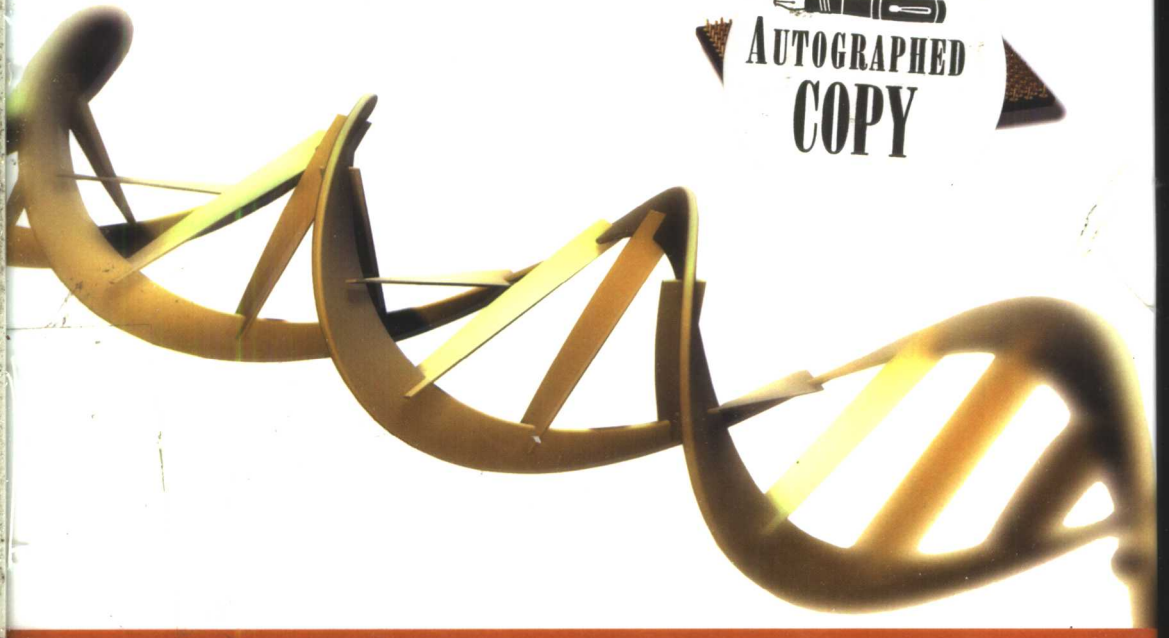
HUMAN NATURES

Genes, Cultures, and the Human Prospect

"The one book to read on human evolution."
Jared Diamond



Paul R. Ehrlich

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Island Press / SHEARWATER BOOKS
Washington, D.C. • Covelo, California

A Shearwater Book
published by Island Press

Illustrations on pages 28 and 54 by Anne H. Ehrlich.

Illustrations on pages 31, 50, 51, 70, 75, 80, 83, 93, 94, 95, 97, 99, 116, 117, 133, 134, 152, 172, 241, and 292 by John and Judy Waller.

Library of Congress Cataloging-in-Publication Data

Ehrlich, Paul R.
Human natures : genes, cultures, and the human prospect / Paul R. Ehrlich.
p. cm.
Includes bibliographical references and index.
ISBN 1-55963-779-X (acid-free)
1. Human evolution. 2. Social evolution. 3. Human behavior. 4. Human beings—Animal nature. I. Title.
GN281.4 .E374 2000
599.93'8—dc21
00-010436

Printed on recycled, acid-free paper

Manufactured in the United States of America
10 9 8 7 6 5 4 3 2 1

PREFACE

What is human nature? For thousands of years, philosophers have discussed and debated that question. Underlying almost all those debates, however, has been a key shared assumption: that human nature is a unitary, unchanging thing. This is the "nature" that, along with nurture, is thought to make us who we are.

As the new millennium dawns, that assumption of a single, enduring nature remains widespread, but in my view it has become a major roadblock to understanding ourselves. "Human nature" as a singular concept embodies the erroneous notion that people possess a common set of rigid, genetically specified behavioral predilections that are unlikely to be altered by circumstances. "After all," we're often told, "you can't change human nature." The notion that there is one such nature to change allows us to be painted in the popular mind as instinctively aggressive, greedy, selfish, duplicitous, sex-crazed, cruel, and generally brutish creatures with a veneer of social responsibility.[1] Our better selves are seen to be in constant battle with a universal set of unchanging, primitive "drives," which frequently break through the veneer and create many of the most serious ills that afflict humanity. It is a view as dismal as it is wrong, considering what is actually known about our behavior.

In recent decades, biological and social scientists have made great strides in developing a different view of where we come from and who we are. They have unraveled much of human evolution, those gradual alterations in our genes and cultures that have transformed us into planet-dominating animals. They have illuminated the behavioral flexibility we all possess—such as the capacity to learn one or more of thousands of different languages. And they have documented the inordinate diversity of individuals and societies in areas as different as sexual preferences and political systems. In light of this scientific progress, I want to highlight human *natures:* the diverse and evolving behaviors, beliefs, and attitudes of *Homo sapiens* and the evolved physical structures that govern, support, and participate in our unique mental functioning. Even though our bodies and behaviors share many common attributes, it's far more fruitful to consider not one human nature but many. The universals that bind people together at any point in our evolution are covered in the word ***human.*** The word ***natures***

emphasizes the differences that give us our individuality, our cultural variety, and our potential for future genetic and—especially—cultural evolution.

If we really want to know who we are and how we can solve the problems humanity faces, we must try to understand not just human natures as they are today but also their origins. Just as one can have only a partial understanding of World War II without knowing about World War I and the various interacting forces that led to it, to understand our human natures in any depth requires knowing something of our prehistory and the mechanisms of both biological and cultural evolution.

Evolutionary processes created not only us but also the rich array of plants, animals, and microbes that surround and support us. Those other life-forms were responsible for generating many of the most important features of the environments that in turn have shaped our own evolution. In this book, I consider many questions about that shaping. Why did we diverge from the other great apes? How did we acquire our upright posture, powerful brains, complex language, and extraordinary ingenuity? Why and how did our ancestors invent religion, art, agriculture, writing, and political states? In short, where did we come from, and how did we get to where we are? Science now has at least partial answers to these questions about the evolution of our natures. I believe we all need to learn our history, our evolution. Doing so will enhance our well-being, enabling us, for example, to develop more effective strategies for dealing with a broad array of social and medical problems. Furthermore, as the dominant animal, we are now modifying Earth in ways that will profoundly influence the evolutionary future of almost all other living beings—and especially the cultural evolution of future generations of our own species. If we care about our descendants and the world they will inherit, we need to develop a firm grasp of the evolutionary process.

My broad purposes in writing this book are to tell simply but accurately what scientists have learned about the answers to those "why and how" questions and to explore the implications of that knowledge for our present and future practices. Throughout, I want to show how deep are our biological and cultural roots and how an understanding of them can inform our decisions about the future. Evolution is the explanatory principle that connects all biological phenomena, including cultures, into a seamless whole; as the great geneticist Theodosius Dobzhansky put it, "Nothing in biology makes sense except in the light of evolution."[2] And human natures are, certainly, "in biology."

But I have more specific purposes than just to provide a concise, and I hope stimulating, overview of current knowledge of the evolution of human natures. First, I want to give an evolutionist's antidote to the extreme hereditary determinism that infests much of the current discussion of human behavior—the idea that we are somehow simply captives of tiny, self-copying entities called genes.[3] Second, I want to emphasize that much of our biology makes sense only when considered in a context of culture, and our culture is changing through an evolutionary process that is generally thought of as history. A third, related purpose

is to call more attention to what a potent force the changes in our store of nongenetic information—our cultural evolution—have been in shaping our past and present. We need to learn how to direct that cultural process in ways more beneficial for the human future. A fourth specific purpose of the book is to explore the puzzles and problems created by differences in rates of evolution. Why did the skulls of our ancestors change at a different rate from the rest of their skeletons? What difference does it make that microbes can evolve much more rapidly than human beings? How can we speed our understanding of ways to organize a more just and sustainable society in order to catch up with our escalating technological capacity to harm one another and our life-supporting environment? Psychologist Daniel Kahneman succinctly stated the basic problem a quarter century ago: "The increase in man's power over his environment has not been accompanied by a concomitant improvement of his ability to make rational use of that power."[4]

Finally, and perhaps most important, I want to show how a greater familiarity with evolution might contribute to our resolving a particular suite of problems that has become known as the human predicament. Human activities are now undermining society's life-support systems—the systems, for instance, that maintain the quality of the atmosphere and, by controlling the cycling of critical gases and nutrients, make it possible for people to grow crops. The human predicament is causing extreme concern among scientists,[5] and an appreciation of its evolutionary roots can only increase our chances of creating a sustainable society. An understanding of the evolution of our perceptual systems makes clear one part of our difficulty in coming to grips with environmental issues—we simply didn't evolve senses capable of detecting some of the most serious problems unaided. Knowledge of that, in turn, suggests directions in which solutions might be found.

I've tried to reach these admittedly ambitious goals while also striving for brevity. For those who would like to investigate the issues in greater depth, I've provided in the endnotes, in addition to full documentation of statements made, suggestions for further reading and amplification of some topics.

The famous cynic H. L. Mencken wrote: "Once apparently the chief concern and masterpiece of the gods, the human race now begins to bear the aspect of an accidental by-product of their vast, inscrutable and probably nonsensical operations."[6] With that statement, he apparently despaired of science illuminating the evolution of human nature. That project of illumination has been a lifelong fascination of mine, and despite my admiration of Mencken, I don't share his despair. We may never reach a full understanding of our natures and the way they have evolved. But it is a goal worth striving toward; there will be more fascinating revelations along the way; and scientists already know enough to enable us to suggest practical applications in some arenas.

Attempts to characterize human natures tend to be very controversial, but the controversy is just one measure of the great interest in understanding them and the importance of our doing so. We need not shrink from debate, but we

should strive to keep it civil and directed at solving human problems. As eighteenth-century Scottish philosopher David Hume said, referring to academics: "If any of the learned be inclined, from their natural temper, to haughtiness and obstinacy, a small tincture of pyrrhonism [radical skepticism][7] might abate their pride, by showing them that the few advantages which they may have obtained over their fellows are but inconsiderable if compared with the universal perplexity and confusion which is inherent in human nature. In general, there is a degree of doubt, and caution, and modesty, which, in all kinds of scrutiny and decision, ought forever to accompany a just reasoner."[8]

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Chapter 1

Evolution and Us

"Among scientific theories, the theory of evolution has a special status, not only because some of its aspects are difficult to test directly and remain open to several interpretations, but also because it provides an account of the history and present state of the living world."

—François Jacob[1]

" . . . when we regard every production of nature as one which has had a history; when we contemplate every complex structure and instinct as the summing up of many contrivances, each useful to the possessor . . . how far more interesting, I speak from experience, will the study of natural history become!"

—Charles Darwin[2]

Columbine High School, Littleton, Colorado, April 20, 1999. Two young men approached their schoolmates and whipped semi-automatic weapons from under their black trench coats. The slaughter began. According to some accounts, one student was asked whether she believed in God. When she replied, "Yes," she was shot dead. An athlete was gunned down because he was black. All told, thirteen people, most of them students, were killed and twenty-three were wounded before the two gunmen killed themselves. This was only one of a dozen or so incidents of senseless mass shootings within a year in the United States. Why did it happen? Why do some kids behave so differently from others? Did the two gunmen have abusive parents? Were they cursed with "killer genes"? Had television, movie, and video game violence warped their minds?

Such carnage is not a special product of human natures in the United States. Similar murder sprees occur around the world. In 1996 in Dunblane, Scotland, a "peculiar" man used four handguns to slaughter sixteen kindergarten students

and their teacher. Shortly thereafter at Port Arthur, Tasmania, a gunman killed thirty-five innocent people, ranging in age from three to seventy-two. Many people also seem ready and willing to participate in much vaster, more organized schemes of murder—to commit genocide, be it in Nazi Germany or Rwanda. And clean-cut American boys, flying bombers, incinerated hundreds of thousands of Japanese and German men, women, and children in World War II. Why do people do such things? Is it human nature? Do we share with chimps a genetically programmed propensity for violence and simply have better weapons and organization than they do? But what, then, of the majority of human beings who *don't* do such things?

Of course, there is a brighter side to our natures. Many human beings risk their lives for others, and some die in the attempt to help. At the Yad Vashem Holocaust memorial outside Jerusalem, there is an "Avenue of the Righteous Among the Nations," along which more than 6,000 trees have been planted, each to memorialize a non-Jew who helped a Jew without expectation of reward.[3] What moved those people and others like them to stand up to one of history's most horrific regimes?[4] Why did they risk their lives to save individuals whom their neighbors were willing to see carted away to their doom? Expression of genes for altruism? Simple conviction, learned in childhood, that it was the right thing to do as one human being to another?

President Jimmy Carter was appalled at having had adulterous thoughts; Bill Clinton and François Mitterrand seem to have had fewer qualms. Is Clinton just a "product of his time," the sexually liberating 1960s, and are the French just innately different? Why do some men apparently seek more sexual variety than others?

Pedro, a middle school student from a family of poor Mexican immigrants, desperately wants to go to college even though no one in his family has ever done so. He studies hard, but his school counselor discourages him. Tests indicate that his intelligence quotient (IQ) is only 98. Grace, on the other hand, a student from a well-to-do Anglo family, scored 125 on the IQ test. She seems bound for Yale University, the college her father attended. She hardly studies at all, yet she gets terrific grades. Did Grace win out in the "smart gene"[5] lottery by being born an Anglo, whereas Pedro had the bad luck to be born into the "wrong" ethnic group? Or is Pedro loaded with smart genes but deprived of an opportunity to develop his potential and held back by a meaningless score on a biased test?

As I write this, my back is aching. That's because I, like the rest of my species, stand on my "hind legs." Why isn't it our nature to run around on all fours like a proper mammal? Why do we end up with such weird posture—a posture that forced me to undergo back surgery and causes virtually all adult *Homo sapiens* to experience back pain?

Where did we get our capacity for conscious awareness and our ability to build long-term plans in our minds and then talk about those plans with other human beings? And with all that capacity for memory and foresight, why do I

still eat rich chocolate desserts whenever I get the chance? I remember the articles I've read that tell me how bad saturated fat is for my circulatory system, and I can foresee a coronary in my future unless I'm careful (or lucky!). But still I have a lust for hot-fudge sundaes. A recent magazine headline suggests I'm far from alone: "Fifty Secrets to Fight Fat—No Dieting Required! Plus, Outsmart Your Family Fat Gene!"[6] Why do so many of us have irresistible cravings, and different ones at that, including addictions to much more life-threatening substances than chocolate?

I had been struggling to learn Spanish for almost a decade, starting in my fifties, when my granddaughter Jessica entered a Spanish immersion school at the age of five. A few days after she started, I tried a little Spanish on her, asking her whether she wanted some chocolate. Her response was an immediate correction: "No, Grandpa, not *chah-kah*-lah-tay—it's *choh-koh*-lah-tay." Why are children natural linguists, whereas adults generally aren't? Why is it that only we human beings, of all creatures, talk, and write to one another?

How Can We Explain Human Behavior?

When we think about our behavior as individuals, "Why?" is a question almost always on the tips of our tongues. Sometimes that question is about perceived similarities: why is almost everyone religious; why do we all seem to crave love; why do most of us like to eat meat? But our differences often seem equally or more fascinating: why did Sally get married although her sister Sue did not, why did they win and we lose, why is their nation poor and ours rich? What were the fates of our childhood friends? What kinds of careers did they have; did they marry; how many children did they have? Our everyday lives are filled with why's about differences and similarities in behavior, often unspoken, but always there. Why did one of my closest colleagues drink himself to death, whereas I, who love wine much more than he did, am managing to keep my liver in pretty good shape? Why, of two very bright applicants admitted to our department at Stanford University for graduate work, does one turn out pedestrian science and another have a spectacular career doing innovative research? Why are our natures often so different, and why are they so frequently the same?

The background needed to begin to answer all these *whys* lies within the domain of human biological and cultural evolution, in the gradual alterations in genetic and cultural information possessed by humanity. It's easy to think that evolution is just a process that sometime in the distant past produced the physical characteristics of our species but is now pretty much a matter of purely academic, and local school board, interest. Yet evolution is a powerful, ongoing force that not only has shaped the attributes and behaviors shared by all human beings but also has given every single individual a different nature.

A study of evolution does much more than show how we are connected to our roots or explain why people rule Earth—it explains why it would be wise to limit our intake of beef Wellington, stop judging people by their skin color, con-

cern ourselves about global warming, and reconsider giving our children antibiotics at the first sign of a sore throat. Evolution also provides a framework for answering some of the most interesting questions about ourselves and our behavior.

When someone mentions evolution and behavior in the same breath, most people think immediately of the power of genes, parts of spiral-shaped molecules of a chemical called DNA. Small wonder, considering the marvelous advances in molecular genetics in recent decades. New subdisciplines such as evolutionary medicine[7] and evolutionary psychology[8] have arisen as scientists have come to recognize the importance of evolution in explaining contemporary human beings, the network of life that supports us, and our possible fates. And the mass media have been loaded with stories about real or imagined links between every conceivable sort of behavior and our genes.

Biological evolution—evolution that causes changes in our genetic endowment—has unquestionably helped shape human natures, including human behaviors, in many ways. But numerous commentators expect our genetic endowment to accomplish feats of which it is incapable. People don't have enough genes to program all the behaviors some evolutionary psychologists, for example, believe that genes control.[9] Human beings have something on the order of 100,000 genes,[10] and human brains have more than 1 *trillion* nerve cells, with about 100–1,000 trillion connections (synapses) between them.[11] That's at least 1 *billion* synapses per gene, even if each and every gene did nothing but control the production of synapses (and it doesn't). Given that ratio, it would be quite a trick for genes typically to control more than the most general aspects of human behavior.[12] Statements such as "Understanding the genetic roots of personality will help you 'find yourself' and relate better to others"[13] are, at today's level of knowledge, frankly nonsensical.

The notion that we are slaves to our genes is often combined with reliance on the idea that all problems can be solved by dissecting them into ever smaller components—the sort of reductionist approach that has been successful in much of science but is sometimes totally unscientific.[14] It's like the idea that knowing the color of every microscopic dot that makes up a picture of your mother can explain why you love her. Scientific problems have to be approached at the appropriate level of organization if there is to be a hope of solving them.

That combination of assumptions—that genes are destiny at a micro level and that reductionism leads to full understanding—is now yielding distorted views of human behavior. People think that coded into our DNA are "instructions" that control the details of individual and group behavior: that genetics dominates, heredity makes us what we are, and what we are is changeable only over many generations as the genetic endowment of human populations evolves. Such assertions presume, as I've just suggested, that evolution has produced a level of genetic control of human behavior that is against virtually all available evidence. For instance, ground squirrels have evolved a form of "altruistic" behavior—they often give an alarm call to warn a relative of approaching

danger. Evidence does indicate that this behavior is rooted in their genes; indeed, it probably evolved because relatives have more identical genes than do unrelated individuals. But some would trace the "altruistic" behavior of a business executive sending a check to an agency helping famine victims in Africa, or of a devout German Lutheran aiding Jews during the Holocaust, to a genetic tendency as well. In this view, we act either to help relatives or in the expectation of reciprocity—in either case promoting the replication of "our" genes. But experimental evidence indicates that not all human altruistic behavior is self-seeking—that human beings, unlike squirrels, are not hereditarily programmed only to be selfish.[15]

Another false assumption of hereditary programming lies behind the belief that evolution has resulted in human groups of different quality.[16] Many people still claim (or secretly believe), for example, that blacks are less intelligent than whites and women less "logical" than men, even though those claims are groundless. Belief in genetic determinism has even led some observers to suggest a return to the bad old days of eugenics, of manipulating evolution to produce ostensibly more skilled people. Advocating programs for the biological "improvement of humanity"[17]—which in the past has meant encouraging the breeding of supposedly naturally superior individuals—takes us back at least to the days of Plato, more than two millennia ago, and it involves a grasp of genetics little more sophisticated than his.

Uniquely in our species, changes in culture have been fully as important in producing our natures as have changes in the hereditary information passed on by our ancestors. Culture is the nongenetic information (socially transmitted behaviors, beliefs, institutions, arts, and so on) shared and exchanged among us. Indeed, our evolution since the invention of agriculture, about 10,000 years ago, has been overwhelmingly cultural because, as we shall see, cultural evolution can be much more rapid than genetic evolution. There is an unhappy predilection, especially in the United States, not only to overrate the effect of genetic evolution on our current behavior but also to underrate that of cultural evolution. The power of culture to shape human activities can be seen immediately in the diversity of languages around the world. Although, clearly, the ability to speak languages is a result of a great deal of genetic evolution, the specific languages we speak are just as clearly products of cultural evolution. Furthermore, genetic evolution and cultural evolution are not independent. There are important "coevolutionary" interactions between them. To take just one example, our farming practices (an aspect of our culture) change our physical environment in ways that alter the evolution of our blood cells, as we shall see in the next chapter.

Not only is the evolution of our collective nongenetic information critical to creating our natures, but also the rate of that evolution varies greatly among different aspects of human culture. That, in turn, has profound consequences for our behavior and our environments. A major contemporary human problem, for instance, is that the rate of cultural evolution in science and technology has

been extraordinarily high in contrast with the snail's pace of change in the social attitudes and political institutions that might channel the uses of technology in more beneficial directions.[18] No one knows exactly what sorts of societal effort might be required to substantially redress that imbalance in evolutionary rates, but it is clear to me that such an effort, if successful, could greatly brighten the human prospect.

Science has already given us pretty good clues about the reasons for the evolution of some aspects of our natures; many other aspects remain mysterious despite a small army of very bright people seeking reasons. Still other aspects (such as why I ordered duck in the restaurant last night rather than lamb) may remain unanswerable—for, as I will argue in a later chapter, human beings have a form of free will. But even to *think* reasonably about our natures and our prospects, some background in basic evolutionary theory is essential. If Grace is smarter than Pedro because of her genes, why did evolution provide her with "better" genes? If Pedro is actually smarter than Grace but has been incorrectly evaluated by an intelligence test designed for people of another culture, how did those cultural differences evolve? If I was able to choose the duck for dinner because I have free will, what exactly does that mean? How did I and other human beings evolve that capacity to make choices without being complete captives of our histories? Could I have exercised my free will to eat a cockroach curry had we been in a restaurant that served it (as some in Southeast Asia do)? Almost certainly not—the very idea nauseates me, probably because of an interaction between biological and cultural evolution.

Every attribute of *every* organism is, of course, the product of an interaction between its genetic endowment and its environment. Yes, the number of heads an individual human being possesses is specified in the genes and is the same in a vast diversity of environments.[19] And the language or languages a child speaks (but not her capacity to acquire language) is determined by her environment. But without the appropriate internal environment in the mother's body for fetal development, there would be no head (or infant) at all; and without genetically programmed physical structures in the larynx and in the developing brain, there would be no capacity to acquire and speak language. Beyond enabling us to make such statements in certain cases, however, the relative contributions of heredity and environment to various human attributes are difficult to specify. They clearly vary from attribute to attribute. So although it is informative to state that human nature is the product of genes interacting with environments (both internal and external), we usually can say little with precision about the processes that lead to interesting behaviors in adult human beings. We can't partition the responsibility for aggression, altruism, or charisma between DNA and upbringing. In many such cases, trying to separate the contributions of nature and nurture to an attribute is rather like trying to separate the contributions of length and width to the area of a rectangle, which at first glance also seems easy. When you think about it carefully, though, it proves impossible.[20]

Diverse notions of inherited superiority or inferiority and of characteristic

innate group behaviors have long pervaded human societies: beliefs about the divine right of kings; "natural" attributes that made some people good material for slaves or slave masters; innate superiority of light-skinned people over dark-skinned people; genetic tendencies of Jews to be moneylenders, of Christians to be sexually inhibited, and of Asians to be more hardworking than Hispanics; and so on. Consider the following quote from a recent book titled *Living with Our Genes*, which indicates the tone even among many scientists: "The emerging science of molecular biology has made startling discoveries that show beyond a doubt that genes are the single most important factor that distinguishes one person from another. We come in large part ready-made from the factory. We accept that we *look* like our parents and other blood relatives; we have a harder time with the idea we *act* like them."[21]

In fact, the failure of many people to recognize the fundamental error in such statements (and those in other articles and books based on genetic determinism, such as Richard J. Herrnstein and Charles Murray's famous *The Bell Curve*)[22] is itself an environmental phenomenon—a product of the cultural milieu in which many of us have grown up. Genes do not shout commands to us about our behavior. At the very most, they whisper suggestions, and the nature of those whispers is shaped by our internal environments (those within and between our cells) during early development and later, and usually also by the external environments in which we mature and find ourselves as adults.

How do scientists know that we are not simply genetically programmed automata? First, biological evolution has produced what is arguably the most astonishingly adaptable device that has ever existed—the human nervous system. It's a system that can use one organ, the brain, to plan a marriage or a murder, command muscles to control the flight of a thrown rock or a space shuttle, detect the difference between a 1945 Mouton and a 1961 Latour, learn Swahili or Spanish, and interpret a pattern of colored light on a flat television screen as a three-dimensional world containing real people. It tries to do whatever task the environment seems to demand, and it usually succeeds—and because many of those demands are novel, there is no way that the brain could be preprogrammed to deal with them, even if there were genes enough to do the programming. It would be incomprehensible for evolution to program such a system with a vast number of inherited rules that would reduce its flexibility, constraining it so that it could not deal with novel environments. It would seem equally inexplicable if evolution made some subgroups of humanity less able than others to react appropriately to changing circumstances. Men and people with white skin have just as much need of being smart and flexible as do women and people with brown skin, and there is every reason to believe that evolution has made white-skinned males fully as capable as brown-skinned women.

A second type of evidence that we're not controlled by innate programs is that normal infants taken from one society and reared in another inevitably acquire the behaviors (including language) and competences of the society in which they are reared. If different behaviors in different societies were largely

genetically programmed, that could not happen. That culture dominates in creating intergroup differences is also indicated by the distribution of genetic differences among human beings. The vast majority (an estimated 85 percent) is not between "races" or ethnic groups but *between individuals within groups.*[23] Human natures, again, are products of similar (but not identical) inherited endowments interacting with different physical and cultural environments.

Thus, the genetic "make-brain" program that interacts with the internal and external environments of a developing person doesn't produce a brain that can call forth only one type of, say, mating behavior—it produces a brain that can engage in any of a bewildering variety of behaviors, depending on circumstances. We see the same principle elsewhere in our development; for instance, human legs are not genetically programmed to move only at a certain speed. The inherited "make-legs" program normally produces legs that, fortunately, can operate at a wide range of speeds, depending on circumstances. Variation among individuals in the genes they received from their parents produces some differences in that range (in any normal terrestrial environment, I never could have been a four-minute miler—on the moon, maybe). Environmental variation produces some differences, too (walking a lot every day and years of acclimatization enable me to climb relatively high mountains that are beyond the range of some younger people who are less acclimatized). But no amount of training will permit any human being to leap tall buildings in a single bound, or even in two.

Similarly, inherited differences among individuals can influence the range of mental abilities we possess. Struggle as I might, my math skills will never approach those of many professional mathematicians, and I suspect that part of my incapacity can be traced to my genes. But environmental variation can shape those abilities as well. I'm also lousy at learning languages (that may be related to my math incompetence). Yet when I found myself in a professional environment in which it would have been helpful to converse in Spanish, persistent study allowed me to speak and comprehend a fair amount of the language. That was possible even long after I had passed the years during which a new language is easiest to acquire—even if I couldn't teach my tongue to pronounce *choh-koh-lah-tay* properly. But there are no genetic instructions or environmental circumstances that will allow the development of a human brain that can do a million mathematical calculations in a second. That is a talent reserved for computers, which were, of course, designed by human minds.

Are there any behavioral instructions we can be sure are engraved in human DNA? If there are, at least one should be the urge to have as many children as possible. We should have a powerful hereditary tendency to maximize our genetic contributions to future generations, for, as we'll see in the next chapter, that's the tendency that makes evolution work. Yet almost no human beings strictly obey this genetic "imperative"; environmental factors, especially cultural factors, have largely overridden it. Most people choose to make smaller genetic contributions to the future—that is, have fewer children—than they could, thus