BEHAVIORAL GENETICS

I. INTRODUCTION

Anyone who has a canine companion knows about behavioral genetics. In the last few thousand years, through selective breeding hundreds of breeds of dogs have been bred from wolves. Besides their wide range of sizes, shapes, and colors, dogs have been bred for their temperament, including herding, hunting, retrieving, and contented sleeping on the couch next to their human companions.

Experts agree that the temperament and behavior of other animals, including humans, also is affected by genetics. But, this is practically where the agreement ends. There is widespread disagreement about the range of behaviors influenced by genetics. Many experts consider mental illness, intelligence, addictive behavior, and sexual orientation to be influenced by genes. Others add to the list a genetic predisposition to rage, happiness, impulsivity, shyness, daydreaming, or suicide. Still others assert that contentment, spatial abilities, nurturing behavior, perfect pitch, and a sweet tooth are influenced by genes. One study claims to demonstrate that one's attitude toward reading books, abortion, playing organized sports, roller coaster rides, and the death penalty are influenced by genes, but not one's attitudes toward gender roles, easy access to birth control, being assertive, and playing bingo.

As important as the types of behaviors influenced by genes is their degree of heritability. Are genes responsible for 5% of intelligence or 50%? One of the most common ways of attempting to estimate the degree of heritability is the use of twin studies, a research method developed by Francis Galton in the 19th century. By comparing the behavioral traits of monozygotic (MZ) twins with dizygotic (DZ) twins, and twins reared apart and reared together, association between heredity and environment ("nature and nurture" in Galton's words) can be estimated. Some twin studies have been criticized on methodological grounds, such as the similarities of twins raised apart are not necessarily attributable to genetic influences when the environments are similar. Nevertheless, some of the similarities of twins reared apart are astounding.

In one celebrated example, MZ (identical) twins Jim Lewis and Jim Springer were adopted into different families in Western Ohio, about 100 miles apart. They were reunited after 39 years when they were part of a twin study conducted at the University of Minnesota. The investigators discovered several coincidences: each had been given the same name by their adoptive families, each had an adoptive brother named Larry and a dog named toy. Other coincidences were more striking: each married and divorced a woman named Linda and remarried a woman named Betty; they named their first sons James Allan and James Alan. In school, both liked math and disliked spelling; both enjoyed carpentry and mechanical drawing; both became deputy sheriffs in different Ohio towns; both drove similar blue Chevrolets; both vacationed on the same beach in Florida; both had nearly identical patterns of chain smoking and drinking; both had a white bench around a tree in their backyard; both made miniature furniture in their wood shop; both had vasectomies; both followed stock car racing and hated baseball. The similarities went on and on. See Lawrence Wright, Twins and What They Tell Us About Who We Are 43–47 (1997). What, if anything, was gene-mediated? What similarities would they have with other men of the same age in the same part of the country of the same socio-economic background? In what ways were they different?

Behavioral genetics is a very complicated field, fraught with scientific and statistical obstacles to correlations that can be verified and replicated. Two of the leading problems are (1) defining the endpoint (e.g. accurately diagnosing mental illnesses or variations in personality traits); and (2) excluding possible confounding factors. In fact, the difficulty in proving associations and the frequency with which research findings have been retracted have led to at least one area of inquiry, the genetics of schizophrenia, to be referred to as "the graveyard of molecular geneticists."

Research methodologies in the post-genomic era increasingly involve more direct gene probes for alleles influencing an aspect of behavior. The research is especially complicated because of the difficulty of measuring behavioral endpoints and in excluding confounding factors. Aside from certain forms of mental illness and mental retardation, behavioral genetic factors are almost certainly complex traits caused by the interaction of multiple genes and environmental factors. The complexity of behavioral genetics has not stopped headline writers from promoting the genetic causes of a seemingly endless stream of behaviors, nor of an increasing segment of the population from adopting overly reductionistic and deterministic views of the role of genes. Indeed, it could be argued that scientific and public sentiment has shifted away from Skinnerian behaviorism, popular in the post–World War II period, to a fixation on genetic factors.

II. HISTORY OF BEHAVIORAL GENETICS

The popularity of genetic determinism, like other beliefs about science, has been cyclical. The golden age of genetic determinism began in the second half of the nineteenth century. As Sir Francis Galton, the father of eugenics, phrased it, the debate centers on whether "nature or nurture" is more important to human development. In mid-nineteenth-century England there was little doubt that inherited explanations of behavior were gaining popularity. Lewontin et al. observe the influence of this theory in Charles Dickens' popular novel *Oliver Twist*, which was published serially between 1837 and 1839. When ten-year-old Oliver first meets Jack Dawkins, the "artful dodger," on his way to London, Oliver is described as having a genteel nature and speaking with perfect grammar, in stark contrast to the streetwise Dawkins. Oliver's mode of expression is inexplicable, inasmuch as he had lived virtually all of his life in a parish workhouse, with no mother and no education. What explains this phenomenon? Oliver's father was from a well-off and socially prominent family; his mother was the daughter of a naval officer. According to Lewontin et al., "Oliver's life is a constant affirmation of the power of nature over nurture."

At the turn of the century, Alfred Binet, director of the psychology laboratory at the Sorbonne, abandoned his work in the field of craniometry (using brain size and structure to measure intelligence) to develop a test that could directly measure inherited, native intelligence. The purpose of his first test, developed in 1905, was to identify Parisian children needing special education. In the second version of his test, published in 1908, he assigned an age level to each task in the test to establish a mental age for each child. In 1912, a year after Binet's death, German psychologist Wilhelm Stern divided mental age by chronological age to establish an intelligence quotient, and the IQ, the supposed expression of innate intelligence, was born. Stanford professor Lewis Terman created a paper-and-pencil version of the basic test, the Stanford–Binet Intelligence test.

In 1914, seventy-six years after *Oliver Twist*, George Bernard Shaw's *Pygmalion* was first performed. Shaw was a follower of Galton, and according to Shaw's vision, culture was not immutably fixed by biology, but nearly so. Only after six months of arduous work and the

talent of phoneticist Professor Higgins could an ignorant flower girl overcome the deprivation of her station in life and appear to be a duchess. Liza Doolittle, of course, was a white English-woman. Were she nonwhite or from central or eastern Europe, the task surely would have been impossible. At this time, pauperism and shiftlessness—not to mention intelligence—were widely believed to be overwhelmingly or exclusively genetic.

English translations and American revisions of the basic intelligence test, primarily the Army Alpha Test, were used on a mass scale during World War I as a way to screen troops. The findings of the test were "startling." The test was given only in English, and immigrants from southern and eastern Europe scored much lower than either native-born Americans or immigrants from northern Europe. * * * [T]hese test results helped to sway Congress in 1924 to reduce immigration from southern and eastern Europe.

It is small wonder that genetic determinism is linked with eugenics. If genes determine the human condition (physical, psychological, behavioral, and social), then improving the gene pool will improve the human condition. The efforts at improvement take on two forms—negative eugenics, preventing the reproduction of the genetically "unfit"—and positive eugenics—encouraging the mating of those with "favored" genetic endowments.

In hindsight, the eugenics movement spun hopelessly out of control. The pursuit of eugenics or the excuse of eugenics resulted in mass sterilization, selective breeding experiments, and genocide by the Nazis, about which much already has been written. Yet, in American culture before World War II, eugenics lacked its current negative connotation. In fact, hundreds of popular films expressly advocating eugenic positions, including *The Black Stork*, were produced between 1915 and the beginning of World War II.

In the post–World War II period, the biological determinism of the nineteenth and early twentieth centuries was supplanted by "cultural," "behavioral," or "environmental" determinism. The pendulum swung back, partly as a response to Nazi atrocities and partly because of the growing acceptance of social science explanations of human behavior. For example, Skinnerian psychology postulated that behavior was most affected by environmental factors. Nurture, the environment, was thought to be more important than nature in shaping behavior and intellect.

In 1990, seventy-six years after Shaw's *Pygmalion*, the popular American film *Pretty Woman* was released. The premise, though hardly original, was simple. Even a lowly streetwalker in Los Angeles could become a member of high society literally overnight so long as she had good looks, a rich benefactor, and designer clothes. (Cinderella required supernatural intervention to accomplish a comparable, though morally pure, transformation.) In popular culture, the pendulum had swung completely from *Oliver Twist*.

The Human Genome Project officially began in 1990. It heralded a period in which claims for a genetic basis for homosexuality, aggression, impulsive behavior, nurturing, and numerous other behaviors was asserted. This has contributed to a resurgence of behavioral genetic determinism that is based on the misapprehension and misapplication of scientific discoveries and that threatens to have grievous social consequences.

Flawed scientific theories can be refuted by more rigorous science. A more perplexing social problem involves the permissible societal response to legitimate discoveries in behavioral genetics. Undoubtedly, there is *some* correlation between certain genes and behavioral traits. The only serious scientific dispute concerns the overall degree of correlation and the applicability of genetic factors in a range of specific behavioral traits. What, then, are the likely psychological, social, political, and legal consequences of such correlations?

As an example, take the case of alcoholism. Several past and ongoing studies have explored whether there is a genetic component to alcoholism. Assume there is such a component in some cases of alcoholism. Does that mean that, as a society, we will be more or less tolerant of alcoholics, more or less inclined to mandate genetic testing for such an allele or alleles, or more or less likely to embrace the disease model of alcoholism? On the one hand, it could be argued that the genetic component vitiates the moral taint from individuals with alcoholism. On the other hand, the genetic, heritable nature of the disorder may increase the stigma associated with alcoholism; it may increase the pressure for genetic screening for the mutation; it may contribute to individuals feeling a sense of resignation and a reluctance to enter treatment; and it may lead to disdain for individuals who, despite knowledge that they have the mutation, proceed to drink nonetheless. Research to find an association between genes and alcoholism is being conducted at the Ernest Gallo Clinic and Research Center at the University of California–San Francisco. If a genetic link to alcoholism were to be established, some of the social pressure against alcoholic beverages and their purveyors might be deflected onto "faulty" genes.

Similar issues are raised with regard to a possible genetic link to homosexuality. If we find a "gay gene," will it mean greater or lesser tolerance? My suspicion is that it will not change the way most people view homosexuals. For individuals who are tolerant of homosexuals, it will reaffirm that the behavior is physiologically based and does not represent moral depravity. On the other hand, for individuals who are intolerant of homosexuality, it will confirm their view that such individuals are "abnormal." It also could lead to proposals that those affected by the "disorder" should undergo treatment to be "cured" and that mea-

tions may be eliminated on the ground that there would be nothing that could be done to change the individual. However, institutionalizing the offender might serve other purposes by deterring others from committing crimes (or from attempting to "game" the system by purporting to have a genetic defense), by preventing the offender (through incarceration) from having the opportunity to commit another crime, and by satisfying society's need for revenge.

Lawyer Maureen Coffey advocates that "In light of increasing knowledge and understanding, traditional yet outdated notions of freedom and responsibility should be modified to square with a scientific view of human conduct." She argues that people with genetic susceptibilities for antisocial behavior are "innately different from the 'normal' person," but that their lessened free will should not make such individuals immune from punishment. Rather, punishment should be based, not on a subjective, moral culpability justification, but on "the legitimate objectives of social control and public welfare." Even though she acknowledges that "punishing an individual for crimes for which he is not responsible in the traditional sense seems to be morally offensive," she feels it can be outweighed by the greater social good.

MILLARD v. MARYLAND

261 A.2d 227 (Md.Ct.Spec.App.1970).

MURPHY, J.

Charged with the offense of robbery with a deadly weapon, appellant filed a written plea that he was insane at the time of the commission of the crime under Maryland Code, Article 59, Section 9(a), which provides:

> "A defendant is not responsible for criminal conduct and shall be found insane at the time of the commission of the alleged crime if, at the time of such conduct as a result of mental disease or defect, he lacks substantial capacity either to appreciate the criminality of his conduct or to conform his conduct to the requirements of law. As used in this section, the terms 'mental disease or defect' do not include an abnormality manifested only by repeated criminal or otherwise antisocial conduct."

The basis for appellant's insanity plea, as later unfolded at the trial, was that he had an extra Y chromosome in the brain and other cells of his body which constituted, within the meaning of Section 9(a), a mental defect resulting in his lacking substantial capacity either to appreciate the criminality of his conduct or to conform his conduct to the requirements of law.

Dr. Cecil Jacobson, the appellant's only medical witness, testified that he was an Assistant Professor in the Department of Obstetrics and Gynecology and Chief of the Reproduction Genetics Unit of the George Washington University School of Medicine; that he had obtained a degree in genetics from the University of Utah in 1960 and was "a research teacher teaching the full-time faculty" at the University; that he had published 42 articles in the field of genetics, had conducted extensive research in the field, supervised a number of genetics laboratories, and was a consultant in genetics to the Federal Government.

Dr. Jacobson testified that genetics was "a sub-speciality biology" having "quite a bit of inference in medicine," involving a specific diagnostic technique dealing with the "very basis of human development, the chromosome material;" that "chromosomes [in the cells of the body] are the way that all genetic machinery is passed from one generation to another;" that "all things that are passed on from parent to child must go through chromosomes;" and that 46 chromosomes constituted the normal complement per cell and a person who possessed 47 chromosomes was genetically abnormal.

Dr. Jacobson testified that on December 16, 1968, appellant was examined and his body cells found to contain an extra Y chromosome (XYY); that the presence of this extra chromosome constituted a "basic defect in the genetic complement of the cell" affecting not only the way the cells grow in the body, but also the physical growth of the body itself; that the presence of the extra Y chromosome caused "marked physical and mental problems" affecting the manner in which persons possessing the extra Y chromosome "will react to certain stimulus; certain physiological problems; certain behavioral characteristics." Dr. Jacobson then told of approximately 40 published reports indicating that persons possessed of an extra Y chromosome tended to be very tall, with limbs disproportionate to their body; that such persons had marked antisocial, aggressive and schizoid reactions and were in continual conflict with the law.