

CONTROLLING THE GENETIC ARSENAL

by Daniel J. Kevles

In April 1991, an exposition opened in the hall atop Paris's great arch of La Defense under the title, *La Vie En Kit (Life in a Test Tube)—Éthique et Biologie*. Along with the displays about molecular genetics and human genome research were a catalogue and placard by psychoanalyst Monette Vaquin. The latter captured many of the anxieties aroused by this subject:

Today, astounding paradox, the generation following Nazism is giving the world the tools of eugenics beyond the wildest Hitlerian dreams. It is as if the unthinkable of the generation of the fathers haunted the discoveries of the sons. Scientists of tomorrow will have a power that exceeds all the powers known to mankind: that of manipulating the genome. Who can say for sure that it will be used only for the avoidance of hereditary illnesses?

Vaquin's apprehensions, echoed frequently by scientists and social analysts, are a powerful reminder of the shadow of eugenics that looms over human genetic research. Ideas about eugenics can be traced back at least to Plato, but modern eugenics originated with Francis Galton (1822-1911), a younger first cousin of Charles Darwin and a brilliant scientist in his own right. In the late 19th century, Galton proposed that the human race might be improved, in the manner of plant and animal breeding, by eliminating so-called undesirables and multiplying so-called desirables. It was Galton who named this

program of human improvement "eugenics," taking the word from a Greek root meaning "good in birth" or "noble in heredity." Through eugenics Galton intended to improve human stock by giving "the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable."

Galton's ideas gained popular acceptance after the turn of the century, finding large followings in the United States, Britain, Germany, and many other countries. One of the organizations formed to promote Galton's ideas was the American Eugenics Society in 1923, which sponsored exhibits at state fairs and other activities. The backbone of the movement consisted of people from the white middle and upper-middle classes, especially professionals, scientists, and physicians. The movement brought together a variety of prominent figures from all points of the ideological compass, including a number of the progressive-minded, such as sexologist Havelock Ellis, anarchist Emma Goldman, and George Bernard Shaw. ("Being cowards, we defeat natural selection under cover of philanthropy," Shaw wrote, "being sluggards, we neglect artificial selection under cover of delicacy and morality.") Eugenists declared themselves to be concerned with preventing social degeneration, which they perceived all around them in urban industrial society. They took crime, slums, and rampant disease to be symptoms of so-



Taking eugenics to the people: At an exhibit at the Kansas State Fair in the mid-1920s, the high rate of illiteracy among immigrants and blacks was attributed to inferior genes.

cial pathologies that they attributed primarily to biological causes—to “blood,” to use the term for inheritable essence common at the turn of the century.

Eugenically minded biologists were intent on rooting out the causes of social degeneration. Their study of medical disorders such as diabetes and epilepsy was motivated not only by the intrinsic interest of these diseases but by concern over their social costs. A still more substantial part of the research program consisted of the analysis of traits alleged to make for social burdens—traits involving qualities of temperament and behavior that might lie at the bottom of alcoholism, prostitution, criminality, and poverty. These biologists were especially interested in mental deficiency—then commonly called “feeble-mindedness”—which was thought to be at the root of many varieties of socially harmful behavior and which could be identified

through recently invented intelligence tests.

In the hope of explaining these pathologies biologically, eugenic researchers such as psychologist Henry H. Goddard resorted to Mendel’s laws of heredity, which had been rediscovered in 1900. They fastened on the idea that biological characteristics were determined by single elements—only later identified as genes. They generally assumed that not only could certain physical characteristics (e.g., eye color) or diseases be explained in a Mendelian fashion but also characteristics of mind and behavior. Charles B. Davenport (1866–1944), head of the biological laboratory at Cold Spring Harbor on Long Island, New York—which in 1918 became the Carnegie Institution of Washington’s Department of Genetics—was one of the nation’s more prominent scientists. He searched for Mendelian patterns of inheritance in many supposed be-

havioral categories, including “nomadism,” “shiftlessness,” and “thalassophilia”—the love of the sea that he discerned in naval officers. (He concluded that thalassophilia must be a sex-linked recessive trait because, like color blindness, it was almost always expressed in males.)

While some eugenic investigations into human heredity proved to have merit, most of them were recognized in the end to be worthless. Combining Mendelian theory with incautious speculation, scientists favored relatively simple single-gene Mendelian explanations, neglecting the fact that many traits are influenced by more than one gene. They also paid far too little attention to cultural, economic, and other environmental influences on behavior and mental abilities. And like Davenport’s behavioral categories, many of the traits that figured in eugenic research were vague or ludicrous, filled with class and race prejudice. In northern Europe and the United States, eugenicists specified standards of fitness and social value that were predominantly white, middle class, and Protestant—and identified with “Aryans.” They reasoned that poverty was the result not of inadequate educational and economic opportunity but of the meager moral and educational capacities of the poor, rooted in their biology. When eugenicists celebrated Aryans, they demonstrated nothing more than their own racial and ethnic biases. Davenport, for example, found the Poles “independent and self-reliant though clannish,” the Italians tending to “crimes of personal violence,” and the Hebrews “intermediate between the slovenly Serbians and the

Greeks and the tidy Swedes, Germans, and Bohemians” and given to “thieving” though rarely to “personal violence.” He expected that the “great influx of blood from Southeastern Europe” would rapidly make the American population “darker in pigmentation, smaller in stature, more mercurial . . . more given to crimes of larceny, kidnapping, assault, murder, rape, and sex-immorality.”

Eugenicists like Davenport urged interference in human propagation in order to increase the frequency of “good” genes in the population and to decrease that of “bad” ones. The interference was to take two forms: One was “positive” eugenics, which meant manipulating the human heredity or breeding to produce superior people. The other was “negative” eugenics, the elimination of biologically inferior human beings from the population by discouraging such people from reproducing or by restricting immigration.

In practice, little was done for positive eugenics, although arguments in favor of increasing the number of offspring born of “desirable” types did figure in the advent of family allowance policies in Britain and Germany during the 1930s. It was also an implicit theme of the American Eugenics Society’s Fitter Family contests in the “human stock” sections at state fairs during the 1920s. At the 1924 Kansas Free Fair, winning families in three categories—small, average, and large—were awarded a Governor’s Fitter Family Trophy, presented by Governor Jonathan Davis. “Grade A Individuals” were awarded a medal that portrayed two diaphanously garbed parents, their arms outstretched toward their (presumably) eugenically meritorious infant.

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Judging from the photographs that survive, it is hard to know what made these families and individuals stand out as especially fit, but some evidence is supplied by the fact that all entrants had to take an IQ test—and the Wassermann test for syphilis.

Much more was done in the name of negative eugenics, notably by means of eugenic sterilization laws. By the late 1920s, some two dozen American states had enacted such laws, which, in general, permitted state prisons and other institutions to perform vasectomies or tubal ligations on inmates who were epileptic, insane, or “feeble-minded,” especially if they had been incarcerated for sexual offenses. The laws were declared constitutional in the 1927 U.S. Supreme Court decision, *Buck v. Bell*. Justice Oliver Wendell Holmes, Jr., delivered the opinion that “three generations of imbeciles are enough.” The leading state in this endeavor was California, which by 1933 had subjected more people to eugenic sterilization than had all other states of the union combined. By 1941, nearly 36,000 Americans had been sterilized under various state eugenics programs.

The most powerful union of eugenic research and public policy occurred in Nazi Germany. Much of the research in Germany before and even during the Nazi period was similar to that in the United States and Britain, but during the Hitler years Nazi bureaucrats provided eugenic research institutions with handsome support, and their programs were expanded to complement the goals of Nazi biological policy. Ongoing investigations into the inheritance of disease, intelligence, and behavior were plumbed for knowledge that could guide the government’s sterilization policy. Eugen Fischer’s Kaiser Wilhelm Institute for Anthropology, Human Heredity, and Eugenics, which included among its staff the prominent geneticist Otmar von Verschuer, trained SS doctors in the intricacies of ra-

cial hygiene and analyzed data and specimens obtained in the concentration camps. Some of the material—for example, the internal organs of dead children and the skeletons of two murdered Jews—came from Josef Mengele, who had been a graduate student of Verschuer’s and was his assistant at the Institute. In 1942, Verschuer succeeded Fischer as head of the Institute (and would serve postwar Germany as professor of human genetics at the University of Muenster). In Germany, where sterilization measures were partly inspired by the California law, the eugenics movement prompted the sterilization of several hundred thousand people. Ultimately, as we know, it helped lead to the death camps.

Since the beginning of the DNA era, many scientists and laymen alike have wondered whether our growing body of genetic knowledge will be exploited for a new program of positive eugenics, for attempts to engineer new Einsteins, Mozarts, or Kareem Abdul-Jabbars. (Curiously, brilliantly talented women such as Marie Curie or Nadia Boulanger or Martina Navratilova are rarely if ever mentioned in the pantheon of superpeople.) Today, hardly a conference is held on human genome research without somebody expressing the fear that the state will seek to foster or enhance desirable human qualities or characteristics. Such apprehensions are not entirely unfounded. In 1984, for example, Singapore’s Prime Minister Lee Kuan Yew scolded his country’s educated women, supposedly possessed of above-average intelligence, for their relatively low birth rate. The elite’s reluctance to reproduce, he said, was diminishing the quality of the country’s gene pool. Embracing a crude positive eugenics, Singapore’s paternalistic government—which also recently banned chewing gum as a national nuisance—has since offered preferential

school enrollment for offspring of such women and a variety of other incentives to increase their fecundity. Their less-educated sisters have been offered similar incentives to have themselves sterilized after the birth of a first or second child.

Engineering a super-race in the laboratory, however, is quite a different matter from extending carrots and sticks to parents, and there are many reasons to doubt that advances in genetic knowledge will lead to any serious engineering efforts. While the U.S. Human Genome Project and its counterparts overseas will undoubtedly accelerate the identification of genes for certain physical and medical traits, it is unlikely to reveal with any speed how genes contribute to the formation of the abilities, behavior, or personal qualities that the world admires. It is quite likely that the genetic contribution (if there is any) to, say, a good sense of humor derives in very complicated ways from more than one gene. And of course most such complex traits are probably influenced by much more than inheritance. Equally important, the designing of entire or substantial parts of human genomes is impossible with current technology and will not likely become much easier in the near future. The only kind of human genetic engineering scientists have attempted thus far is a primitive form of gene therapy to overcome a relatively simple, if deadly, immune disorder, adenosine deaminase deficiency. It will be quite a long time before scientists possess the knowledge and technology that would enable them to attempt significantly more sophisticated forms of designer human genetics.

The prospect of a revival of negative eugenics has stirred far more concern, voiced by people like the late Nobel laureate biologist Salvador Luria and rights-for-the-disabled advocate Barbara Faye Waxman. Since it will in principle be easy to identify individuals with genes for "undesirable"

physical or supposedly antisocial traits, the state may intervene to discourage such people from passing them on. Indeed, in 1988, China's Gan-su Province adopted a eugenic law that would—so the authorities said—improve "population quality" by banning the marriage of mentally retarded people unless they first submitted to sterilization. Since then, such laws have been adopted in other provinces and have won the endorsement of Prime Minister Li Peng. As the official newspaper *Peasants Daily* explained, "Idiots give birth to idiots."

Closer to home, the European Commission, the executive arm of the 12-nation European Community, seemed to be motivated by an interest in negative eugenics in its July 1988 proposal for a European human genome project. Billed as a health measure, the proposal was called "Predictive Medicine: Human Genome Analysis." Its rationale rested on a simple syllogism—that many diseases result from interactions of genes and environment; that it would be impossible to remove all the environmental culprits from society; and therefore that individuals could be better defended against disease by identifying their genetic predispositions to fall ill. Predictive medicine, said a summary, "seeks to protect individuals from the kinds of illnesses to which they are genetically most vulnerable and, where appropriate, to prevent the transmission of the genetic susceptibilities to the next generation." The Commission, which apparently had in mind susceptibilities to such illnesses as diabetes, cancer, stroke, and coronary disease, believed that the proposal would make Europe more competitive—indirectly, by helping to slow the rate of increase in health expenditures, and directly, by strengthening its scientific and technological base.

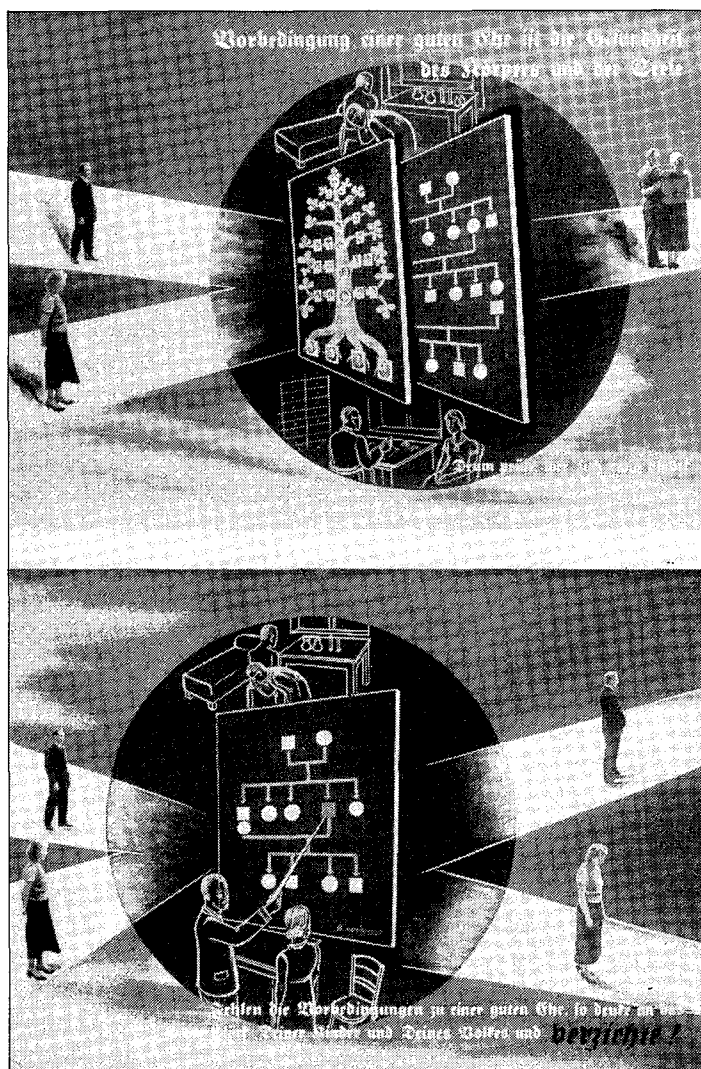
Such economic considerations may

well prove to be a powerful incentive to a new negative eugenics in the future. They clearly played a role in the emergence of the early eugenics movement. At the 1926 Sesquicentennial Exposition in Philadelphia, the American Eugenics Society's exhibit included a board that, in the manner of the population counters of a later day, revealed with flashing lights that every 15 seconds \$100 of taxpayers' money went for the care of persons with bad heredity, that every 48 seconds a mentally deficient person was born in the United States, and that only every seven-and-a-half minutes did the United States enjoy the birth of "a high-grade person . . . who will have ability to do creative work and be fit for leadership." Such cost-consciousness may have been behind the fact that, in California and several other states, the rate at which eugenic sterilizations were performed increased significantly during the 1930s, when state budgets for the mentally handicapped were squeezed.

In our own day, the more that health care in the United States becomes a public responsibility, payable through the tax system, and the more expensive this care becomes, the greater the possibility that taxpayers will rebel against paying for the care of those whom genetics inclines or dooms to severe disease or disability. Public officials may feel pressure to encourage or

even to compel people not to bring genetically marked children into the world—not for the sake of the gene pool but in the interest of keeping public-health costs down.

All this said, however, there are many reasons to doubt the rise of socially controlled reproduction, let alone a revival of a broad-based negative eugenics. Eugenics profits from authoritarianism—indeed, al-



A Nazi publicity poster (circa 1941) encouraged hereditary screening prior to marriage. Ironically, many German racial hygienists privately considered Hitler an "inferior" un-Nordic East Slav.

most requires it. The institutions of political democracy may not have been robust enough to resist altogether the violations of civil liberties wrought by the early eugenics movement, but they did contest them effectively in many places. The British government refused to pass sterilization laws. So did many American states, and where they were enacted they were often unenforced. It is farfetched to expect a Nazi-like eugenics program to develop in the contemporary United States so long as the democratic process and the Bill of Rights survive. If such a program ever does threaten to take shape, the country will have a good deal more to worry about politically than just eugenics.

Awareness of the barbarities and cruelties of state-sponsored eugenics in the past has tended to set most geneticists and the public at large against such programs. During the 1950s, for example, genetic counselors, fearful of the eugenic taint, made it their standard practice to offer their clients information but no advice. Most geneticists today know better than their early-20th-century predecessors that ideas concerning what is "good for the gene pool" are highly problematic. Then, too, the handicapped and victims of inherited diseases, as well as minority groups, are much more organized and politically powerful than they were in the early 20th century. They may not have enough power to counter all quasi-eugenic threats to themselves, but they are politically positioned, with allies in the media, the medical profession, and elsewhere, including the Roman Catholic Church, a staunch opponent of the eugenics movement, to block or at least to hinder eugenics proposals that might affect them.

The European Commission's proposal mobilized just such an anti-eugenics coalition. Guided by Benedikt Härlin, a West German Green, the European Parliament's Committee on Energy, Research and Tech-

nology quickly raised a red flag against the Commission's approach to genome research. Its report reminded the Community that in the past eugenic ideas had led to "horrific consequences" and warned of the "eugenic tendencies and goals" implicit in the intention of protecting people from contracting and transmitting genetic diseases. Using human genetic information for such purposes would almost always involve decisions—fundamentally eugenic ones—about what are "normal and abnormal, acceptable and unacceptable, viable and non-viable forms of the genetic make-up of individual human beings before and after birth." The Härlin report also warned that the new biological and reproductive technologies could ultimately make for a "modern test tube eugenics," a eugenics all the more insidious because it could disguise more easily than its cruder ancestors "an even more radical and totalitarian form of 'biopolitics.'"

Härlin was not a Luddite, opposed to a genome program in principle. "You can't keep Germany out of the future," he later said about his own country's involvement in genome research. He was searching for a way to make a genome program palatable. Approved by the Committee in January 1989, the Härlin report urged 38 amendments to the Commission's proposal, including the deletion of the phrase "predictive medicine" from the text. In the European Parliament, the Härlin report won support not only from the Greens but from conservatives on both sides of the English Channel, including German Catholics. As a result, Filip Maria Pandolfi, the new European commissioner for research and development, froze Community research subsidies in April 1989. "When you have British conservatives agreeing with German Greens," he explained, "you know it's a matter of concern."

In mid-November, the European Com-

mission issued a revised proposal. It called for a three-year program of human genome analysis as such, without regard to predictive medicine, and committed the European Community in a variety of ways—most notably, by prohibiting human germ cell research and genetic intervention with human embryos—to avoid eugenic practices, prevent ethical missteps, and protect individual rights and privacy. It also promised to keep the Parliament and the public fully informed via annual reports on the moral and legal basis of human genome research. Formally approved the following June, the EC's human genome program will cost 15 million ECU (about \$17 million) over three years, with some one million ECU devoted to ethical studies. (The much larger U.S. Human Genome Project also devotes a share of its budget to such studies; it conducts only basic research and its activities are closely regulated by various review boards and by Congress.)

As this experience suggests, the eugenic past is prologue to the human genetic future in only a strictly temporal sense—that is, it came before. Of course, the imagined prospects and possibilities of human genetic engineering remain tantalizing, even if they are still the stuff of science fiction, and they will continue to provoke both fearful condemnation and enthusiastic speculation. However, the near-term ethical challenges of human genome research lie neither in engineering human genetic improvement nor in some state-mandated program of eugenics. They lie in the grit of what the project will produce in abundance: genetic information. They center on the control, diffusion, and use of that information in a market economy, and they are deeply troubling.

The advance of human genetics and biotechnology has created the capacity for a kind of “homemade eugenics,” to use the

term of analyst Robert Wright—“individual families deciding what kinds of kids they want to have.” At the moment, the kinds they can choose (if they are willing to abort the fetus) are those without certain disabilities or diseases, such as Downs' Syndrome or Tay-Sachs. Most parents would probably prefer a healthy baby. In the future, even without the development of the means to alter the genome, genetic analysis of embryos may give parents the opportunity to select the “best” of their fertilized embryos, selecting children who are likely to be more intelligent or more athletic or better looking—whatever those terms may mean.

Would people exploit such possibilities? Quite possibly, given the interest that some parents have shown in choosing the sex of their child or that others have pursued in the administration of growth hormone to offspring who they think will grow up too short. A 1989 editorial in *Trends in Biotechnology* recognized a major source of the pressure: “‘Human improvement’ is a fact of life, not because of the state eugenics committee, but because of consumer demand. How can we expect to deal responsibly with human genetic information in such a culture?”

Even this challenge, however, is distant, since the means of identifying the relevant genes are likely to remain beyond our grasp for a long time to come. More urgent are the questions of social decency posed by the torrent of new human genetic information (and misinformation). There is, for example, the distinct possibility that employers may use genetic screening and seek to deny jobs to applicants with a susceptibility—or an alleged susceptibility—to disorders such as manic depression or illnesses arising from special susceptibility to certain chemicals or other workplace hazards. Around 1970, for example, a single questionable case raised the fear that people with sickle-cell trait—that is, who pos-

sess only one of the two recessive genes needed to develop a full-blown case of the disease—might suffer the sickling of their red blood cells in the reduced oxygen environment of high altitudes. For a time, the U.S. Air Force Academy barred people with the trait from its entering classes, and several major commercial air carriers restricted them to ground jobs. Some people with the trait were charged higher premiums by insurance companies.

As more information becomes available in the future, life and medical insurance companies may well wish to know the genomic signatures of their clients, their risk profile for disease and death. Even national health systems may choose to ration the provision of care on the basis of genetic propensity to disease, especially to families at risk for bearing diseased children.

Should individual genomic information be protected as strictly private? Many critics say so. However, a great deal more thought needs to be given to the rights of individuals to withhold and the rights of insurers to demand such information. Insurance, and insurance premiums, depend on assessments of risk. If a client has a high genetic medical risk that is not reflected in her premiums, then she would receive a high payout at low cost to herself but at high cost to the company. The problem would be compounded if she is aware of the risk—while the company is not—and she purchases a large amount of insurance. In either case, the company would have to pass its increased costs along to other policyholders, which is to say that high-risk policyholders would be in effect taxing others to pay for their coverage. Insisting on a right to privacy in genetic information

could well lead—at least under the largely private system of insurance that now prevails in the United States—to inequitable consequences.

The eugenic past has much to teach us about how to avoid repeating its mistakes—not to mention its sins. But what bedeviled our forebears will not necessarily vex us, and certainly not in the same ways. In human genetics as in so many other areas of life, the flow of history compels us to think and act anew. It is important not to be swept away by exaggerated fears that genetic research will lead to a program to engineer superbabies or the callous elimination of the unfit.

America's state and federal legislatures, those most practical of governmental bodies, have already begun to focus on the genuine social, ethical, and policy issues that the Human Genome Project raises, particularly those concerning the use of private human genetic information. "One of the most serious and most immediate concerns," noted Representative Bob Wise (D-W. Va.) at a House subcommittee hearing last fall, "is that genetic information may be used to create a new genetic underclass." At about the same time, the California state legislature passed a bill banning employers, health service agencies, and disability insurers from withholding jobs or protection simply because a person is a carrier of a single gene associated with disability. Vetoed by Governor Pete Wilson, it is nevertheless a harbinger of the type of public-policy initiative that the genome project will—and should—call forth. If we do not use our knowledge wisely, it will be a failure not of science but of democracy.