

*Biological Determinism*

*R. C. LEWONTIN*

THE TANNER LECTURES ON HUMAN VALUES

Delivered at  
The University of Utah

March 31 and April 1, 1982

RICHARD LEWONTIN was born in New York and attended the public schools there. He was an undergraduate student in mathematical statistics and genetics at Columbia. He has taught at North Carolina State University, the University of Rochester, the University of Chicago, and at Harvard, where he is currently Alexander Agassiz Professor of Zoology, Professor of Biology, and Professor of Population Science. He has spent his professional life studying genetic variation in natural populations of insects and human beings, from both an experimental and a theoretical point of view. He has also written extensively on philosophical and historical issues in biology. In addition to about 100 papers in scholarly journals, he has written *The Genetic Basis of Evolutionary Change* and, most recently, *Human Diversity*.

Over the last fifteen years the English-speaking public has been made aware of a variety of theories and claims about human beings and their societies that, at first sight, seem unrelated and of independent origin. In 1967 A. R. Jensen published a now-famous article, "How much can we boost IQ and scholastic achievement?" in which he argued that black children, on the average, were genetically less able than white children to solve cognitive problems so that no attempts at compensatory education could erase the differences in social status between the races.<sup>1</sup> In 1975, the evolutionist E. O. Wilson wrote in the *New York Times Magazine* that all societies of the future, no matter how egalitarian, would always give a disproportionate share of power to men because of unchangeable genetic differences between men and women.<sup>2</sup> More recently, it has been suggested that men are biologically better able to do mathematics than women. During a period of great social unrest and uprisings of urban blacks, three neurologists, in the leading American medical journal and later in a popular book, advanced the theory that urban rioters suffered from irreversible brain disease that could be treated only by neurosurgery.<sup>3</sup> At the same time large numbers of inmates of state prisons were being subjected to neurosurgery in an attempt to make them more manageable.

These examples, which can be multiplied many times over, are the continuation of a long tradition of social explanation going back to the nineteenth century. They have in common that they attempt to deal with observed variation in human social conditions

<sup>1</sup> *Harvard Educational Review* 39 (1969), pp. 1–123.

<sup>2</sup> "Human Decency Is Animal," *New York Times Magazine*, October 12, 1975.

<sup>3</sup> V. H. Mark, W. H. Sweet, and F. R. Ervin, "Role of brain disease in riots and urban violence," *J. Am. Med. Assoc.* 201 (1967), p. 895. See also the book by V. H. Mark and F. R. Ervin, *Violence and the Brain* (New York: Harper and Row, 1970).

by an appeal to the determinative role of individual biology. Far from being isolated independent theories about particular phenomena arising from new scientific developments, they are manifestations of a general world view that has characterized social explanation for more than 150 years. Actual discoveries in biological science have had remarkably little influence on their major premises, but rather have simply changed the specific mechanisms to which appeal is made.

So, in the nineteenth century, in the heyday of anatomy, it was supposed that differences in brain *size* were responsible for differences in intelligence and social achievement. When biologists finally satisfied themselves that there was no relation, within the human species, between brain size and brain function, the emphasis changed to the pattern of neuronal connections and, with the increasing importance of genetics in biology, to the genes that supposedly governed those connections. So too with the explanation of the condition of women. It was widely believed among Victorian physicians that the uterus and brain were in competition for development, so that educated women would be barren and fertile women dull. Why does the anatomical theory appear so quaint to us, while the notion that women are genetically incapable of doing creative mathematics has such modern credence? Certainly it is not because of any scientific evidence, which is the same for both theories. It is just that the notion that anatomy is destiny seems rather old-fashioned when we all know that it is really DNA that makes the world go round. If we want to understand where these biological determinist theories of human life come from and what gives them their perpetual appeal, we must look not in the annals of biological science, but in the social and political realities that surround us, and in the social and political myths that constitute the ideology of our society.

One of the most obvious features of our social existence is the vast inequality that exists between individuals and groups in their status, wealth, and power. Some people have great wealth and

others live in the direst poverty; some have control over the conditions of their own lives and over the lives of others, while most people feel themselves passive objects of social forces beyond their own control. Some few, by their high status, are constantly reminded of their own worth and importance, while most perceive their lives as unappreciated and essentially socially valueless. Just as there is material wealth and poverty so, too, there is vast variation in the psychic rewards dealt out by society to its members. Nor are the psychic and material inequalities simply an individual matter. There are rich nations and poor, powerful countries and their client states. Everyone knows that in America blacks as a group are poorer, less employed, die earlier, and spend more time in prison than whites. And virtually everywhere men, as a group, are more socially powerful than women. What makes these various inequalities between individuals, races, nations, and the sexes so problematic for us is the obvious contradiction between the fact of inequality and the ideology of equality on which our society is supposedly built. If we indeed live in a society of "liberty, equality, and fraternity," why are so many people unfree, why are there such immense inequalities of wealth and power, why do relations of domination so characterize our collective lives? The ideology of biological determinism has been built over the last two hundred years as a solution to this socio-political paradox.

Before the bourgeois revolutions of the seventeenth and eighteenth centuries in Europe and North America, inequality of station was regarded as natural and normal. The privileges of the *ancien régime* were grounded ideologically in Divine Providence. Charles I, before he had his head cut off, ruled *Dei gratia* and, in general, the conferral or withdrawal of divine grace was the explanation offered for radical changes in fortune. The chief agent of ideological control of society was thus the church. Social unrest arising from the great inequalities in material and political power was opposed from the pulpit with the aid of the Doctrine of Grace. Even that most seditious and revolutionary priest Martin

Luther preached that “peace is more important than all justice; and peace was not made for the sake of justice, but justice for the sake of peace.”<sup>4</sup> The successful overturning of the old order by the seventeenth- and eighteenth-century revolutionaries demanded that this old legitimating ideology be destroyed and that a new view of a just society be put in its place, a view that would justify new political, social, and economic relations. Thus, it was discovered that God was not really on the side of the nobility after all and that grace was not the exclusive property of the nobility. On the contrary, “all men are created equal, and they are endowed by their Creator with certain inalienable rights.” Of course the founding fathers did not mean literally “*all men*,” since blacks were counted only as three-fifths of a person each, but they certainly did mean “*all men*,” women having to wait nearly 150 years even for the right to vote. Revolutions are not made with the slogan “Liberty and equality for some,” however, so the ideology of equality became universalized far beyond the ability or desire of the new ruling political forces to make it actual. Inequality has remained a prominent fact of social life, and with it a unique social dissonance has emerged. In the bad old days of the *ancien régime*, social unrest could be met with the argument that an unequal society was the way God meant it to be. Social theory and social practice were in conformity. After the democratic bourgeois revolutions, however, social practice was, for the first time, in direct contradiction to the stated political values of the society.

The solution to the contradiction between the value of equality and the fact of inequality has been to put a new gloss on the word “equality.” It is not that democratic society provides equality of *station*, but rather equality of *opportunity*. Life is a race, as the psychologist E. L. Thorndike put it, “a race not to get ahead, but to get ahead of *somebody*.” In the old days the privileged few had a headstart in the race, or perhaps were the only ones permitted to run, but now we all start together. Those who win are

<sup>4</sup> Martin Luther, *On Marriage*, 1530.

simply those who are intrinsically better runners. In this view democratic society is a meritocratic society. Social entropy has been maximized, or nearly so, and only a small amount of tinkering is necessary before inequalities become as small as they can be, given the intrinsic differences between individuals. The view of democratic society as removing all externally imposed inequalities and allowing the “natural” differences between people to determine their lives was expressed by Lester Frank Ward, a major figure in nineteenth-century American sociology, when he wrote that education “is destined to remove all artificial inequality and leave the natural inequalities to find their true level. The true value of a newborn infant lies . . . in its naked capacity for acquiring the ability to do.”<sup>5</sup> It is this claim that natural and intrinsic inequalities between individual human beings at birth are determinative of eventual differences in their status, wealth, and power that is the defining property of biological determinism.

A second feature of biological determinist theories of society is their reductionism. Individuals are regarded as ontologically prior to groups, so that inequalities between races, classes, sexes, or nations are claimed to be the direct consequence of intrinsic differences between the individuals who make up the groups. If blacks are less successful than whites, it is not because blacks as a group suffer from racism, but because individual blacks have, in general, less ability than individual whites. Men dominate women because men as individuals are intrinsically more aggressive and more rational than individual women. In this way social classes become biological entities, groups whose individuals possess different inherent biological properties. The psychologist Richard Herrnstein, a prominent modern ideologue of biological determinism, explains that:

The privileged classes of the past were probably not much superior biologically to the downtrodden, which is why revolution had a fair chance of success. By removing artificial barriers

<sup>5</sup> Lester Frank Ward, *Pure Sociology* (London: Macmillan, 1903).

between classes, society has encouraged the creation of biological barriers. When people can take their natural level in society, the upper classes will, by definition, have greater capacity than the lower.<sup>6</sup>

It follows from such a reductionist view that improvements in the general level of psychic and material welfare of society as a whole can come only by changing the mix of individuals that make it up. That is, general social amelioration can come only from eugenic measures.

Oh could we do with this world of ours,  
As thou dost with thy garden bowers,  
Reject the weeds and keep the flowers,  
What a heaven on earth we'd make it.

Sir Thomas More, "Irish Melodies"

Of course, the possibility of "rejecting the weeds and keeping the flowers" depends on knowing one from the other. That is, it depends on having a society in which "true merit" will be allowed to manifest itself, a virtue claimed for democratic bourgeois society as opposed to the artificiality of a previous time. It is ironic that precisely the same argument was used by H. J. Muller in the early 1930's to claim that only after the socialist revolution would eugenic measures be worthwhile, since only under socialism would "true merit" appear, uninhibited by the artificial class structures of capitalist society!

The claim that inequalities in society are a consequence of intrinsic differences in ability between individual human beings is not sufficient to resolve the problem of inequality because there is a second disturbing observation that reminds us of aristocracy. Social power runs in families. The children of oil magnates own banks, while the children of oil workers borrow money from the banks. All studies of the social origins of higher professions show

<sup>6</sup> *IQ and the Meritocracy* (New York: Little Brown, 1973).



them to be virtually entirely recruited from middle and upper middle class families. The most quoted study of American social mobility by Blau and Duncan shows that 71 percent of the sons of white collar workers are themselves white collar and 62 percent of the sons of blue collar workers remain in that category. This study greatly underestimates the familiarity of social class, however, since most passage from “blue collar” into “white collar” is a passage into jobs as sales clerks, typists, and service workers.

But if parents pass on social power and wealth to their children, what has happened to meritocracy? The answer offered is that the inheritance of social class is a consequence of *biological* inheritance and is not an arbitrary passing of privilege across generations. That is, success is not only a consequence of intrinsic biological properties, but those properties are coded in the genes. Thus, it is only natural and fair that wealth and poverty run in families because success is genetic. The Doctrine of Grace has thus been replaced by the Central Dogma of Molecular Genetics.

The specific claim that biological differences between individuals are the consequence of differences in their DNA is also a manifestation of the reductionist outlook of biological determinism. Society is nothing but the collection of individuals that make it up, and individuals are nothing but the collection of genes that are present in the fertilized egg. An interesting consequence of the belief that an organism is completely determined by its genes is that not only abortion, but any birth-control method that acts to prevent implantation of a fertilized egg is equivalent to the killing of a fully-formed infant or even of an adult since the adult is already completely contained in the fertilized egg.

Even the assertion that there are inherited differences in abilities does not complete the justificatory argument. I might claim, as did Thomas Dobzhansky in *Genetic Diversity and Human Equality*, that even though there are intrinsic inherited differences in abilities between people, there is no necessity to build a society that gives differential rewards. Why not a society in which in-

ternists and plumbers, artists and housepainters, dentists and ditch-diggers all receive the same psychic and material rewards? To handle this problem, biological determinism shifts its ground from explaining the differences between individuals and groups to claims about human universals and, in particular, about the biological determination of hierarchies. Biological determinism as a total system of explanation then must include a human nature theory. According to this theory, differences in ability between individuals and groups will always be translated into hierarchical social structures with dominant and subordinate groups because the tendency to form such hierarchies is coded in the human genome. During the course of evolution, human nature has been produced by natural selection — a human nature that guarantees the domination of women by men, a drive to accumulate wealth and social power, and a general self-interest that precludes real cooperation or self-sacrifice except as means to a selfish end.

Sociobiology, the evolutionary theory of human nature, is both determinist and reductionist in common with other aspects of biological determinist thought. The reductionism of sociobiology lies in the ontological priority it gives to the individual over society and over the species as a whole. If people behave in a certain way, say they are entrepreneurial, it is because each person, individually, possesses an intrinsic property of entrepreneurship. Individual entrepreneurs create an entrepreneurial society, not the other way round. Moreover, the entrepreneurial tendency is coded in the genes of which we are the ineluctable product. No matter how hard we try we cannot escape the dictates of our genes. The extreme determinism of biological human nature theory, together with its mechanical reduction of social organization to the properties of the DNA molecules possessed by individual human beings, is epitomized by Richard Dawkins' description of people in *The Selfish Gene* as "lumbering robots" controlled by their genes "body and mind." The political implications of this determinism are that nothing significant in human society can be changed. So, in specu-

lating about the future of social relations between the sexes, E. O. Wilson predicts that “the genetic bias is intense enough to cause a substantial division of labor even in the most free and most egalitarian of future societies. . . . Even with identical education and equal access to all professions, men are likely to continue to play a disproportionate role in political life, business and sciences.”<sup>7</sup>

Biological determinism has taken a number of specific forms as particular social problems have become the focus of attention:

1. Most basic, differences between *individual* human beings in manifest abilities and temperament are ascribed to unalterable genetic differences. In particular, differential social success is ascribed to differential innate intelligence, coded by the genes.

2. *Race* differences in social status and group behavior are ascribed to genetic differences between the different races. Blacks have lower social status than whites because, it is claimed, blacks on the average lack genes for cognitive function that are possessed by whites.

3. *Sex* differences in social status are ascribed to differences between the sexes in innate abilities and temperament that are a consequence of the chromosomal difference between males and females. Male anatomical and physiological development is claimed to cause greater aggressiveness, analytic ability, synthetic ability, leadership, and rationality in the face of danger or emergency.

4. *Class* differences are thought to be a consequence of the poorer genetic endowment of those who find themselves in the lower social classes. This is not simply a circular argument, defining the lower social classes as the collection of individuals of low social status, because social class is said to be biologically heritable. Poverty runs in the family for genetic reasons.

5. *Aberrant social behavior* is said to arise from biological predisposition. The criminally insane, especially violent men, are said to owe their behavior to their possession of an extra Y chromo-

<sup>7</sup> Wilson, “Human Decency Is Animal.”

some that, so to speak, magnifies the male tendency to aggressiveness beyond the normal bounds. Social violence, like that shown in urban riots, is a consequence of anatomically and chemically disordered brains. An important difference from most biological determinist theories arises in this case, because the disorder is regarded as treatable —by surgery or psychoactive drugs. Similarly, behavior patterns in children labeled as “hyperactivity” or “minimal brain dysfunction” (MBD) are supposed to be the consequence of chemical imbalances that are to be treated with drugs. Indeed, the entire range of behavioral variation from severely debilitating schizophrenias and autism, to the mildest fidgeting of a bored school child, are laid at the door of disordered molecules.

6. *Human nature* theories, particularly sociobiology, universalize historically contingent social forms and postulate genes that produce them. So, warfare, territoriality, entrepreneurship, religion, incest taboos, male dominance, conformism, and spite, among many other traits, are said to be human universals that have been built into our genes by natural selection during the course of human evolution. These characteristics are then said to be unchangeable so that any society which consciously attempted to change or eliminate them would be bound to fail.

Biological determinism is, then, an articulated theory of human social existence that provides a complete explanation of the hierarchical structure of present human society as both natural and unavoidable. Differences in abilities between individual human beings are unchangeably coded in their genes. Races, classes, and sexes are biologically different in their abilities because the individuals that make them up are intrinsically different. So, group differences are also unchangeable except perhaps by eugenic measures. Finally, because of the genetically fixed and unchangeable properties of human nature, the differences in individual abilities that exist will always be translated into structures of social inequality and domination. Put so baldly, there seems little to choose between the justification offered in biological terms for the struc-

tures of privilege in modern democratic society and the justification offered by the *ancien regime* for its structure of unchangeable privilege. If the biological determinists are right, then the society we now live in will be with us until the extinction of the species. The question is, are they right?

It is not possible in a short space to examine in detail all the specific forms of biological determinism as they have appeared even in recent years. The conceptual and factual errors on which these theories are built, however, can be fairly well exposed by a close look at two of the manifestations of the theory: the theory of intelligence and social achievement and the sociobiological theory of human nature.

#### IQ AND SOCIAL STATUS

The theory that social status of individuals and groups is fixed by means of fixed genetic differences in intelligence has a straightforward logical form that makes its detailed analysis fairly easy. The argument of the biological determinists is:

1. There are differences between individual people in their status, wealth, and power.

2. The achievement of high status, wealth, and power is a consequence of the possession of intrinsic intellectual ability.

3. Such intellectual ability can be assessed even in childhood by a set of tests loosely called "IQ tests," which measure intelligence on a one-dimensional scale.

4. IQ test performance (and therefore intrinsic intelligence) is largely inherited genetically. The figure of 80 percent heritability is widely quoted.

It then is said to follow from (1) to (4) that,

5. Differences among individuals in status, wealth, and power are largely biologically inherited and therefore unchangeable.

6. Differences between groups (e.g., blacks and whites) in social status are largely genetic and are therefore only trivially changeable by environmental or social change arrangements.

What are we to make of this argument?

1. There are differences in status, wealth, and power. No one, of whatever political viewpoint, can quarrel with the first assertion. In the United States and Britain, about 20 percent of the total income accrues to the highest 5 percent of families, while only 5 percent goes to the lowest 20 percent of families. The distribution of wealth is much more unequal, with 60 percent of all corporate stock belonging to 1 percent, while 83 percent of stock belongs to only 5 percent of all families. Across racial and class lines the facts are equally clear. In the United States blacks have 1.8 times the infant mortality rate of whites and a 10 percent lower average expectation of life. In Britain, prenatal mortality of working class children is more than twice that for upper middle class children. Moreover, virtually no change has taken place in these racial and class differentials in the last fifty years. There is, indeed, vast social and material inequality.

2. Differences in status come from differences in intrinsic abilities. There are serious difficulties here at two different levels. First there is the problem of whether persons of high status and wealth do indeed manifest skills not possessed by the poorer members of society. What skills did, say, Nelson Rockefeller possess that were not also a property of, say, a shop foreman in a General Motors plant? Did the managers of the Chrysler Corporation, or Braniff Airways, have special skills that enabled them to draw immense salaries and stock benefits while driving their corporations into bankruptcy? Do internists, radiologists, and neurologists possess special abilities (as opposed to special *knowledge*) that is not in the possession of their nurses and aides? Several studies of the stock market have concluded that in the absence of inside information, no investor can do, on the average, better than the Dow Jones Index, and that especially successful speculators have been either especially lucky or in possession of special information. No one has ever succeeded in isolating the special skills and abilities, if any, needed to be a physician rather than a lower grade medical

worker. One form the abilities argument has taken is the assertion that success in modern technological industry favors the more skilled, more sophisticated worker, so that the intrinsically unintelligent sink permanently into an under-class. Yet the close examination of productive work has shown a progressive deskilling of labor with greater and greater specialization into atomized tasks requiring less and less cognitive ability and manual skill from each worker.<sup>8</sup> Moreover, the prejudice that urbanization somehow requires greater mental ability can only come from an urban intellectual elite who have never tried to make a living in a rural setting, especially in farming.

The deeper problem that is raised is the difference between manifest abilities and intrinsic talents. A professional mathematician has a much greater manifest ability to solve mathematical equations than I do. What would it mean to say that she had greater intrinsic or innate ability? It certainly cannot mean that irrespective of upbringing and education she would, at the age of fifty-two, have greater mathematical skill than I since, if she had been brought up in a highland peasant village in Guatemala, she would not have been able to solve equations at all. Nor can it mean that at birth she was better able to solve equations than I, since at the age of 52 hours neither of us could do mathematics. All it might mean is that, given identical and sufficient education and upbringing, she would have turned out a better mathematician than I am. But there is no way to check up on such an assertion since two people clearly do not have identical education and upbringing. Claims about innate talents or abilities are claims about in principle unobservable forces that may or may not become manifest depending upon circumstances that are themselves unspecified, and unspecifiable. There is, in fact, no independent evidence for the existence of innate or intrinsic abilities as distinguished from manifest achievement.

<sup>8</sup> See, for example, Harry Braverman, *Labor and Monopoly Capital* (New York: Monthly Review Press, 1975).

3. Intelligence tests measure intrinsic cognitive ability. It is the claim of intelligence testers that, even if one cannot independently describe what intelligence is, IQ tests measure it. Indeed, the relative constancy of the IQ score of a person over his or her lifetime is regarded as a major evidence that there is something real and intrinsic that is being measured, although it cannot otherwise be isolated or seen. In E. G. Boring's famous dictum, "Intelligence is whatever IQ tests measure." But the ability to perform an operation that produces a numerical value is no evidence that some natural property is, in fact, being measured. If I multiply the length of my nose by the year of my birth and divide by my social security number, I will obtain a number that characterizes me as an individual, possibly uniquely so, and will remain stable over my lifetime. Yet no natural property with any causal efficacy has been measured. The reification of IQ scores, with no independent evidence for the existence of a real property or intrinsic force, is a major epistemological difficulty of the theory of innate intelligence. Moreover, the tests must do more than measure "something." They must measure something that itself is the cause of social and material power or else the entire exercise is irrelevant.

The chief support for the claim that IQ tests measure an intrinsic ability to succeed is the often-repeated assertion that IQ scores in childhood are highly correlated with eventual socioeconomic status. That is, it is claimed that if I know a child's IQ, I have a powerful prediction of his or her eventual success in life and that the prediction arises from a direct chain of causations. There are two problems, however. First, IQ score is not all that good a predictor of eventual success. It is certainly true that if one measures success by income, or by what sociologists call Socioeconomic status (SES), a combination of income, years of school, and occupation, then people with higher incomes or higher SES did better on IQ tests when they were children than did people with low incomes or low SES. Only about half the variation in SES among adults is related to variation in IQ scores, however,



the other half arising from independent sources. More to the point, it is essential to distinguish between a factor *A* being a *statistical predictor* of a second factor, *B*, and *A* being a *cause* of *B*. *A* may be correlated with *B* if *A* is a cause of *B*, but also if *A* and *B* are both the result of a third cause, *C*. On a worldwide basis, protein consumption and fat consumption per capita are highly correlated. Rich countries consume a lot of both, and poor countries little. Yet protein consumption is neither the cause nor the effect of fat consumption. Both are a consequence of how much money people have to spend on food. This is precisely the case with IQ and socioeconomic status. For example, a child in the top 10 percent of IQ performance is fifty times more likely to wind up in the top 10 percent of income than is a child who is in the lowest 10 percent of IQ performance. If, however, we hold constant the number of years of schooling, and the socioeconomic status of the child's family, then a child in the top 10 percent of IQ has only twice, not fifty times, the chance of winding up in the top 10 percent of income. On the other hand, a child whose parents are in the top 10 percent of economic success has a twenty-five times greater chance of also being at the top of the economic scale than does a child whose parents are in the lowest 10 percent economically, *even when both children have only average IQ*. Thus, the leading underlying cause of socioeconomic success is family background, not IQ, which is a result, not a cause, of social status. Obviously, it is better to be born rich than smart.

An examination of IQ tests bears out these statistical results. Over and over such tests ask questions that reflect substantive knowledge, sophisticated vocabulary, and middle class social attitudes. ("Who was Wilkins Micawber?" "What is the meaning of *sudorific*?" "What is the right thing to do when you find you are late for school" are examples of test questions.) Most important, an acceptance of the necessity and eventual value of sitting attentively for several hours, answering meaningless questions, depends upon a general acceptance of the routine of formal

schooling and a belief that, after all, it will lead to a useful result. Most working class children, and children from chronically depressed families, simply do not see the relevance of schooling to their future prospects.

4 and 5. IQ performance and social status are largely heritable and unchangeable. This is the heart of the biological determinist position and its greatest weakness. The notion of “heritable” is used in a way that implies a fixed and unchangeable character that is passed from parent to child. Determinists mix a technical meaning of heritability with this everyday sense of its popular usage and thus seem to be saying that intelligence is, essentially, determined by genes. We need to distinguish three forms of error about inheritance that are committed by biological determinists at various times. The most vulgar error is to say that a character is determined completely by genes and is therefore unchangeable. So, if I inherit the gene for blue eyes, I will have blue eyes. In fact, there is virtually no trait whose relation to genes is so simple and direct. An organism at every stage of its life is the result of a developmental process in which the internal genetic factors and the external environmental factors are in constant interplay. If the genes of the fertilized egg are specified, the eventual organism is not fixed, because development also depends upon the sequences of environments in which the embryo and juvenile finds itself. Size, shape, behavior, physiological activity all depend both on genes and on environment. A fruit fly with “normal” genes will develop an eye that has about 1000 cells if it is raised at 15°C, but at 30°C it will develop an eye with only 800 cells. Even the classical inherited diseases are not independent of environment. Wilson’s disease results from a single recessive gene that codes for a defective enzyme. The consequence of the enzyme defect is an inability to detoxify copper which, consumed in the diet, continues to accumulate until the victim dies of copper poisoning. The disease can be prevented completely, however, by taking a drug, penicillamine, that removes the copper. So an inherited disease is both

dependent on the food taken in for its expression and, at the same time, curable by an environmental manipulation. The most fundamental rule of the relation between gene and organism is that genes are inherited, while traits are developed. This fundamental distinction is that between the *genotype*, the set of DNA molecules and cytoplasmic factors that is present in the fertilized egg, and the *phenotype*, the set of traits that characterizes the whole organism at each stage of its life. Between the genotype and the phenotype are complex developmental processes that occur not in a vacuum, but in an impinging world of environmental circumstances and developmental accidents.

Biological determinists sometimes recognize the contingent nature of development and substitute a slightly less vulgar error for the fixity of inherited phenotype. "Of course," they say, "we know that environment matters. It is not the phenotype that is inherited, it is a tendency that is in the genes." The introduction of predispositional language, the language of tendencies, however, does not come close to expressing the biological situation, although it has a great deal of common-sense appeal. What does it mean to say, "Diana tends to be fat, while Charles tends to be thin"? It must mean that under some circumstances Diana will be fat but that under other circumstances she will not. How then do we choose which circumstances are to be the background for the characterization of tendency? If she is sometimes fat and sometimes thin, the descriptions are symmetrical. Clearly, there is a set of environmental circumstances that is taken as normal or usual and which serves as the reference for characterizing tendency. And it is certainly true that under the usual conditions of social existence and education in America, blacks "tend" to do more poorly on IQ tests than whites. But this observation begs the entire question of what set of environments can or ought to be established for human existence. In some other circumstances blacks may "tend" to do better on IQ tests than whites, or there may be no difference at all. From the standpoint of biology, tendency statements are mislead-

ing. All that can be described is the set of phenotypes that will develop from various combinations of gene and environment.

A third form of popular but misleading language about genes and organisms is the statement that genes determine *capacity*. This is the bucket metaphor. At birth we are empty buckets to be filled by our life experiences, and by education in particular. Some of us are born with large buckets and some with small. If we are educationally deprived, if little is poured into our buckets, then we will all be deficient. If, however, a rich set of experiences is provided, then those with the large buckets will acquire great knowledge and mature abilities, while the small buckets will soon be filled to overflowing and no matter how much more is added, they will not exceed their inherited capacities. A corollary of this view of gene action, one explicitly invoked by A. R. Jensen, is that genetic differences between the races will only be exacerbated by improvements in the general education, so that blacks will be stimulated to expectations they cannot hope to have fulfilled. Far better that the blacks be provided with an education more suited to their limited genetic capacities. Like genes as tendencies, genes as capacities are without any biological basis. It must be literally true that there is some maximum height, say, to which I can grow under the best of all possible environments for growth and that my maximum height is different from that of someone with a different genotype. It turns out, however, from experiments with both domesticated animals and plants and laboratory organisms, that the environment which produces maximum phenotype for one genotype is, in general, different from the environment necessary for maximum expression in another genotype. Moreover, the order of the genotypes in one environment is no clue to the order in another. So, if genotype *A* is taller than genotype *B* at 2,000 calories per day, it is not possible to say which will be taller at 1,500 calories, in the absence of direct observation, and it certainly cannot be said that *A* has a greater "capacity" than *B* for growth. For example, modern varieties of hybrid corn yield a good deal

more per acre than varieties used fifty years ago when the varieties are tested under poor-to-average conditions of cultivation with mechanical harvesting and high planting densities. At the best levels of cultivation, however, or with hand harvesting and low planting densities, the older hybrids outproduce the modern ones. Whatever the relative phenotypes of two genotypes may be in one environment, when the environment is changed, all bets are off.

If neither phenotype nor tendency nor capacity is inherited, what is? What is inherited *physically* is a set of molecules and subcellular structures in the nucleus of the cytoplasm of a fertilized egg. For brevity we may call these the genes, but they include other structures outside the DNA. What is inherited *potentially* is a vast set of alternative pathways of development, a set of alternatives specified by the physical genes, each alternative being contingent for its realization on the environmental history of the developing organism. That is, what is inherited is a set of correspondences between possible environmental sequences and organismic end products. Different genotypes have different sets of correspondences. The genes act as a kind of mapping function that converts environment into phenotype. This function, the *norm of reaction* of a genotype, is known in detail for only a few genotypes over a relatively small range of environments. It is important to note that genotypes map a *sequence* of environments into a *sequence* of phenotypes. Development is a process that is extended in time, and the order of environmental events is critical to the outcome at any future stage. There are sensitive moments in development, moments at which particular environmental events have a strong influence on future development, while at other times the same environmental variation will be without any effect. If fruit flies are given a brief treatment with ether vapor in early development, some will eventually develop an extra set of wings, but a later ether treatment will have no effect. Environments cannot be arbitrarily ordered with the expectation that the end product of development will be the same.

To characterize the norm of reaction of a genotype requires that individual organisms with the same genes be raised in a variety of different environmental sequences. But this requires the production of a large number of individuals all of the same genotype. In some experimental organisms that is possible, as for example in plants that can be cut into several pieces, each of which will form an entire new plant. To characterize human norms of reaction would require, first, that a group of identical decuplets or, better, centuplets be produced and, second, that each infant be subjected to carefully chosen alternative environmental sequences. Fortunately, such an experiment lies entirely in the realm of science fiction, but its impossibility means that we have no information about the norms of reaction for human genotypes. If these norms are anything like those measured for physical, physiological, and behavioral traits in laboratory organisms, they are non-linear and cross each other in unpredictable ways over a range of environments. There is certainly no evidence that the phenotypic differences between individuals will increase as environment is "enriched." Jensen's argument is pure invention without the slightest evidence to support it and a good deal of evidence from experimental organisms contradicting it. If there is any genetic variation for IQ performance at all, and that is by no means certain, we simply cannot say how that variation will be altered by social manipulation, nor what will happen to the relative ordering of individuals under changed circumstances.

We come finally to the question of what is meant by numerical characterizations of heritability, such as the often repeated claim that IQ is 80 percent heritable. This sounds like it is saying that 80 percent of one's IQ is determined by genes and 20 percent by environment, but that is clearly absurd. Of my height of five feet, eleven inches, I can hardly say that five feet were produced by my genes and the remaining eleven inches by the food I ate. There is, nevertheless, the vague feeling that such a percentage must mean that genes are four times as important, in some sense, as environ-

ment in determining IQ. And indeed it is precisely the intention of giving such numbers that the unwary will draw the conclusion that environmental manipulation can only change people's IQ a little because the genes predominate. Yet the actual meaning of a heritability of 80 percent is quite different.

In any population there will be variation from individual to individual in a trait, say height. That variation arises from two interacting sources. First, there are many different genotypes in the population, each with a different average height. Second, the various individuals of the same genotype will nevertheless differ from each other because each has experienced a different environmental sequence. Thus, there will be variation around each genotypic average. The total variation in the population is a consequence of pooling all the genotypes, each different on the average and each with variation around its average. Of the total variation some proportion can be calculated among the genotypic means, the remainder being the variation between individuals within genotype. The *heritability* of a trait in a population is defined as the proportion of all the variation within a population that arises from the variation among the genotypic averages, as opposed to the so-called "environmental variation" among genotypically identical individuals. So defined, the heritability of a trait is not some universal constant for the trait, but is contingent on the population and the environment. So, a population made up mostly of one genotype, or of genotypes that had similar norms of reaction, would have a low heritability, while the very same trait would have a high heritability in a different population containing a greater variety of genotypes. More to the point, different sets of environment will produce different heritabilities, even when the environments are in some physical sense equally variable or equally constant. Among the readers of this essay are people with varying amounts of body fat, a trait that is known to be influenced by genes. Provided they are all fully clothed, the internal body temperature of all the readers will be 37°C, whether they are out

in the hot sun, in the house at moderate temperature, or outside on a cold day. Thus there will be no variation in body temperature arising from the genetic differences in body fat. Suppose, however, that all my readers were stripped naked and then sent out into the snowy winter. The thin ones would soon lose enough heat to suffer a marked reduction in internal body temperature, while the plumper ones could maintain themselves at 37°C for much longer. Under these environmental circumstances, absence of clothing, the genetic difference between individuals would manifest itself as an observable variation.

In general, the amount of variation in phenotype among different genotypes depends on the environment. Thus, the heritability of a trait will be large or small, depending upon what specific environments are experienced. If it were really the case that IQ variation was 80 percent heritable in some circumstances, nothing could be predicted about its heritability in other circumstances. More to the point, a heritability of 80 percent does not mean that 80 percent of the variation among individuals would remain even if all the environmental variation disappeared, or that environmental manipulation could only change the trait by 20 percent. There is no relation at all between the percent heritability of a trait in a particular population in a particular environmental range and how much the trait can be changed by shifting the environments. Indeed, the heritability of a trait could be 100 percent in some environment, yet could be radically altered by a change to a different environment. Wilson's disease is 100 percent heritable with a normal diet and no medication, yet a relatively simple environmental intervention eliminates it. There is thus no foundation whatsoever for the biological determinist claim that IQ differences among individuals are virtually unchangeable because IQ is 80 percent heritable. Indeed, the most striking feature of IQ studies is the very large change in IQ that accompanies major changes in the circumstances of upbringing. Children from or-



phanages who are adopted, usually by middle class families, show average increases in IQ of about 20 points after adoption.

There remains the question of whether IQ is really 80 percent heritable or indeed heritable at all. The evaluation of the data on which heritability of IQ has been calculated has had a long and tortured history. The attempt to measure heritability has depended entirely on the similarity in IQ performance between persons of various degrees of genetic relationship. The most widely used data are those from reports of identical twins raised apart and together. When these studies have been examined, they have turned out to be deeply flawed methodologically and, in the infamous case of the reports by Sir Cyril Burt, they turned out to be a fraudulent fabrication of non-existent twins.<sup>9</sup> The scandal of the Burt frauds, which has destroyed the only “data” on separated twins which claimed to eliminate biases from similarity of environment, has cast a pall over studies of the heritability of IQ from which they are not likely to recover for a long time, if ever. The methodological difficulties of separating genetic from environmental similarities in human beings are virtually insuperable. But even if the heritability of IQ could be established with some confidence in some human population, it would have no significance for social policy because of the total lack of relationship between heritability and changeability.

6. Differences between races and classes in IQ performance are genetic and unchangeable. The last conceptual and factual error of the determinist position on IQ is the translation of the causes of differences between individuals within groups into the causes of the differences between groups. It has been explicitly claimed that the 15-point difference in average IQ performance between black and white American school children is probably “mostly genetic” (whatever that may mean) because the heritability of IQ is 80 percent.

<sup>9</sup> For a critical survey, see Leon Kamin, *The Science and Politics of IQ* (Potomac, Md.: Erlbaum, 1974).

The conceptual error is to suppose that the causes of differences between individuals are the same as the causes of differences between groups. In fact they are independent. Consider variation in skin color. Among New Yorkers classified as white, there is considerable variation in skin color, largely genetic, arising for the most part from the varied migrant populations into the United States. There are fair-skinned Swedes and Scots, darker central Europeans and even darker Mediterraneans. If we compare the difference in skin color between white New Yorkers and the richer members of their families who live in Miami and Fort Lauderdale, we will find a very considerable difference in average skin color between the two groups, but the difference is entirely environmental. The fact that group boundaries can be established is, in itself, evidence that there are likely to be causes acting to differentiate the groups that are different from the forces acting differentially within each group. Differences in locality, in diet, in social status, in self-image, in wealth, in employment, in language, in transmitted cultural identity, in every conceivable aspect of social life exist between groups defined by ethnicity, religion, and race. It is simply not possible to judge the importance of these intergroup variables by studying the heritability of a trait within groups where the variables are constants, or at least have a different range.

There are, in fact, some direct observations that are relevant to the existence of genetic differences in IQ between races. The results, and the way they have been reported, are revealing. There are just four sets of observations that are relevant to genetic differences in IQ performance between blacks and whites. Children of German mothers and black American soldiers who left the mothers and children behind after the Second World War have slightly higher IQ scores than the children of German mothers and white fathers. The difference is not statistically significant. Black children in Dr. Bernardo's Homes in Britain taken into the Homes before the age of six months do better than white children in the same Homes on three tests of IQ, although the difference is not

statistically significant. There is no significant correlation between the degree of white ancestry as judged by blood groups and the performance of black children on IQ tests, although the more white ancestry they had, the more poorly the children did. Finally, there is no greater proportion of white ancestry in black children of exceptionally high IQ than in black children of average IQ. This is the totality of the evidence, and it points unambiguously to a lack of any genetic differentiation for IQ performance between blacks and whites. When the results are summarized, it is stated that there were small differences between black and white children, but these differences were not statistically significant. The summaries leave the impression, however, that it is the white children who did better than the blacks, if only slightly, whereas the results are in the contrary direction. If there are any genetic differences between blacks and whites in IQ performance, it is the blacks who are superior!

#### HUMAN NATURE

The second biological determinist doctrine that has been of powerful influence on popular and scientific thought has been sociobiology, developed over the last ten years. As applied to the human species, sociobiology has the two aims of ascribing human social universals to the action of genes possessed in common by all members of our species, acquired during the process of human adaptive evolution, and of explaining the differences between human cultures as the consequence of genetic differences that have arisen between local groups during evolution.<sup>10</sup> The social agenda, made quite explicit by human sociobiologists, is to provide a technological background for determining how societies may be constructed or reconstructed, based on the limitations imposed by the genetic determination of behavior. The political agenda, as I have

<sup>10</sup> The first of these two programs is laid out most specifically in E. O. Wilson, *On Human Nature* (Cambridge: Harvard University Press, 1978); and the second in W. Lumsden and E. O. Wilson, *Genes, Mind and Culture* (Cambridge: Harvard University Press, 1981).

already suggested, is to argue that no serious reconstruction of society is possible because our genes make us what we are and that no reconstruction is desirable since natural selection has optimized our behavior, or nearly so. The philosophical discrepancy between these two positions seems not to have bothered sociobiologists, who take sometimes one and sometimes the other position. They seem not to realize that if we live in the *only* possible world, we cannot, except in the most trivial sense, describe it as the *best* possible world. Where there is no choice, there are no oughts.

The argument of sociobiology is in three parts. First, a description of human nature is given. Sociobiologists look around the world, both in their own culture and in the ethnographic record (although never, apparently, in history books) and abstract from their perceptions of the human condition what they conceive to be human universals. These constitute their picture of human nature. It is not an accident that historiography provides no data for their inferences, since the assumption of a universal human nature cancels out history. To the extent that any changes in time are assumed, those changes are thought to lie far back in human evolution. Differences between cultures are accepted but regarded as variations on basic universal themes, alternative formulations of the same innate drives.

Second, it is postulated that the described elements of human nature have a genetic basis and, in the usual argument, are directly coded by the genes and are therefore unchangeable. Differences between cultures are said to result from genetic differences between groups.

Third, an evolutionary story is told for each element of human nature. The story is in each case an adaptive one showing why natural selection would favor the particular trait, say religiosity, over alternative phenotypes, say skepticism. What is required in each case is to show why the possessor of a trait will leave more living offspring and thus spread the genes determining the trait through the population.

When one contemplates the description of human nature offered by sociobiologists, the immediate impression is of extraordinary superficiality and ethnocentricity. Faced with the extraordinary richness and complexity of human social life in the past and the present, they have chosen the nineteenth-century path of describing the whole of humankind as a transformation of European bourgeois society. Wilson's description of human political economy, in a book purporting to be a technical work on evolutionary theory, is a fine example: "The members of human societies sometimes cooperate closely in insectan fashion, but more frequently they compete for the limited resources allocated to their role sector. The best and the most entrepreneurial of the role-actors usually gain a disproportionate share of the rewards, while the least successful are displaced to other, less desirable, positions."<sup>11</sup>

That this description of a possessive individualist entrepreneurial society would apply to the peasant economy of eleventh-century France or the serfs of Eastern Europe, or Mayan and Aztec peasants, seems patently wrong. One can only assume that the insectan hordes of cooperators are blue-clad Maoist Chinese "energized by goals of collective self-aggrandizement."<sup>12</sup> The list of universal human traits varies from author to author, but generally speaking, human beings are seen as selfish, self-aggrandizing, territorial organisms in which cooperation is a mask for reproductive advantage. Among the traits that are said to constitute human nature are religiosity, conformity, territoriality, male dominance, entrepreneurship, indoctrinability, blind faith, and xenophobia. Some of the "scientific" descriptions of human nature smack of barroom wisdom ("Men would rather believe than know").<sup>13</sup>

There are a number of problems of the description of human nature that have not been considered in sociobiological theory, which lead to serious errors.

<sup>11</sup> E. O. Wilson, *Sociobiology: The New Synthesis* (Cambridge: Harvard University Press, 1975), p. 554.

<sup>12</sup> Wilson, *On Human Nature*, p. 3.

<sup>13</sup> Wilson, *Sociobiology*, p. 561.

1. *Confusion of proscription and proscribed.* In an attempt to explain the near-universality of incest taboos, sociobiologists refer to a genetic predisposition to avoid incest. But incest taboos and incest are two very different things. Both are common. Father-daughter incest in the United States is an everyday affair, and, although the data are understandably hard to obtain, it appears from psychiatric interviews that brother–sister incest is also common. Any theory that tries to explain incest taboos as a consequence of a genetic detestation for the act itself is in serious difficulties.

2. *Tautological universality.* By appropriately redefining each trait and providing enough latitude in its characteristics, any behavior can be claimed to be universal. A classic is Wilson’s definition of territoriality:

Anthropologists often discount territorial behavior as a general human attribute. This happens when the narrowest concept of the phenomenon is borrowed from zoology. . . . Each species is characterized by its own behavioral scale. In extreme cases the scale may run from open hostility . . . to oblique forms of advertisement or no territorial behavior at all. One seeks to characterize the behavioral scale of the species and to identify the parameters that move individual animals up and down it. If these qualifications are accepted, it is reasonable to conclude that territoriality is a general trait of hunter gatherer societies.<sup>14</sup>

Of course, if love is really hate and passivity really a form of hidden aggression, then hate and aggression are universals, but what is not?

3. *Conflation.* Different meanings of the same word are conflated into the same phenomenon, although they are utterly different. Thus, warfare is described as simply the group manifestation of individual aggressiveness because the word “aggression” is used for both. But warfare is an organized activity for political and

<sup>14</sup> *Ibid.*, pp. 564–65.

social ends which does not begin because the contending parties want to punch each other in the nose. People go to war because they are forced to do so by state apparatuses that threaten them with dire punishment if they do not go out and kill for the common good. That is the basis of selective service.

4. *Reification.* Abstract constructs are given a material reality as causes and effects. Many of the mental constructs that are said by sociobiologists to evolve have only historical and cultural contingency. What could “religion” have meant to the Athenians, who had no word for it and for whom it did not exist as a separate social phenomenon? Is violence real, or a construct with no one-to-one correspondence in the physical world? What is meant by “verbal violence,” or “a violent exception”? The possession of real property is a modern legal fiction unknown in thirteenth-century Europe, when the relationship was between persons rather than between a person and property that could be alienated. It is absurd to talk of property possession as an ahistorical real phenomenon that has evolved biologically.

5. *Arbitrary agglomeration.* Behavioral units are built up arbitrarily out of bits and pieces. But how are we to know what the natural units of behavior are that evolution has operated upon? In the case of physical parts, the issue is in doubt. We are not sure whether the hand, each finger, or each joint of each finger is an appropriate unit of heredity and natural selection. For social behavior, the choice of elements of behavior is entirely arbitrary.

6. *False metaphor.* Words that describe human behavior are taken over into animal behavior (slavery, aggression, warfare, cooperation, kinship, loyalty, coyness) and then, when these are described in animals, by a kind of back etymology they are rederived in humans as a special case of a general animal phenomenon. Slavery in ants is not the same as the economic property relation called slavery in humans. Ants know neither auction block, commodities, economic surplus, nor rates of interest, yet the two “slaveries” are described as the same institution.

If the problems of adequate description of human nature are severe, the problems of studying its inheritance are enormous. To put it briefly, there is not one jot or tittle of evidence that any of the traits described as human behavioral universals are coded in specific genes, nor that any of the differences between populations are a consequence of genetic differentiation between them. Nor is there any prospect of getting such information. The evidence offered by sociobiologists for the genetic basis of traits of human nature is either that the trait is universal, and on that basis alone must be presumed to have a genetic basis, or else that a heritability has been demonstrated in studies of relatives, in which case the trait is not universal. In fact, there are no studies which would pass even the minimal tests for adequacy that demonstrate heritability of human social traits. In nearly all cases, the resemblance of parents and offspring is the only evidence. But parents may resemble offspring for purely cultural reasons, and the chief problem of human genetics is to distinguish familial resemblance, the observation, from biological inheritance, a possible cause. The highest parent-offspring correlations for social traits known are for political party and religious affiliation, yet even the most sanguine biological determinist would not suggest that Republicanism or being a Seventh-Day Adventist is coded in the genes.

The other error committed by sociobiologists is one they have in common with all biological determinists, the belief that phenotypic traits are unalterably coded in the genes. E. O. Wilson's dictum that men would always dominate women, even in the most egalitarian society, was based, it will be remembered, on his supposition that the domination was genetically determined. Sometimes sociobiologists say that genes do not fix characters but only provide tendencies or possibilities. But, as we have shown, the language of tendencies is empty, and if all that sociobiology is saying about human behavior is that all known human behaviors are biologically possible, they have wasted a great deal of time and effort on a truism.



The deepest problem of genetic determination of behavior is the incorrect assumption that individual constraints translate into constraints on social function. The reductionism of sociobiology leads it to characterize social behavior as nothing but the collection of individual behaviors, and social limitations as individual limitations writ large. Yet this reductionism misses an essential truth about human social activity — that social organization can actually negate individual limitations. I mean this negation in much more than the sense that ten people can lift a weight ten times as great as can one person. None of us can fly by flapping our arms. That is a biological limitation. Yet we do fly as a consequence of the social organization that has given rise to airplanes, airfields, pilots, controllers, fuel, metallurgy, hydrodynamic theory, and organized economic activity. It is not society that flies, however, but individuals. Thus, the constraints on individual human beings have been negated by social activity, and they have become new individual human beings with new properties and abilities. (And constraints. I cannot bring myself to kill another human being, but I could, had I been raised differently.)

The third step in the process of sociobiological explanation is the invention of a suitable adaptive story to explain why the trait supposed to be universal, coded by the supposed genes, has been incorporated into the human genome by natural selection. A direct explanation can be invented for most traits. A xenophobic person will keep out strangers, and so have less competition for food in short supply and so successfully raise more offspring. As a result the genes for xenophobia will spread. The same story can be applied to territoriality and aggressiveness. Male domination is incorporated because dominant males control more females and so simultaneously produce more offspring and maintain a captive labor force to rear them. And so on. There is no end to the just-so stories that can be invented. A difficulty arises with some traits, however, that appear to be of reproductive cost to their possessor. Such so-called altruistic traits ought not to be established by natu-

ral selection. A triumph of sociobiological theory, regarded by most sociobiologists as the major theoretical contribution of the field to evolutionary studies, has been the invention of *extended fitness*. This notion is based on the realization that the gene for a trait will spread in a species even if its carriers do not directly benefit reproductively, provided that a group of organisms who also carry the gene are sufficiently benefited. In particular, if close relatives of the actor receive a sufficient reproductive benefit, the actor may sacrifice its own reproduction, yet its genes will still spread.

An example of an explanation involving this sort of kin selection is the just-so story for homosexuality. The problem posed is to explain the widespread occurrence of homosexuality when the genes for the behavior should have been selected out of the population because of the failure of homosexuals to reproduce. It should be noted, first, that there is no evidence that homosexuality does lead to lower reproductive fitness. Only a typological definition of homo- and heterosexuality which assumes that all people are exclusively one or the other would lead to such a conclusion. The evidence is clear, however, that people display a broad range of mixed homosexual and heterosexual behavior in their lives, and many persons who later declare themselves to be exclusively homosexual have been the fathers and mothers of children in their earlier lives. Second, there is not the slightest evidence that different degrees of homo- and heterosexuality are in any way genetically based. So the problem may be a pseudo-problem. Given that the assumptions of lower reproductive rate and heritability are correct, the following story has been invented. Since homosexuals do not have their own children, then in primitive societies they were free to help raise and feed the children of their brothers and sisters so that their genes actually increased by kin selection. Aside from the difficulty of checking up on the behavior of homosexuals in the Neolithic (if indeed there were any as a distinct group), what we know of modern hunters and gatherers lends no plausi-

bility to this story. Nevertheless, it is a model for the kind or uncheckable story that can be invented ad hoc to explain observations. The sociobiologist Barash has, with unusual candor, called this kind of story-telling "Let's Pretend."<sup>15</sup> It seems a strange procedure for a modern biological science.

#### BIOLOGY, CAUSATION, AND FREEDOM

Biological determinist theories are easy targets. They combine elementary misconceptions about genes and organisms with philosophical naïveté, bad data, and an overtly political purpose. But they speak to a deep problem. How are we to understand the etiology of human differences and similarities, especially in social structures? Those who expose the fallacies of biological determinism are often accused of being radical environmentalists who view human individual and social behavior as determined in detail by the sequence of experiences that each of us undergoes, especially in early childhood. Vulgar economism, which explains all attitudes by social class and immediate economic pressure is an example. So is Skinnerian behaviorism. Radical environmentalism so described is as much a biological determinism as the genetic determinism of A. R. Jensen and E. O. Wilson. Both are positions taken because their proponents reject what seems to them the only alternative, a dualism that introduces free will. How are we to understand human freedom in a world of cause and effect? If we give up cause and effect, we fall into the pit of mysticism and anti-materialism. If we insist on cause and effect, we seem to be determinists of one sort or another who can, in principle, like Laplace's Demon, predict every last detail of every life from previous information. We are then not free.

There are *two* solutions offered to this dilemma that are current. One is Kant's dualistic solution, if it can be called that, which simply asserts that as physical beings we are determined,

<sup>15</sup> David Barash, *Sociobiology and Behavior* (Amsterdam: Elsevier, 1977), p. 277.

but as moral social beings we are free and must accept responsibility for our acts. Hume's solution was to change the terrain of the problem to a political one. We are free, he held, if we can act according to our wishes and desires. The prisoner is not free because, no matter how much he wishes to be at large, he is confined to his cell. But Hume does not deal directly with the determination of our wishes and desires. If *they* are determined, then in what sense is the free man freer than the prisoner?

At a political level, we must ally ourselves with Hume. A theory of human freedom that does not distinguish between a free person's liberty and a prisoner's confinement is a political weapon that can only enslave people. Slavery is not freedom, not even in 1984. Our problem is to accept material cause and to see how human freedom can be a consequence of cause and effect rather than its negation.

When we examine physical systems, we see that randomness and determination are not in contradiction, but arise one from the other as levels of organization are crossed. Random radioactive decay is the basis for the most exquisitely exact clocks, accurate to a millionth of a second. On the other hand, the completely determined forces acting on a molecule in a gas may nevertheless give it a movement that is random for all practical purposes. It is usually said that this latter randomness is only epistemic since, in principle, we could, if we knew enough, predict that path of the molecule. There is, however, an important difference between the determined molecule moving at "random" and, say, a railroad train moving on a track, although both are completely determined. The train is determined by a small number of causes and is strongly constrained by the track. The movement of the molecule, however, is the conjunction of a very large number of causal chains, no one of which strongly constrains it. Thus, the molecule is infinitesimally correlated with any one cause, while the train is strongly correlated with the direction of the track. On the other hand, the train is moving at random with respect, say, to people in

houses near the railway, whose movements are, again, only infinitesimally correlated with it because of the weakness of gravitational forces.

We are then led to a definition of freedom within causality. A process is free from, or at random with respect to, some set of causes if it is extremely weakly correlated with any one cause or small subset of these causes, although its movement may be perfectly determined by the conjunction of all of them. Normal human beings are free to the extent that no single obsession rules their lives and no walls pen them in. The obsessive madman, like the prisoner, is controlled not by a conjunction of a vast number of infinitesimally small causes, but by one large one. The fox is free; the hedgehog is not. Our biologies, created in the course of evolution, make us foxes and not hedgehogs. We are forever re-creating our own psychic and material environments, and, as the result of the social organization produced by our material brains and hands, our individual lives are the consequences of a bewildering variety of intersecting causal pathways. In this way, our biology has freed us from the constraints of biology.