Eugenics and the Indeterminacy of Genetic Determinism

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The Occasional Papers of the School of Social Science are versions of talks given at the School's weekly Seminar. At these seminars, Members present work-in-progress and then take questions. There is often lively conversation and debate, some of which will be included with the papers. We have chosen papers we thought would be of interest to a broad audience. Our aim is to capture some part of the cross-disciplinary conversations that are the mark of the School's programs. While Members are drawn from specific disciplines of the social sciences—anthropology, economics, sociology and political science—as well as history, philosophy, literature and law, the School encourages new approaches that arise from exposure to different forms of interpretation. The papers in this series differ widely in their topics, methods, and disciplines. Yet they concur in a broadly humanistic attempt to understand how, and under what conditions, the concepts that order experience in different cultures and societies are produced, and how they change.

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Eugenics and the Indeterminacy of Genetic Determinism

On April 1, 2012, National Public Radio (NPR) broadcast a story on the program "All Things Considered" about the Porsafillo Academy, a preschool on the Upper West Side of Manhattan that admitted (and rejected) prospective students solely on the basis of their DNA. As the school's headmaster explained, "we now know that simple DNA testing can determine whether a child will end up at Yale or at Yonkers Community College." Due to the preschool's long wait list, parents had to submit DNA samples before their children were even born. The parents of some children who had not been admitted planned to sue the school for discrimination, but the headmaster defended the process, claiming that "this is no longer a subjective decision; this is a clinical test that can show us how a child will perform throughout its life" (National Public Radio 2012).

After hearing the story, some listeners turned to Twitter to express their outrage, referring to the preschool's admissions process as "eugenics in action" or "the new Darwinism." One tweet emphasized "this is happening now!" Except that it wasn't happening then. The report was totally fabricated, part of NPR's long tradition of airing joke stories on April Fools' Day (Porsafillo is an anagram of April Fools).

The idea of a DNA-based preschool entrance exam worked as a joke because it tapped into several real sources of anxiety among NPR listeners: the scarcity of preschools and the long waiting lists for quality daycare placements; the growing perception that early childhood education unlocks the door to future academic and socioeconomic success; the decline of good job options for non-college graduates along with the rise of student loan debt for those who did go to college; the expansion of prenatal screening and the growing popularity of direct-to-consumer genetic testing; and the hollowing out of the welfare state. Three weeks later, a *New York Times* story inspired by the NPR prank concluded that "the only reason that no elite school has adopted DNA tests is that no one has figured out how to use them to predict academic achievement. Yet" (Frank 2012).

This ominous conclusion proved prescient. A study published in 2013 suggested that it *was* possible to predict academic achievement with DNA (Rietveld et al. 2013). Over the next couple of years, the online publication *Nautilus* ran stories speculating that couples undergoing in-vitro fertilization, or IVF, would soon be able to choose which embryos to implant on the basis of their predicted intelligence quotient (IQ) or educational attainment. Although physicist Steve Hsu (2014) and sociologist Dalton Conley (2015) disagreed over whether this kind of genetic engineering was a good idea, neither doubted its possibility.

In 2017, Hsu launched the company Genomic Prediction as the first step toward creating the "super-intelligent humans" he had envisioned in his 2014 *Nautilus* article. Genomic Prediction offered IVF clients estimates of the lifetime risk of a variety of complex diseases for each of their viable embryos. The list included diabetes, several types of cancer, and low predicted educational attainment. To make this last test more palatable to

customers, the company termed it "intellectual disability," reducing a complex social phenomenon to individual biology (Adler 2019).

The science of predicting educational attainment and other social outcomes from individual DNA is one strand of the larger field of social science genomics, or sociogenomics for short, which came into being after the completion of the Human Genome Project. Other strands of sociogenomics are rooted in medical sociology. One uses DNA to control for genomic predictors of disease in order to better tease out social causes (Robinette, Boardman, and Crimmins 2019, 2020). Another uses epigenetic markers, such as methylation and telomere length, to identify the cellular pathways through which the social world gets under the skin to cause disease (Marzi et al. 2018; Massey et al. 2018; Mitchell et al. 2017). These lines of research identify biological effects of social causes, generating a new type of evidence for something social scientists have long known, which is that the social world affects individual health and that various types of social inequality produce health disparities. The line of sociogenomic research that goes in the other direction, from DNA to educational attainment and other social outcomes, is the focus of this essay. In contrast to the others, it originated in behavior genetics, a subfield of psychology that emerged in the mid-twentieth century out of the American eugenics movement. To differentiate it from the other strands of sociogenomics, I will refer to it as "molecular behavior genetics."

This historical pathway, from eugenics to molecular behavior genetics, has largely escaped the attention of present-day observers, though the field's practitioners once readily admitted their field's eugenic origins (e.g. Osborne and Osborne 1999). Existing histories of eugenics typically end after World War II, producing the widespread but false impression that eugenics was thoroughly discredited by the Holocaust. Scholarship that does follow eugenics past this historical firewall typically focuses on sterilization policy in the United States (Kluchin 2009; Ladd-Taylor 2017), or on the eugenic origins of medical genetics (Comfort 2012; Kevles 1985), marital and genetic counseling (Ladd-Taylor 2001; Stern 2005, 2012), or demography (Merchant 2021). Recent histories of behavior genetics, most of which have been written by behavior geneticists themselves (Gilger 2000; Loehlin 2009; Plomin and Rende 1991) or by sociologists relying on interviews with behavior geneticists (Panofsky 2014), have downplayed the eugenic origins of the field. It is likely that many of today's behavior geneticists simply don't know about their field's institutional links with the American eugenics movement. For example, behavior geneticist Kathryn Paige Harden begins her 2021 book *The Genetic Lottery: Why DNA Matters for Social Equality* with a history of eugenics that ends at the Holocaust, providing no indication of the linkages between eugenics and behavior genetics. She then explains that "we can draw a direct line, both financially and ideologically, from these eugenicists of the early twentieth century to the white supremacists of today" (Harden 2021, 18). What she does not say—and may be unaware of—is that it is also possible to draw a direct line, financially, ideologically, intellectually and institutionally, from early twentieth-century eugenics to her own field of molecular behavior genetics.

This essay reconstructs those linkages from eugenics, as first articulated by Francis Galton in 1865, to today's efforts to identify genomic causes of individual differences in

educational attainment and other social outcomes. It focuses primarily on the United States and, to a much lesser extent, the U.K. The reasons for this are threefold. First, although eugenics existed on all inhabited continents of the world in the first half of the twentieth century, it traditionally operated at a national level, with policies and programs designed to improve the supposed "quality" of national populations in order to increase a country's geopolitical power relative to other countries (Bashford and Levine 2010). Eugenics therefore differed fairly dramatically from place to place. The version of eugenics that gave birth to behavior genetics emerged in the United States in the mid-twentieth century, though eugenicists in the United States have typically maintained strong cross-Atlantic connections, and a similar version of eugenics emerged in the U.K. at the same time (Kevles 1985). Second, behavior eugenics originated in the United States (though it was also practiced in the U.K.), and its development was strongly linked to U.S. racial politics, as will be described below. Third, although sociogenomics is a transnational science, most practitioners of the version I am calling "molecular behavior genetics" work in and/or were trained in the United States or collaborate with U.S.-based scientists (Bliss 2018).

In following the trajectory from eugenics to molecular behavior genetics, this essay demonstrates that, as scientists have developed more precise ways to measure the influence of DNA on social outcomes, those influences have paradoxically become more and more indeterminate, and this indeterminacy has supported a range of new eugenic projects. Galton hypothesized that social outcomes were nearly entirely driven by biological inheritance. Over the past 150 years, as scientists have worked to validate his claims, they have instead turned up more and more evidence that biological inheritance plays a much smaller role than Galton believed, and that the effects of genetics are inseparable from those of a person's social, biological, and natural environment. Nonetheless, molecular behavior geneticists present their research to the public as if it indicated a decisive role for genetics in creating our social world, and advocate for policies premised on that overdrawn conclusion. The determinacy (and sometimes outright determinism) of scientists' public statements about the genetic causes of social outcomes is therefore at odds with the indeterminacy revealed by their own science and that of others.

This article links the eugenic projects of a hundred years ago with molecular behavior genetics in three steps. First, it excavates the eugenic origins of the concept of intelligence and of the estimation of the heritability of intelligence. Second, it describes the rise of behavior genetics and scientists' use of behavior genetics to oppose the civil rights movement. Finally, it demonstrates that the introduction of molecular methods into behavior genetics has produced more evidence of the fundamentally indeterminate relationship between DNA and social outcomes, even though some scientists working in this area have presented their research to the public as solid evidence that social outcomes have genetic causes.

The Eugenic Origins of Intelligence and its Heritability

English polymath Francis Galton coined the term "eugenics," literally meaning "good breeding," in 1883 (Galton 1883). By then, he had been working out the ideas that would characterize eugenics for nearly twenty years, beginning with an 1865 pair of articles that he would later expand into the book *Hereditary Genius* (Galton 1865, 1870). A cousin of Charles Darwin, Galton made it his life's work to extend Darwin's evolutionary theory into the social realm. Galtonian eugenics had three basic premises. First, and foundationally, was the claim that socioeconomic status is primarily determined by individual intelligence and abilities, which themselves are substantially shaped by biological heredity, or what we now recognize as DNA. The phrase "hereditary genius" encapsulates this perfectly. The next two premises were corollaries of the first. The second was that racial differences in socioeconomic status are underpinned by genetic inequality, and the third was that selective breeding is the most effective route to ameliorating social problems. Galton came up with these ideas in England during a time when workers were demanding the right to vote and when imperial power was being challenged in various parts of the world, most notably by the 1857 uprising against the British East India Company and the 1865 Morant Bay Rebellion in Jamaica. Galton's eugenic principles naturalized metropolitan socioeconomic inequality and imperial domination, and proposed a biological alternative to democratization.

Today, eugenics often gets dismissed as a relic of the past: a pseudoscience and/or a political movement rooted in pseudoscience that has been discredited. Indeed, equating eugenics with pseudoscience has long been a strategy for erecting a temporal *cordon sanitaire* around eugenics, keeping it safely in the past. The truth, however, is more complicated. Galton and many other eugenicists *did* subscribe to scientific theories that have since been disproven, but so did other early (non-eugenicist) scientists, including Darwin, who believed that acquired characteristics were biologically inherited (Paul 1995). Nonetheless, Galton and other eugenicists made important contributions to science that are still recognized as such today, including most of the techniques of inferential statistics, and they made these contributions in the pursuit of eugenics (MacKenzie 1981; Porter 1986). Eugenicists and their supporters also laid the groundwork for the establishment of entire fields of scientific research, such as molecular biology and evolutionary biology, that continue to be pursued by scientists who are unaware of the eugenic origins of their research questions (Kay 1993; Subramaniam 2014). Finally, while individual eugenicists, including Galton, wedded themselves to theories of biological heredity that were ultimately disproved, eugenics as an ideology was quite resilient and compatible with a range of models of inheritance. As this essay will show, the American eugenics movement adapted as the science of heredity developed across the first half of the twentieth century.

Galton and his protégé Karl Pearson subscribed to a model of heredity known as "ancestral inheritance," according to which human characteristics varied on a continuous scale and children resembled a blend of the characteristics of their two parents. American eugenicists, however, led by Charles Davenport at the Cold Spring Harbor Station for

Experimental Evolution, rejected ancestral inheritance in favor of Mendelian heredity, which had been re-discovered at the beginning of the twentieth century (Rosenberg 1976). According to their simple Mendelian model, illustrated in the Punnett squares many of us learned in high school, biological and behavioral characteristics were categorical and inherited in discrete units, with dominant characteristics prevailing over recessive ones. The embrace of Mendelian inheritance by such American eugenicists as Charles Davenport and Raymond Pearl strained their relationships with Galton and Pearson in the final years of Galton's life (Pearson 1910a, b).

Although Galton theorized that all human characteristics were governed by biological inheritance, he focused on intelligence as the one that most directly mediated between a person's biological makeup and their socioeconomic status, with higher intelligence underlying higher socioeconomic status. Davenport, working with a Mendelian model, focused instead on "feeblemindedness," a term commonly used at the time to describe the below-average intelligence thought to underlie poverty, crime, and the transgression of social norms. In 1909, Davenport teamed up with the psychologist Henry Herbert Goddard, director of research at the Vineland Training School for Feeble-Minded Girls and Boys in New Jersey, to collect data on patterns of feeblemindedness in families (Goddard 1909-1910).

Just one year before, Goddard had imported the world's first intelligence test, the Binet-Simon, from France. While the test had originated as a tool for identifying schoolchildren who could benefit from remedial education, in Goddard's hands it became instead a tool for identifying inherited—and therefore irremediable—feeblemindedness (Carson 2007; Zenderland 1998). Goddard and Davenport understood feeblemindedness to be inherited in a Mendelian fashion, and sought data showing that the children of two feebleminded parents would always be feebleminded (Goddard 1909-1910; Paul and Spencer 2001). To manage the data they collected, Davenport established the Eugenics Record Office at Cold Spring Harbor in 1910 with a grant from railroad heiress Mary Harriman. These data would inform Goddard's 1912 book, *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*, which introduced eugenics to a broader audience (Smith and Wehmeyer 2012).

During World War I, Goddard teamed up with the Stanford University psychologist Lewis Terman to produce an intelligence test for U.S. Army recruits, evaluating over 1.7 million men before the armistice (Carson 1993). In the years leading up to the war, Terman had revised the Binet-Simon test—now called the Stanford-Binet—to produce a quantitative measure of intelligence across the spectrum from low to high, which became known as the intelligence quotient, or IQ (Terman 1916). Terman understood feeblemindedness as the low end of a continuous distribution, with genius at the high end. Although Terman's continuous concept of intelligence was incompatible with Mendelian inheritance, Terman, himself a member of the eugenicist Human Betterment Foundation, had no doubt that intelligence was inherited biologically. Over the next few years, the eugenicist statistician Ronald A. Fisher would solve this discrepancy by articulating the beginning of what is now known as the modern evolutionary synthesis, a new model of heredity that reconciled

Galton and Pearson's "ancestral inheritance" with Mendelian inheritance and laid the foundation for the field of quantitative or statistical genetics. According to this model, which remains the dominant one, continuous characteristics—such as height or intelligence—are controlled by multiple genes, each of which is inherited in a Mendelian manner (Fisher 1918, 1919).

In the years following the war, Terman and his colleagues shocked the American public with the results of Army intelligence testing, generating widespread acceptance of eugenic principles and widespread support for eugenic policies. Nearly thirty-one percent of Army recruits had to take the Beta test because they were not literate enough for the Alpha test (NYT 1919). Overall, about forty-seven percent of White recruits had a mental age of twelve or younger, a category for which Goddard had coined the term "moron." Black Americans scored lower than White Americans and immigrants from Southern and Eastern Europe scored lower than native-born White people (Brigham 1922). Harry Laughlin, superintendent of Davenport's Eugenics Record Office, used these results to lobby for immigration restriction at the federal level and eugenic sterilization laws at the state level (Wilson 2002). Immigration restriction went into effect in the mid-1920s and thirty-two states adopted sterilization laws prior to World War II.

Just as Galton's eugenic theories had legitimated the restriction of democracy in Great Britain and the British Empire, Terman and other psychologists warned that most Americans did not have the innate intelligence required to participate in democratic self-government. Their critics, most prominently Walter Lippmann, countered that intelligence testing itself, not the low intelligence of the U.S. population, posed the real threat to democracy (Pastore 1978). Lippmann challenged Terman's key claims, first that a high IQ qualified one to lead society and second that IQ was inherited biologically (Lippmann 1922). Terman would spend the rest of his life trying to prove the first point by following a cohort of high-IQ California children into adulthood (Terman 1926). These intelligent girls and boys grew into amazingly accomplished men and women, though their success can't be attributed entirely to their IQ: Terman provided them with lifelong guidance, connections, and letters of recommendation (Shurkin 1992). Due to Terman's influence, a disproportionate number attended Stanford University.

Terman left it largely to the next generation of educational psychologists to prove that intelligence was inherited rather than acquired. Their research built upon the modern evolutionary synthesis and a related statistical concept developed by Fisher: the analysis of variance, a method for the partitioning of sources of variance that act *independently* of one another. Theorizing that nature and nurture act independently to produce individual outcomes (which we now know is not true), Fisher (1918) contended that it was possible to measure the amount of variance in a sample that was caused by genetic difference, a measure that, over the next several years came to be known as "heritability" (Lush 1943; for a critique of this measure, see Lewontin 1974).

Psychologists approached the problem of measuring heritability in two ways. Animal researchers, such as Robert Tryon, did it experimentally, selectively breeding animals for various indicators of intelligence, such as maze-running ability in rats. After seven

generations, Tryon (1929) had produced two distinct strains of rats, one "bright" and the other "dull," as measured by the number of mistakes they made when going through a standard maze. Human researchers, such as Barbara Burks (1928) and Karl Holzinger (1929), adapted a method developed by Sewall Wright (1921), known as path analysis, to compare IQ correlations between various types of relatives, usually adoptive parent-child pairs compared to biological parent-child pairs and monozygous twins compared to dizygous twins, in order to see how much the genetic relationship contributed to correlations in their intelligence (Burks 1927). Burks was a student of Terman, who described her in 1942 as "one of the two or three ablest women psychologists in the United States" (Terman 1942). Terman pointed to her findings as proof of his claim that IQ was, in large part, inherited biologically (Terman 1928). After graduating from Stanford, Burks took a job with the Eugenics Record Office and joined the American Eugenics Society, eventually becoming a member of its board (King, Montañez-Ramírez, and Wertheimer 2012).

Burks, Holzinger, and other psychologists working on heritability questions presented their findings as estimates of *the* heritability of intelligence. Other scientists, however, including both eugenicist Charles Davenport and non-eugenicist Sewall Wright, pointed out the illusory nature of heritability measurement, particularly in the case of human intelligence. Davenport routinely eschewed attempts to estimate heritability, predicting that "long after I am dead and gone, people (even eugenicists) will be saying 'Further studies are needed on the relative roles of heredity and environment in determining human characteristics.' Very likely large sums of money will be solicited from philanthropists to study this question, but I fear in vain because the question as phrased has so little meaning" (Davenport 1935). For Davenport, environment had no effect on its own, but only ever acted interactively with genetics to produce the outcome in question. The two were simply inseparable. While Davenport focused on *interactions* between genes and environment, Wright (1927) focused on their *correlation*, coming to the same conclusion that the effects of genes and environment could not be disentangled, except perhaps under such quasi-experimental conditions as twinning and adoption.

Even under those conditions, however, Wright (1927) warned that heritability estimates are properties of the sample being studied, or of a population from which that sample was selected randomly, rather than a property of the trait in question. Technically, heritability refers to the amount of variance *in a sample* with respect to a given trait that can be attributed to genetic variation. It is a proportion, so it will always be between zero and one, though it is usually represented as a percentage. In a sample of clones, all variance in intelligence (or any other trait) would be due to non-genetic causes, so heritability would be zero. In a sample of people with different genes in the same controlled environment, all variance in intelligence (or any other trait) would be due to genetics, so heritability would be one or one hundred percent. Since heritability can only be estimated using samples of twins or adoptees, those estimates are not generalizable to larger populations. It therefore makes no sense to speak of *the* heritability of intelligence, though many psychologists did so anyway. In so doing, they encouraged their audiences to interpret heritability in its colloquial sense, as indicating that something is directly inherited from one's parents (Keller

2010). Higher estimates for "the heritability of intelligence" implied to nonspecialist audiences that intelligence was less malleable, though they actually meant nothing of the sort.

At the same time that psychologists developed methods for estimating heritability, they adjusted IQ tests to increase heritability estimates, since higher heritability estimates supported their claim that intelligence tests were measuring an innate quality rather than an acquired one. Through this process, IQ and its heritability were mutually constituted by eugenicists as a means of operationalizing and validating Francis Galton's concept of hereditary genius.

The New Eugenics, Behavior Genetics, and Race

Eugenics in the United States changed dramatically between the mid-1930s and mid-1940s. This shift has long been misunderstood by non-historians as the American rejection of all things eugenic in response to the horrors of the Holocaust. But Americans did not reject all things eugenic—only some aspects of eugenics (and even those were still held fast in some quarters)—and this turn was already well underway before the beginning of World War II.

The transition first became visible in the late 1920 and early 1930s with the growing distaste for racism among scientists. Even those who remained strongly committed to racism and anti-Semitism in their personal lives excised these features from their scientific work (Barkan 1992). As scientific racism fell out of favor, the Eugenics Record Office (ERO) at Cold Spring Harbor, whose eugenic research remained deeply and unapologetically racist, lost its funding from the Carnegie Institution (Allen 1986; Rosenberg 1976). By that time, the ERO had already broken its ties with the American Eugenics Society (AES), which had been founded in the mid-1920s by ERO leaders Davenport and Laughlin, together with paleontologist Henry Fairfield Osborn and lawyer Madison Grant, prominent eugenicists and race scientists (Spiro 2009). When these men resigned from the board of the AES in the mid-1930s, they were replaced by younger eugenicists, including Barbara Burks and Frederick Henry Osborn, a railroad tycoon and nephew of Henry Fairfield Osborn (American Eugenics Society 1930-1942).

These younger eugenicists, particularly Osborn, recognized that scientific racism was falling from grace and worked to save American eugenics from the same fate by distancing eugenics from racism. As state control over reproduction became increasingly associated with European fascism, Osborn began to articulate an ostensibly non-racist eugenic program based on the legalization of contraception and nominal freedom of choice over reproduction rather than one that relied on state-mandated sterilization (Merchant 2021). Reflecting the eugenics movement's turn away from a focus on sterilization, the Human Betterment Foundation, a California-based eugenics organization that had been a major proponent of sterilization, closed in 1942. The mission of the American Eugenics Society remained, as it had always been, "selecting the better and suppressing the poorer stocks" (James Angell, quoted in American Eugenics Society 1932). Under Osborn's leadership, however, the organization eschewed race and national origin as proxies for genetic quality,

instead advocating selection on the basis of individual attributes, primarily intelligence and socioeconomic status. It also insisted that selection should be made by couples themselves rather than the state, with social norms and financial incentives guiding couples toward eugenic rather than dysgenic choices.

This new eugenic program was grounded in the modern evolutionary synthesis and the estimation of heritability. Osborn replaced the discrete category of feeblemindedness with a continuous concept of "quality," which he usually left undefined but at times equated with intelligence or socioeconomic status. Whereas Davenport had advocated sterilization as a means of eliminating supposedly defective alleles from the gene pool, Osborn understood quality as being transmitted according to the principles of quantitative genetics, meaning that the goal was *increasing quality* rather than *eradicating defectiveness*. According to Osborn's theory, overall population quality could be increased by encouraging large families among supposedly higher-quality (wealthier and more educated) parents and small families among supposedly lower-quality (poorer and less educated) parents (Osborn 1961).

As non-hereditarian, or so-called "environmental" explanations for intelligence and socioeconomic status became more popular in the 1940s and 1950s, Osborn began to give his hereditarianism an environmentalist veneer. He recognized that there were no biological markers for the "quality" he sought to maximize, and argued that the home environment parents provided for their children was the best available proxy. The environment itself didn't matter much to children's outcomes, he contended, but it signaled genetic quality in the parents that they would pass along to their children. To accomplish this selection without overt state control over reproduction, Osborn recommended that child tax credits be made proportional to income (so higher-income parents would receive a larger credit for each child) and that higher education be made free for the child of college graduates (so they wouldn't have to limit themselves to the number of children they could afford to educate). He also relied on wishful thinking, asserting that people with the qualities he favored had a natural affinity for parenting and therefore wanted more children. Osborn and his wife ultimately had six kids (Merchant 2021).

The eugenics program promoted by the American Eugenics Society under Osborn looked very different from the eugenics that had come before, and very different from what most people today envision when they hear the word "eugenics." It was devoid of overt racism and state control over reproduction. Osborn and his colleagues were not anti-racist, nor did they oppose sterilization or immigration restriction. They simply excised these elements from their eugenic agenda. Some historians have suggested that the American Eugenics Society abandoned eugenics altogether, shifting from a focus on selective breeding to environmental improvement (Ramsden 2003). But the AES still promoted a thoroughly hereditarian eugenics. While it is true that Osborn advocated for some social welfare programs, these were all designed either to shift the bulk of reproduction from the poor to the wealthy, as described above, or to separate the wheat from the chaff. For example, Osborn recommended the free provision of lunch in school, not because it would help all children, but because those with superior genes needed adequate nutrition to perform at their best and thereby have their superiority recognized. Despite his family's long-term

relationship with the Roosevelts, Osborn was a staunch opponent of the New Deal. In his mind, the only legitimate purpose of the welfare state was to promote a eugenic distribution of births under conditions of nominal reproductive freedom.

Although the AES no longer advocated scientific racism, it continued to hold fast to the first and third tenets of Galtonian eugenics: the idea that genetic difference was the primary driver of socioeconomic inequality and that selective breeding was the most effective means of ameliorating social problems. In Osborn's view, genetic science simply hadn't caught up to eugenic theory. Genes *did* determine intelligence and socioeconomic status, Osborn believed; the *way* in which they did so, however, remained indeterminate.

Osborn was not a scientist himself, but he worked hard to keep eugenics aligned with cutting-edge science. He did this by nurturing fledgling fields that he saw as potential allies for his eugenic project and whose practitioners needed support. In the 1930s this was demography (Merchant 2021); in the 1950s it was medical genetics and genetic counseling (Comfort 2012; Stern 2012), and in the 1960s it was behavior genetics.

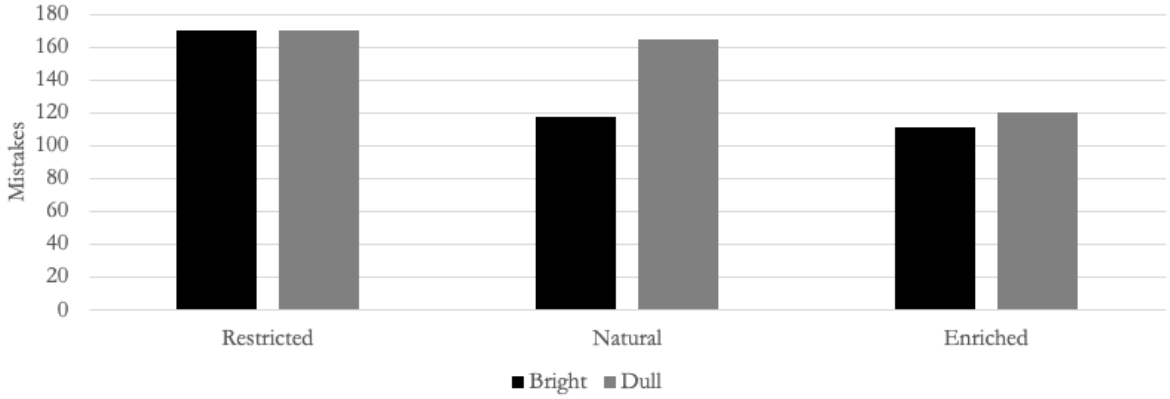
By the beginning of the 1960s, Osborn had grown concerned that neither demographers nor geneticists were taking seriously the effects of changing birth rates on the intelligence of the American people (Osborn 1963). He organized a series of conferences in Princeton between 1964 and 1969 that aimed to put demographers and geneticists into conversation with one another. The demographers who were most interested initially were those working for philanthropic organizations trying to solve "the population problem" (Merchant 2021), specifically Dudley Kirk at the Population Council and Clyde Kiser at the Milbank Memorial Fund. The genetic side included population geneticists Theodosius Dobzhansky and his former student Richard Lewontin. Over time, the conferences drew in more and more psychologists working on the genetics of behavior, such as Jerry Hirsch, Gardner Lindzey, John Loehlin, and Irving Gottesman (American Eugenics Society 1964-1969). These psychologists were the heirs to the research program on intelligence and its heritability that had been inaugurated by Lewis Terman, Barbara Burks, Karl Holzinger, and Robert Tryon earlier in the century. In 1970, they created the Behavior Genetics Association, with funding from the American Eugenics Society (American Eugenics Society 1971; Osborne and Osborne 1999). The two organizations remained close, connected by interlocking directorates.

Even before the Behavior Genetics Association officially launched, however, the new field was thrown into controversy by a 1969 publication in the *Harvard Educational Review* by psychologist Arthur Jensen. The article presented heritability estimates as evidence that programs like Head Start would never close the IQ gap between Black and White students because the gap was rooted in genetic difference. Jensen called for the resegregation of American education, and for a eugenics program that would reduce the childbearing of all individuals with low IQs but especially African Americans. Nobel Prize-winning physicist William Shockley had been using his celebrity status to advance similar claims for a few years by that point, and Jensen's article seemed to add the scientific authority that Shockley lacked because he didn't have a background in genetics (Shurkin 2006).

Jensen, however, misrepresented genetic science in three important ways that denied its indeterminacy and oversold the scientific evidence to publics and policy makers. First, he presented heritability estimates for intelligence as if heritability were a property of the *trait* rather than a property of the sample. Second, he claimed that higher heritability meant a trait was less susceptible to change through non-genetic mechanisms, such as education in the case of intelligence. Third, he argued that the heritability of intelligence among White Americans—the only people who had been studied to that point—*must* mean that group differences between White and Black Americans were genetic in nature (Jensen 1969).

A 1958 experiment with Tryon's rats shows why Jensen's conclusions were unwarranted. In the 1920s, Tryon had demonstrated that rats could be bred to be either good or bad at running mazes. But the 1958 study showed that the environment in which the rats were raised mattered as much as their genetics (Cooper and Zubek 1958). As Figure 1 illustrates, in a restricted environment, "bright"-genotype rats made just as many mistakes as "dull"-genotype rats, and in an enriched environment, "dull"-genotype rats made nearly as few mistakes as "bright"-genotype rats. Although maze-running ability was highly heritable in Tryon's initial sample, it was just as susceptible to change through environmental manipulation as through selective breeding, and rats that were genetically identical in terms of maze-running ability performed very differently depending on the conditions in which they had been raised. Moreover, the environment determined how much difference genotype made and genotype determined how much difference the environment made.

Figure 1. Bright and Dull Rats in Three Environments



Another problem with Jensen's claims had nothing to do with genetics. Sociologists at the University of Wisconsin had recently demonstrated that intelligence plays a limited role in a person's educational attainment and adult socioeconomic status, with several other variables mattering just as much (Hauser 1970). Jensen's bombshell claims, however, focused debate on the causes of IQ differences, eliding all of the structural factors that create and perpetuate socioeconomic inequality.

Some psychologists and geneticists came out strongly against Jensen. Jerry Hirsch (1975) accused Jensen of scientific misconduct, Leon Kamin (1974) argued that Jensen and others had wildly overestimated the heritability of intelligence, and Richard Lewontin (1974) pointed out that heritability did not mean what Jensen claimed it meant. Many non-scientists reacted with outrage to Jensen's racism. Protesters disrupted his lectures and threatened physical harm. The tires on his car were slashed and police had to open his mail. He received bomb threats at his office and his family had to seek protection (Scarr 1998). This response allowed Jensen to portray himself as a victim, even as he advocated genocide against African Americans according to the UN definition of the term, which included restricting births among a racially- or ethnically-defined group (United Nations 1948).

Jensen's supporters, meanwhile, compared him and other behavior geneticists advancing similar claims to Galileo (Page 1972). The Behavior Genetics Association, and the field of behavior genetics in general, rallied around him. As behavior geneticists defended Jensen, they became hyper-focused on estimating the heritability of intelligence and other mental traits and behaviors, using the type of twin and adoption studies pioneered by Barbara Burks and Karl Holzinger more than forty years earlier (Panofsky 2014). These studies suggested that all traits and behaviors are heritable, though heritability estimates varied widely between samples for the same trait (Turkheimer and Gottesman 1991). They also appeared to show that social institutions—such as families, schools, and religion—played only a trivial role in individual outcomes (Rowe 1994). Channeling Frederick Osborn, behavior geneticists even claimed that a child's home environment was genetically determined (Plomin and Bergeman 1991).

Behavior geneticists supported Jensen's misleading statements about the meaning of heritability estimates, and defended his "intellectual freedom" to make scientifically unwarranted claims about the relationship between race and intelligence. To these white and mostly male scientists, protecting Jensen's freedom to speculate idly about the innate inferiority of an oppressed segment of society was more important than protecting his targets from the consequences of such speculation. An attempt by the wider genetics community—the Genetics Society of America (GSA)—to make a clear statement to the American public that "there is no convincing evidence of genetic difference in intelligence between races" failed because several GSA members pointed out that it would be equally true to say that "there is no convincing evidence that there are *not* genetic differences in intelligence between races" (Loehlin 1975, emphasis in the original). Ultimately, the GSA took a non-position on the issue, stating "in our view, there is no convincing evidence as to whether there is or is not an appreciable genetic difference in intelligence between races" (Russell 1976).

As behavior geneticists doubled down on their support for Jensen, the gulf between them and other social and medical scientists widened (Panofsky 2014). Researchers outside of behavior genetics put little stock in heritability studies, so behavior geneticists developed their own publishing ecosystem to bring their work into print. They published in eugenics journals that had recently taken the word "eugenics" out of their titles (such as the *Annals of Eugenics*, which had become the *Annals of Human Genetics*; *Eugenics Quarterly*, which had

become *Social Biology*; and the *Eugenics Review*, which had become *Biosocial Science)*, and in new journals specific to behavior genetics (such as *Behavior Genetics*, *Twin Research and Human Genetics*, *Intelligence*, and *Personality and Individual Differences*). There was even a set of journals (such as *Mankind Quarterly*, the *Journal of Social, Political, and Economic Studies*, and *Population and Environment*) for research that was too racist to be published in the more mainstream eugenics and behavior genetics journals. Even for behavior geneticists, some research, such as that of J. Philippe Rushton and Richard Lynn, was beyond the pale. Yet these men had their scientific defenders, notably the prominent biologist Edward O. Wilson, who came out strongly in support of Rushton (Borrello and Sepkoski 2022; Farina and Gibbons 2022).

Those who did this racist research received generous support from the Pioneer Fund, whose primary aim was to overturn *Brown v. Board of Education* and resegregate American education (Tucker 2002). The Pioneer Fund made grants to Jensen, Shockley, Rushton, and Lynn, as well as to several other intelligence researchers, many of whom are now on the Southern Poverty Law Center's extremist watchlist. When Richard Herrnstein and Charles Murray published *The Bell Curve* in 1994, they disproportionately cited scholars who had received support from the Pioneer Fund. Their argument differed little from the one advanced by Jensen and Shockley, but publishing twenty-five years later, they could make the disingenuous and obviously untrue claim that the civil rights movement had equalized opportunities between Black and White Americans, so any remaining disparities in IQ or socioeconomic status "must" be genetic in origin (Herrnstein and Murray 1994). In response to widespread criticism of the book, fifty-two behavior geneticists, many of them Pioneer Fund grantees, published an open letter in *The Wall Street Journal* in Herrnstein and Murray's defense (Gottfredson 1994). Titled "Mainstream Science on Intelligence," the letter portrayed the book as having been based in solid scientific research. The claims it made were considered "mainstream" primarily among scientists supported by the Pioneer Fund, but its publication in *The Wall Street Journal* elevated those claims to the status of established fact among the American public. Such claims were also aired in other popular press outlets, such as *Science News*, which just recently apologized for its support for eugenics and scientific racism (Science News Staff 2022).

Behavior genetics also authorized a bizarre eugenic venture. In 1980, the Repository for Germinal Choice opened just outside San Diego. One of the country's first sperm banks, it offered the gametes of Nobel Prize-winning (male) scientists to high-IQ women, who could use them to have smarter children than they would be able to conceive with their male partners (Plotz 2005). Only women married to men could qualify. The Repository instantiated a vision first articulated in 1964 by the Foundation for Germinal Choice, which had been established by Nobel Prize-winning geneticist (and eugenicist) Hermann J. Muller (1964). Businessman Robert Klark Graham, the primary force behind the Repository, cited Muller as a founder even though he died more than a decade before the Repository opened (Graham nd). Few Nobel Prize winners ever donated their sperm—William Shockley was the only one who publicly admitted to having done so—and the Repository eventually cast a wider net, trawling the halls of university math and science departments. The Repository's

legitimacy depended on the indeterminate genetic determinism that formed the heart of Osborn's eugenic program. Sperm donors did not undergo any kind of genetic testing. Since behavior genetics had demonstrated that intelligence was heritable, the Nobel Prize itself served as a genetic marker of intelligence. As sperm banking grew in popularity, choosing a donor at least partly on the basis of his test scores or educational attainment became the norm, demonstrating general public acceptance of eugenic principles grounded in indeterminate determinism (Daniels and Golden 2004).

During these last few decades of the twentieth century, the meaning of eugenics shifted yet again. Jensen, Shockley, and the Pioneer Fund used the word "eugenics" to describe their explicitly racist breeding proposals. A new organization, the American Eugenics Party, sprang up in the mid-1960s, vocally equating eugenics with racism (American Eugenics Party 1964-1968). It seemed that Osborn and the American Eugenics Society had lost the thirty-year battle to divorce eugenics from racism in the popular imaginary. The racism of the Pioneer Fund and the American Eugenics Party, however, was different from that of the Eugenics Record Office and other eugenic organizations at the beginning of the twentieth century. The earlier eugenics had drawn racial boundaries within Europe as well as between Europe and other continents, and had relied primarily on anthropometric (primarily craniometric) measures of biological difference. The new racial eugenics eschewed intra-European distinctions, conceiving of race in strictly continental terms. It also drew increasingly on genetics and evolutionary concepts—such as those that would come to characterize sociobiology and evolutionary psychology—to demarcate and theorize racial difference.

In 1972, the American Eugenics Society changed its name to the Society for the Study of Social Biology (American Eugenics Society 1972). Its program hadn't changed, but its leaders, now primarily drawn from the new field of behavior genetics, wanted to distance the organization from the word "eugenics," which was no longer separable from racism. Ironically, the behavior geneticists associated with the erstwhile American Eugenics Society were among the less racist members of their field. As the leaders of the organization embraced the new name, they also projected that name backward in time, rewriting the previous thirty years of the organization's history. In this revisionist version, eugenics had never changed; the organization had simply stopped doing eugenics around the time of World War II. Professional historians such as Daniel Kevles (1985) and Charles Rosenberg (1961, 1976) contributed to this rewriting, the former by describing Osborn's rebranding of eugenics as the beginning of the shift from eugenics to genetics and the latter by equating eugenics with Charles Davenport and his long-discredited Mendelian theories of the inheritance of human behavior. The 1990s saw an outpouring of histories of eugenics, covering most parts of the world. The majority of this scholarship ended before 1945, producing the popular impression that eugenics ended then as well. Osborn's eugenics was no longer eugenics; it was now simply behavior genetics, medical genetics, genetic counseling, and fertility medicine. This rewriting allowed behavior geneticists to disavow and forget the eugenic origins of their field, even as they hailed Francis Galton as their field's founder (e.g. Gilger 2000; Plomin and Rende 1991). It also reduced eugenics to

racism, making it impossible to recognize or critique such eugenic initiatives as the Repository for Germinal Choice *as* eugenics because they weren't explicitly racist (though the Repository only collected the sperm of White men and only made it available to White women).

Behavior Genetics Goes Molecular

Twentieth-century behavior genetics embodied the same kind of indeterminate genetic determinism that had animated Osborn's eugenic project and that of the Repository for Germinal Choice. Twin and adoption studies demonstrated that *all* human outcomes were heritable (Turkheimer and Gottesman 1991), but they provided no information about which genes might contribute to which outcomes or how they might do so. They therefore supported sweeping claims: that the existing social structure was rooted in genetics and therefore natural, just, and immutable; that most findings in sociology and economics were wrong because they didn't take genetics into account; and that racial discrimination was a reasonable response to genetic difference rather than the primary cause of social inequality. At the beginning of the twenty-first century, behavior genetics went molecular (Panofsky 2015).

After the completion of the Human Genome Project, it began to seem possible that behavior geneticists might finally be able to overcome their field's indeterminacy by locating the actual genes that contribute to intelligence and socioeconomic status. Other social scientists also became interested in genetics at this point. Sociologists and epidemiologists were excited to identify the genes that predispose people to complex diseases in order to better tease out their social causes. Some sociologists were also curious about the genetics of behavior. In the quantitative social sciences, outcomes are always underdetermined, meaning that, no matter how many variables a model includes, it will never be able to account for all or even most of the variance in the outcome. Sociologists suspected that genes might explain why people often respond differently to the same social circumstances (Conley and Fletcher 2017; Freese 2018).

Behavior geneticists and their new partners initially looked for correlations between specific traits and genes with known biochemical effects. Within a decade, however, it became clear that this candidate-gene approach wasn't working. Researchers attained few positive results, and even fewer of these replicated. The most well-known is probably the so-called warrior gene, a variant that was found to predispose men to aggressive behavior. When this result failed replication, behavior geneticists hypothesized that perhaps it only caused aggression in people who had been abused as children (Caspi et al. 2002). Further research, however, showed that children who were abused were more likely to be aggressive adults regardless of their genotype (Haberstick et al. 2014). Nonetheless, Genex Diagnostics still sells an over-the-counter test for this variant.

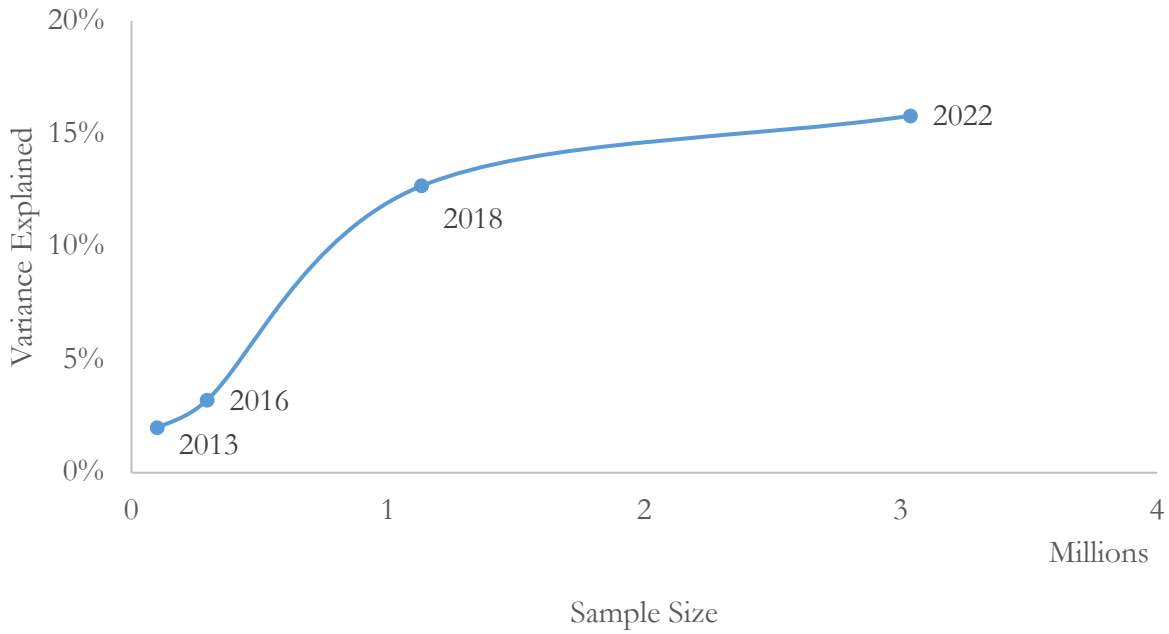
In 2012, a group of genetically-oriented social scientists announced that "most reported genetic associations with general intelligence are probably false positives" (Chabris et al. 2012). This finding didn't shake behavior geneticists' faith that intelligence was driven

largely by DNA, but it did encourage them to adopt a new paradigm. In keeping with the modern evolutionary synthesis, behavior geneticists had long worked on the assumption that intelligence and socioeconomic status were polygenic, that is, influenced by multiple genes. This assumption didn't change, but after the failure of candidate gene studies, behavior geneticists decided that, instead of looking for a small number of genes with large effects, they should look for a large number of genes with tiny effects (Chabris et al. 2013). They termed this theory the "fourth law of behavior genetics" (Chabris et al. 2015).

Following the lead of medical and psychiatric genetics, molecular behavior geneticists turned to genome-wide association studies. Known familiarly as GWAS, these hypothesis-free studies simultaneously but independently test hundreds of thousands of loci (single-nucleotide polymorphisms, or SNPs) across the genome for statistically-significant correlations with the outcome in question. Since they seek minuscule effects, they require enormous sample sizes. The Social Science Genetic Association Consortium was born in 2012 from the need for these huge samples. As a consortium, it can meta-analyze samples across a variety of studies to get the statistical power necessary to identify tiny genetic effects. But molecular behavior geneticists quickly realized that they couldn't do a GWAS on intelligence, as most genetic studies hadn't tested participants' IQ. They had, however, asked participants about their educational attainment, so this became the SSGAC's primary outcome of interest.

The SSGAC published its first GWAS of educational attainment in 2013 (Rietveld et al. 2013). Although the study would prove highly consequential, its findings were not particularly impressive. It identified three SNPs with statistically significant effects, each of which was associated with about a month of additional schooling. Altogether, DNA appeared to account for about 2% of the variance in educational attainment, leaving 98% unexplained by genetics. The popular press reported on the study with an appropriate level of skepticism. *Futurity* stated that "genes have small effect on length of education" (Devitt 2013). The *Chronicle of Higher Education* announced that "there is no gene for finishing college" (Voosen 2013). Even *The Wall Street Journal* cautioned readers that there probably isn't a "gene for" height or intelligence (Sapolsky 2014). But those closer to the study read its results differently. They believed that, with a larger sample, a GWAS could account for *more* than 2% of the variance in educational attainment. They were right. The SSGAC published two more GWAS of educational attainment in 2016 and 2018, the latter using a discovery sample of 1.1 million people and accounting for approximately 12% of the variance in educational attainment (Lee et al. 2018; Okbay et al. 2016). A fourth GWAS came out just this year (Okbay et al. 2022). With a sample size of 3.3 million, it managed to raise the variance explained up to 16%, as shown in Figure 2.

Figure 2. Sample Size and Variance Explained in GWAS of Educational Attainment

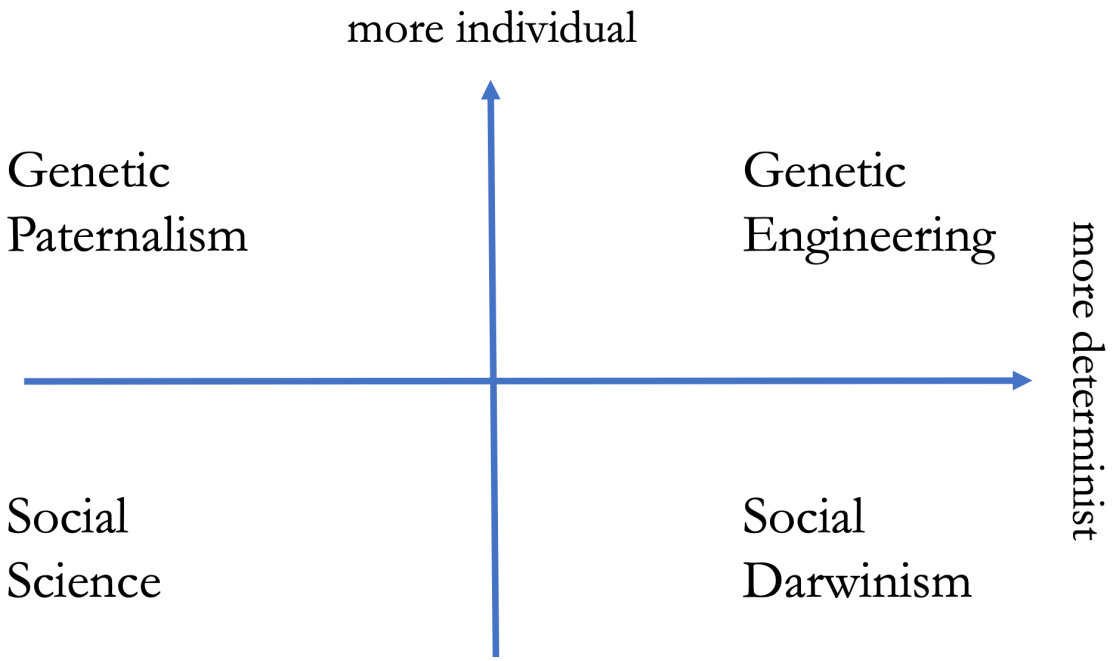


Behavior geneticists and their new colleagues responded to the 2016 and 2018 studies with breathless enthusiasm, publishing books for popular audiences that touted GWAS and the polygenic sores or indices they generate as the key to predicting social outcomes and assessing human potential (Conley and Fletcher 2017; Harden 2021; Plomin 2018). While Conley, Fletcher, and Harden were much more cautious, Plomin described GWAS as validation of the genetic determinism represented in twin and adoption studies. His popular 2018 book, *Blueprint: How DNA Makes Us Who We Are*, represents polygenic scores as much more than a measure of genomic propensity. At times Plomin equates them with "genes for" the outcomes they predict and at other times as measures of those outcomes themselves. Polygenic scores are more determinate than the heritability estimates produced by twin and adoption studies in the sense that they provide individual predictions of the outcomes for which they are constructed, though the SSGAC has warned against using polygenic scores for educational attainment in this way. Polygenic scores are, however, still indeterminate in the sense that they provide no information about which variants *contribute* to the outcome in question (as opposed to simply predicting it) or how they do so.

Molecular behavior geneticists and their supporters generally represent four agendas, shown in Figure 3. Starting in the lower right, social Darwinists see GWAS as evidence that the existing social order is a product of nature and would therefore be difficult or impossible to change. This category includes people like Charles Murray and Sam Harris, who present GWAS as further evidence that racial differences in socioeconomic status are genetic in origin (for a critique, see Turkheimer, Harden, and Nisbett 2017). In the upper

right, eugenicists, such as Steve Hsu, contend that GWAS can point the way toward using genetic engineering to breed smarter humans. In the upper left, genetic paternalists like Robert Plomin and Paige Hardin suggest that knowledge about the genetics of education can guide personalized education programs or otherwise improve education or other social policies. This position appears progressive on its face, but genetic paternalists typically argue *against* equalizing the provision of resources or opportunities because genetic differences would still produce an achievement gap (e.g. Asbury and Plomin 2013; Harden 2021), denying the possibility that the gap can be meaningfully narrowed with interventions that are not genetically informed. In the lower left, sociologists like Dalton Conley and Jason Fletcher maintain that knowing how genetics influence education and socioeconomic status will allow social scientists to control for DNA so as to better estimate the effects of social variables on a variety of outcomes.

Figure 3. Agendas in Molecular Behavior Genetics



Certainly, being able to adequately control for genetic heterogeneity would be a boon to the social sciences, but molecular behavior genetics is a long way from providing that control for such social outcomes as educational attainment, income, and wealth. Since we still know nothing about which genes might contribute to which outcomes or how they might do so (Belsky and Harden 2019), the only tools with which to control for genetics are polygenic scores. For physiological characteristics, such as height, polygenic scores do seem to capture actual genetic causes of differences between individuals. But for complex social

outcomes, specifically educational attainment, direct genetic effects represent only a small fraction of the total effect of the polygenic score (Barcellos, Carvalho, and Turley 2021; Cheesman et al. 2020). Using the polygenic score as a control is therefore inappropriate, as it absorbs the effects of social variables, biasing parameter estimates rather than making them less biased, as their proponents claim (e.g. Conley and Fletcher 2017; Harden 2021). Researchers *can* identify the direct genetic effect of the polygenic score by controlling for parents' genotypes, but this direct genetic effect is very small and still highly indeterminate in the sense that nobody knows the causal mechanisms behind it. In the case of educational attainment, a high polygenic score *could* mean that a person has SNPs that make them more intelligent. However, it could also mean that they have SNPs that make them a morning person, which makes it easier to get to school on time, or it could mean that they have SNPs that make them taller or more attractive, putting them on the right side of teachers' biases. Even when we only include the direct genetic effect of the polygenic score, we still don't know what it is we are controlling for.

Another serious problem with sociogenomics writ large is that it only includes White people (Henn, Merchant, O'Connor, and Rulli 2021). This is true of genome-wide association studies in general, which use supposedly "ancestrally-homogeneous" samples in order to avoid spurious associations (Popejoy and Fullerton 2016). Unsurprisingly, researchers have found that the racial exclusivity of medical GWAS threatens to exacerbate health disparities (Martin et al. 2017), and the same would undoubtedly be true if the GWAS for educational attainment were used for educational or policy purposes. Molecular behavior geneticists and their supporters have largely brushed this problem aside, claiming that GWAS will become more representative any day now (e.g. Harden 2021). While it is true that initiatives like the National Institutes of Health's "All of Us Project" are rapidly increasing the diversity of genome databases, much work still needs to be done to overcome the methodological challenges to performing GWAS on ancestrally-diverse samples (personal communication with Dalton Conley 2022). Until then, research incorporating polygenic scores as control variables is limited primarily to White people with exclusively European genetic ancestry, who represent a minority of Americans, much less the rest of the world, and recent research has demonstrated that polygenic scores are more predictive for some White people than for others (Freese et al. 2019).

Conclusion

Overall, the results of molecular behavior genetics have demonstrated that genetics plays a much *smaller* role in the production of individual differences in educational attainment and other socioeconomic outcomes than was previously thought. While twin and adoption studies had generated heritability estimates in the neighborhood of 50% for most of these outcomes (Plomin 2018), the most recent GWAS of educational attainment suggests that the direct genetic effects of the polygenic score accounts for about 5% of the variance in educational attainment among White Americans (Okbay et al. 2022). In addition to being small, these effects are largely drowned out by those of socioeconomic status. Individuals

with the *highest* polygenic scores for educational attainment whose fathers are in the bottom quartile of the income distribution are less likely to graduate from college than are individuals with the *lowest* polygenic scores whose fathers are in the top quartile of the income distribution (Papageorge and Thom 2018). Kids with low polygenic scores for educational attainment are more likely to complete advanced math classes in high school if they attend wealthy schools than if they attend poor ones (Harden et al. 2020).

Molecular behavior geneticists and their colleagues are well aware of these limitations and have published at length about them in venues frequented by specialists. However, they present a very different image in venues intended for popular audiences. To be sure, most molecular behavior geneticists do not write for popular audiences. Those who do, however, tend to oversell the role of genetics in producing social outcomes. In public facing publications, Plomin (2018) and Harden (2021) exaggerate the findings of molecular behavior genetics—including their own research—to convince readers of Galton's fundamental eugenic principle: that socioeconomic status is primarily determined by individual intelligence and abilities, which themselves are substantially shaped by biological heredity (Turkheimer 2022). While Harden has explicitly disavowed Galton's second and third principles (that racial inequality in socioeconomic status reflects genetic difference and that selective breeding is the most effective way to improve society), Plomin has not (Gillborn 2016).

These scholars represent a tiny fraction of their field, but serve as its ambassadors to the general public, not just in the United States, but worldwide. As such, they foster the widespread acceptance of deterministic ideas about the effects of genetics on behavior, even as they themselves disclaim genetic determinism (Coop and Przeworski 2022). This determinism supports a range of eugenic projects, from the everyday eugenics of sperm and egg donation, to the high-tech eugenics of Genomic Prediction and other companies that provide polygenic embryo screening (though no company currently offers to screen for predicted intelligence), to new versions of such old-school racist projects as white nationalism and genocide. On May 14, 2022, an eighteen-year-old white supremacist entered a supermarket in a black neighborhood of Buffalo, NY, bearing an assault rifle with a racist epithet etched on it. He opened fire, killing ten shoppers and employees and injuring three more before he was apprehended. The diatribe he posted online shortly before driving to Buffalo cited the third iteration of the SSGAC's GWAS of educational attainment as supposed evidence that African Americans are genetically inferior to White Americans (Molteni 2022). This research is dangerous.

In the ten years since the *All Things Considered* story about Porsafillo Preschool aired, the technology has almost caught up with the joke. It is now possible to predict a person's future educational attainment from their DNA, though you couldn't predict the educational attainment of a fetus by drawing its mother's blood. You would need to use amniocentesis or chorionic villus sampling, or test IVF embryos prior to implanting them. Plomin himself has advocated using polygenic scores for educational attainment in exactly this way, arguing that it is an "intelligence test" that people can't cheat on or study for. But nobody knows what it measures, and allocating education on the basis of this polygenic

score would simply replicate existing sources of inequality (Harden 2021). The real danger of this new eugenics is not that Genomic Prediction or another company will breed "super-intelligent humans" (Hsu 2014). A recent article in the *New England Journal of Medicine* (again, not a venue frequented by the general public) explains that selecting embryos on the basis of the polygenic score for educational attainment is unlikely to have the intended effect because the direct genetic effect of the polygenic score is quite small (Turley et al. 2021). Rather, the problem with eugenics is that attributing socioeconomic inequality to genetic diversity is simply the wrong diagnosis, one that ignores a century of social scientific, historical, and genetic research. As such, it can only point to ineffective or at best inefficient solutions that are more likely to perpetuate inequality than to overcome it. Eugenics doesn't "work" by breeding better people; it works by convincing us that people are fundamentally different from one another, and therefore some are more deserving—of education, wealth, and even life—than others. An indeterminate determinism may therefore serve its purpose better than a determinate one.

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