds of diseases at a time, but also create more uncertainty about their role in disease. The duty of physicians to recontact patients when research pertinent to their conditions becomes available is significantly increased by these advanced sequencing techniques.


Tabery, a philosopher from the University of Utah, discusses gene-environment interaction in a gene controlling neuroenzymatic activity (Monoamine oxidase A) with exposure to childhood abuse and the development of antisocial personality disorder (ASPD).

The paper is based on a review of 119 articles and provides developmental background on genetic testing as well as an outline of the ethical problems identified (including objectives, selection of candidates, and the nature of the techniques involved) and solutions adopted in preclinical protocols.


An historian, Wexler intertwines the stories of her mother's struggle with Huntington's disease, the discovery of a genetic marker for it, and the hope for a cure generated by this discovery. After analyzing the psychosocial issues raised by a predisposition to Huntington's disease in an era of feminism and patient's rights, the author describes the "toxic knowledge" that can result from genetic testing for a disease that has no cure.

Williamson, Jennifer; Goldman, Jill; and Marder, Karen S. *Genetic Aspects of Alzheimer Disease*. *Neurologist* 15(2): 80-86, March 2009. doi:10.1097/NRL.0b013e318187e76b

The authors discuss mutations in three genes that lead to early-onset familial Alzheimer Disease (AD), and review specific polymorphisms in apolipoprotein E associated with the more common form of AD that develops after age 65. They caution that this new research in the genetics of AD has not been replicated, and that genetic testing is only recommended for familial early-onset disease in symptomatic individuals and asymptomatic relatives.

VII. Direct-to-Consumer Genetic Testing


The United States Food and Drug Administration requires that genetic testing be analytically valid, clinically valid, and have clinical utility. The authors describe potential harms with direct-to-consumer testing: lack of doctor-patient confidentiality, invalid or unusable results, and "…screening without consensus on interpretation and follow-up."

*Direct-to-Consumer Genetic Testing* [Special Issue]. *GeneWatch* 23(4), August-September 2010.

This special issue contains ten articles on aspects of direct-to-consumer (DTC) genetic testing, including interviews with genetic counselors and with the owners of 23andMe, a company selling DTC test kits to the public.

A workshop was held August 31-September 1, 2009 to explore the issues raised by the proliferation of companies offering whole genome testing kits directly to consumers. Representatives from the Institute of Medicine, the National Cancer Policy Forum, and the National Research Council discussed models for a regulatory framework for such tests, and for educational programs for the public and the medical community.


This website is the Genetic Testing Registry of the U.S. National Institutes of Health. The Registry has the following functions: 1) to encourage producers of genetic tests "to publicly share information about the availability and utility of their tests", 2) to provide a centralized "information resource" and 3) to facilitate data sharing. The program is voluntary. It is anticipated that the Registry will be operative in 2011.


This empirical study of the marketing of direct-to-consumer genetic testing via the internet identifies three types of testing: diagnostic tests, risk assessment tests, and enhancement tests. Diagnostic tests and risk assessment tests are more likely to be mediated by a physician or to advise genetic counseling than are enhancement tests.


This review article contains definitions of genetic testing and direct-to-consumer genetic testing, as well as a table of companies and the tests which they offer to the public. American and European companies are included. The regulatory frameworks of direct-to-consumer genetic tests in the United States and Europe are also given. There are gaps in regulations in both the U.S. and Europe.


Holtzman reviews the decision of the United Kingdom's Advisory Committee on Genetic Testing to allow the public to obtain testing for inherited recessive disorders directly from suppliers or commercial laboratories. For other types of genetic testing a physician must be involved. Thus some tests are available to those who can pay for them; others must obtain testing through the National Health Service, which at present only covers the
testing of relatives for cystic fibrosis. *The Code of Practice on Human Genetic Testing Services Supplied Direct to the Public* is included as an appendix.


This Brief discusses FDA regulation of IVDs ("in vitro diagnostic devices") sold as kits versus LDTs (laboratory-developed tests) which are much less regulated.


The American Society for Human Genetics recommends transparency regarding predictive value, strength of scientific evidence, risks, and CLIA (Clinical Laboratories Improvement Amendments), lab certification, provider education and high standards of test and laboratory quality.


Developed by a working group comprised of representatives from genetic testing companies, patient advocacy groups, and the U.K. National Health Service, the principles cover all facets of genetic testing: marketing, counselling, consent, data protection, laboratory processes, interpretation and provision of test results, support groups and complaint procedures. The principles were formulated to facilitate the development of codes of practice.


This report from the Genetics and Public Policy Center, Johns Hopkins University provides a review of the role of the U.S Congress and federal agencies in ensuring "the accuracy and reliability of genetic testing." The roles of the Clinical Laboratories Improvement Amendments of 1988 (CLIA) and the Centers for Medicare and Medicaid Services (CMS) are outlined.


The authors provide a decision tree for the inclusion of tests in a genetic testing registry. Proposed content for such a registry is outlined. The authors argue that the Registry should be mandatory. The legal basis for the Registry in the United States rests via the
Federal Food, Drug, and Cosmetics Act as well as the Clinical Laboratory Improvement Act (CLIA).


In this brief article, the authors address the need for regulation of direct-to-consumer genetic testing. They cite California and New York as examples of states which do regulate these tests and also present the arguments that the genetic testing companies give against such regulation.


Matloff and Caplan discuss Myriad Genetics, a company which holds the patent on testing for BRCA1 and BRCA2. The company launched a Direct-to-Consumer marketing campaign in the Northeast United States in 2007. The authors discuss ramifications of this campaign for patients and healthcare providers.


Stein reports that the U.S. Food and Drug Administration questioned the mass marketing of genetic tests in Walgreens Drugstores without federal oversight. Subsequently, Walgreens withdrew the product from company stores. The reporter suggests that this action may indicate more close scrutiny of consumer genetic tests in the future.


This document from the U.K. Government advisory board on new developments in human genetics includes recommendations for purpose and scope of such tests, marketing and advertising, regulation, information for prospective consumers, counseling and support, consent, data protection, sample handling, laboratory processes and interpretation of test results.


After a U.S. provider of BRCA testing (Myriad Genetic Laboratories, Inc., Salt Lake City, Utah) conducted a pilot direct-to-consumer (DTC) marketing campaign in two cities (Atlanta, Georgia, and Denver, Colorado), the CDC surveyed consumers and providers in the pilot sites and two comparison cities (Raleigh-Durham, North Carolina, and Seattle,
Washington) to assess the impact of the campaign on consumer behaviors and health-care provider practices. The findings underscore the need for evidence-based recommendations for appropriate use of genetic tests and for the education of providers and the public to achieve maximum individual and public health benefit from genetic testing.


The Secretary’s Advisory Committee on Genetics, Health, and Society, chartered in 2002 by the U.S. Secretary of Health and Human Services, is a public forum for consideration of issues related to the development and use of genetic tests. Important issues include: analytical and clinical validity of the tests, proficiency testing and quality assurance, demonstration of clinical utility, education and guidance for clinicians, and ongoing public health surveillance


After a systematic review of the evidence relating to genetic screening for breast and ovarian cancer, the United States Preventive Services Task Force issued recommendations that only women with a family history of those cancers be referred for BRCA mutation testing. A one-page patient summary of these recommendations is available online at: [http://www.annals.org/cgi/reprint/143/5/I-47.pdf](http://www.annals.org/cgi/reprint/143/5/I-47.pdf)


Direct-to-consumer genetic testing is evaluated using the principles of beneficence, non-maleficence, justice, and autonomy. The authors argue that non-maleficence is the most germane principle; the tests are susceptible to inaccuracy and misinterpretation in the absence of the input of medical professionals.

**VIII. GINA – Genetic Information Nondiscrimination Act (2008)**


Appelbaum of the Department of Psychiatry at Columbia University gives an overview of the two major sections of GINA: 1) Title I prohibits health insurance companies from requesting genetic information to make coverage decisions and 2) Title II prohibits
employers from requiring that workers be tested for genetic tendency to an illness or to use such testing in employment decisions.

He concludes that because the genetics of mental disorders appear at this time to be very complex and involve environmental influences, GINA may have less of an impact in psychiatry than in other branches of medicine. However, for family members of persons with mental disorders stigmatization may occur especially in the workplace.


This twenty-one page document from the Coalition for Genetic Fairness clearly delineates the scope and history of GINA. The prohibitions for health insurance and employment are given. Also, there are sections for each Title which outline ‘What does GINA not do?’


In critiquing the Genetic Information Nondiscrimination Act of 2007, Epstein argues that employers should not bear the responsibility of "providing parity between genetically high-risk and low-risk workers." He advocates the use of government subsidies to achieve this parity.


Erwin discusses the strengths and weaknesses of the Genetic Information Nondiscrimination Act, including the argument that genetic antidiscrimination legislation may increase stigmatization for consumers with genetic conditions.


Roberts distinguishes the Genetic Information Nondiscrimination Act (GINA) from prior employment discrimination statutes—Title VII of the Civil Rights Act, the Age Discrimination in Employment Act, the Rehabilitation Act, and the Americans with Disabilities Act—which were based on past discrimination to justify protection in the present and in the future. GINA is preemptive in that it anticipates a form of discrimination that may pose a risk in the future. While examples of genetic discrimination do exist, both “...advocates and adversaries agreed that scant evidence indicated a significant history of genetic-information discrimination.” In addition to discussing GINA as a model act, the author traces the evolution of GINA from its introduction in 1995 to its passage in May 2008, and explores the strengths and weaknesses of preemptive antidiscrimination legislation generally. The author concludes that “…the statute’s preemptive qualities carry with them potentially serious hurdles regarding GINA’s enforcement and effectiveness.”

After declaring that GINA’s main value is to provide protection against genetic discrimination for those who have individual health insurance policies in states without genetic antidiscrimination legislation, Rothstein identifies three major flaws with GINA: 1) its protections do not apply to life insurance, long-term care insurance, and credit applications; 2) GINA applies only to asymptomatic individuals and does not address insurance coverage should an individual develop a genetic disease; and 3) employers can still obtain genetic information regarding their employees because GINA’s provisions on the protection of health information are too vague and cumbersome.


This article provides a legislative history, a list of provisions, and a description of protected and non-protected tests under the Genetic Information Nondiscrimination Act (GINA). Since GINA does not prevent insurance companies from canceling or denying coverage once a person develops a condition to which she/he is genetically predisposed, The Affordable Care Act of 2009 supplements GINA by: 1) prohibiting health insurance companies from categorizing genetic predisposition as a preexisting medical condition; and 2) prohibiting the denial of claims based on such conditions.


The Genetic Information Nondiscrimination Act of 2008 (GINA) is landmark federal legislation enacted to prohibit genetic discrimination by health insurers and employers. Individuals cannot be denied health insurance or employment as a consequence of the results of a genetic test. It was signed into law on May 21, 2008 by President George W. Bush.

IX. Search Strategies for Genetic Testing

These search strategies reflect the status of the respective databases as of April 2011.

Database: Academic Search Premier (Private Database: EBSCO Industries, Inc.)
Search Strategy:

1st query box: genetic screening  [select Subject Terms from the right drop-down menu]

2nd query box: AND bioethics or ethics or ethical or legislation or privacy or confidentiality or policy or religion [retain Select a Field]

Database: ETHXWeb  (Public Database: Bioethics Research Library at Georgetown University)

Search Strategy: (("*genetic discrimination" or "*genetic privacy" or "*dna fingerprinting") or (15.3[pc] and testing[ti]) or (15.2[pc] and counseling[ti]))

Database: Google Scholar  (Public Database: Google)

Search Strategy:

exact phrase genetic testing

at least one legislation or privacy or confidentiality or discrimination or policy or religion or ethics or ethical or bioethics or bioethical

Database: JSTOR  (Private Database: ITHAKA)

1st query box: “genetic screening” or “genetic testing” [retain full-text]

2nd query box: AND (legislation or privacy or confidentiality or policy

or religion or bioethics or bioethical or ethical or ethics)

[retain full-text]

Database: LexisNexis Academic  (Private Database: Reed Elsevier, Inc.)

Search Strategy:

Combined Search genetic testing or genetic discrimination or genetic enhancement or genetic counseling or selective abortion [check Law Reviews]
Database: NLM Book Catalog (Public Database: U.S. National Library of Medicine)
Search Strategy: (genetic testing/ethics [majr] OR genetic privacy [majr] OR dna fingerprinting/ethics [majr])

Database: ProQuest (Private Database: Cambridge Information Group)
Search Strategy:
1st query box: (genetic testing or genetic screening or dna fingerprinting) [select Subject from the right drop-down menu]
2nd query box: AND (legislat* or privacy or confident* or policy or religion) [select Subject from the drop-down menu]
3rd query box: OR (bioethic* or ethic*) [retain Citation and abstract]

Search Strategy: (genetic testing/ethics [majr] OR genetic privacy [majr] OR dna fingerprinting/ethics [majr])

Database: WorldCat (Public Database: OCLC Online Computer Library Center)
Search Strategy (for clinical genetic testing):
1st query box: genetic testing [select Subject from the left drop-down menu]
2nd query box: ethic* [select Keyword from the left drop-down menu]

Search Strategy (for forensic genetic testing):
1st query box: dna fingerprinting [select Subject from the left drop-down menu]
2nd query box: ethic* [select Keyword from the left drop-down menu]

The following chart provides search strategies for researchers who have access to the corporate versions of the legal databases LexisNexis and Westlaw.
PRIVACY AND LEGISLATION

Issues include:

- 4th Amendment and use of genetic information in criminal law
- Genetic privacy related legislation prohibiting genetic discrimination by insurance companies
- Informed consent and privacy issues in genetic research

<table>
<thead>
<tr>
<th>Suggested search for criminal law</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WestlawNext</strong></td>
</tr>
<tr>
<td><strong>Westlaw</strong></td>
</tr>
<tr>
<td><strong>LexisNexis</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested search--criminal law, specifically Fourth Amendment</th>
</tr>
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<tbody>
<tr>
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<td><strong>Westlaw</strong></td>
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<tr>
<th>Other informed consent/privacy and legislation--simple search</th>
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<tr>
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<td><strong>Westlaw</strong></td>
</tr>
<tr>
<td><strong>LexisNexis</strong></td>
</tr>
<tr>
<td>Other informed consent/privacy and legislation--broader search</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>WestlawNext</strong></td>
</tr>
<tr>
<td>(“genetic discrimination” “genetic privacy”) OR ((“genetic testing” “genetic research” “genetic database” “DNA testing” “DNA database”) /100 (insurance discrimination privacy advertising “informed consent” confidentiality consent)) % paternity</td>
</tr>
<tr>
<td><strong>Westlaw</strong></td>
</tr>
<tr>
<td>(“genetic discrimination” “genetic privacy”) OR ((“genetic testing” “genetic research” “genetic database” “DNA testing” “DNA database”) /100 (insurance discrimination privacy advertising “informed consent” confidentiality consent)) % paternity</td>
</tr>
<tr>
<td><strong>LexisNexis</strong></td>
</tr>
<tr>
<td>(“genetic discrimination” OR “genetic privacy”) OR ((“genetic testing” OR “genetic research” OR “genetic database” OR “DNA testing” OR “DNA database”) w/100 (insurance OR discrimination OR privacy OR advertising OR “informed consent” OR confidentiality OR consent)) AND NOT paternity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested search – genetic testing</th>
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</thead>
<tbody>
<tr>
<td><strong>WestlawNext</strong></td>
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<tr>
<td>(abortion /p eugenic) OR (“genetic enhancement” “genetic screening” “genetic counseling” “selective abortion” “prenatal diagnosis” “preimplantation diagnosis”)</td>
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<tr>
<td><strong>Westlaw</strong></td>
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</table>

*Genetic Testing and Genetic Screening* was originally authored by Pat Milmoe McCarrick, M.L.S., a reference librarian at the Bioethics Research Library (BRL) and published in the *Kennedy Institute of Ethics Journal*, Vol. 3, No. 3, pp. 333-354, September, 1993. This publication has been updated periodically by BRL staff members Martina Darragh, Harriet Gray,
and Kathleen Schroeder. Maddalena Tilli Shiffert, Assistant Professor, Department of Biology, Georgetown University, was a scientific advisor on this project in 2011, when this bibliography was last updated. Also in 2011, Katherine L. Record and Melissa K. Bourne of the Georgetown University Law Center, developed search strategies to access the legal literature; these are incorporated into each Scope Note on genetics, along with strategies for other disciplines designed by BRL staff.

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