CHAPTER 4

Nature, Nurture, and Human Diversity

What makes you you? In important ways, we are each unique. We look different. We sound different. We have varying personalities, interests, and cultural and family backgrounds.

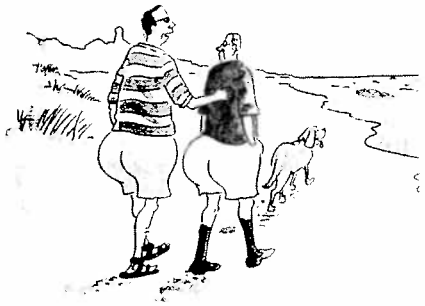
We are also the leaves of one tree. Our human family shares not only a common biological heritage—cut us and we bleed—but also common behavioral tendencies. Our shared brain architecture predisposes us to sense the world, develop language, and feel hunger through identical mechanisms. Whether we live in the Arctic or the tropics, we prefer sweet tastes to sour. We divide the color spectrum into similar colors. And we feel drawn to behaviors that produce and protect offspring.

Our kinship appears in our social behaviors as well. Whether named Wong, Nkomo, Smith, or Gonzales, we start fearing strangers at about eight months, and as adults we prefer the company of those with attitudes and attributes similar to our own. Coming from different parts of the globe, we know how to read one another's smiles and frowns. As members of one species, we affiliate, conform, return favors, punish offenses, organize hierarchies of status, and grieve a child's death. A visitor from outer space could drop in anywhere and find humans dancing and feasting, singing and worshiping, playing sports and games, laughing and crying, living in families and forming groups. Taken together, such universal behaviors define our human nature.

What causes our striking diversity, and also our shared human nature? How much are human differences shaped by our differing genes? And how much by our *environment*—by every external influence, from maternal nutrition while in the womb to social support while nearing the tomb? To what extent are we formed by our upbringing? By our culture? By our current circumstances? By people's reactions to our genetic dispositions? This chapter begins to tell the complex story of how our genes *(nature)* and environments *(nurture)* define us.

Courtesy Brendan Baruth

The nurture of nature Parents everywhere wonder: Will my baby grow up to be peaceful or aggressive? Homely or attractive? Successful or struggling at every step? What comes built in, and what is nurtured—and how? Research reveals that nature and nurture together shape our development—every step of the way.



"Thanks for almost everything, Dad."

Behavior Genetics: Predicting Individual Differences

What are genes, and how do behavior geneticists explain our individual differences?

IF JADEN AGASSI, SON OF TENNIS STARS Andre Agassi and Stephanie Graf, grows up to be a tennis star, should we attribute his superior talent to his Grand Slam genes? To his growing up in a tennis-rich environment? To high expectations? Such questions intrigue **behavior geneticists,** who study our differences and weigh the effects and interplay of heredity and **environment.**

Genes: Our Codes for Life

Behind the story of our body and of our brain—surely the most awesome thing on our little planet—is the heredity that interacts with our experience to create both our universal human nature and our individual and social diversity. Barely more than a century ago, few would have guessed that every cell nucleus in your body contains the genetic master code for your entire body. It's as if every room in the Empire State Building had a book containing the architect's plans for the entire structure. The plans for your own book of life run to 46 chapters—23 donated by your mother (from her egg) and 23 by your father (from his sperm). Each of these 46 chapters, called a **chromosome,** is composed of a coiled chain of the molecule **DNA** (*deoxyribonucleic acid*). **Genes,** small segments of the giant DNA molecules, form the words of those chapters (**FIGURE 4.1**). All told, you have 30,000 or so gene words. Genes can be either active (*expressed*) or inactive. Environmental events "turn on" genes, rather like hot water enabling a tea bag to express its flavor. When turned on, genes provide the code for creating *protein molecules,* the building blocks of physical development.

behavior genetics the study of the relative power and limits of genetic and environmental influences on behavior.

environment every nongenetic influence, from prenatal nutrition to the people and things around us.

chromosomes threadlike structures made of DNA molecules that contain the genes.

DNA (deoxyribonucleic acid) a complex molecule containing the genetic information that makes up the chromosomes.

genes the biochemical units of heredity that make up the chromosomes; a segment of DNA capable of synthesizing a protein.

genome the complete instructions for making an organism, consisting of all the genetic material in that organism's chromosomes.

identical twins twins who develop from a single fertilized egg that splits in two, creating two genetically identical organisms.

fraternal twins twins who develop from separate fertilized eggs. They are genetically no closer than brothers and sisters, but they share a fetal environment.

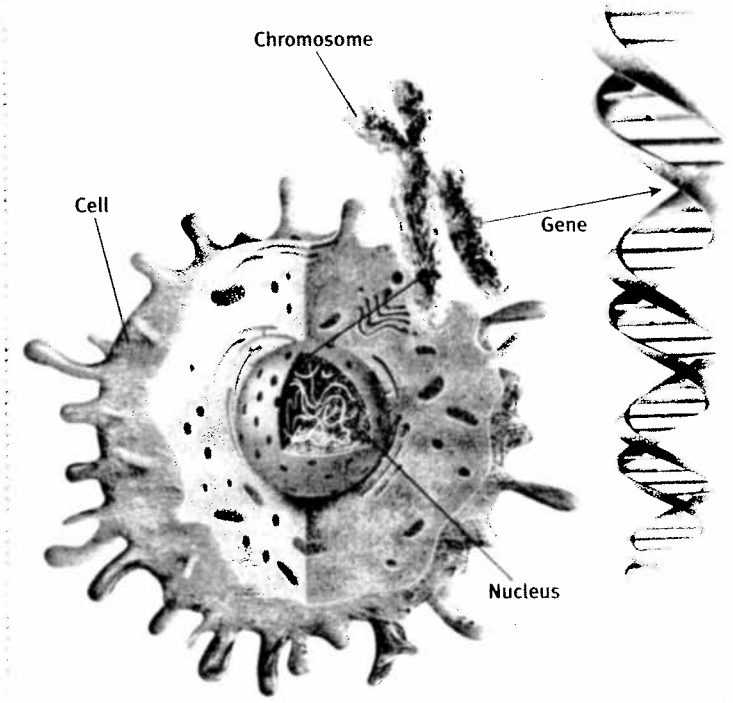


FIGURE 4.1
The human building blocks The nucleus of every human cell contains chromosomes, each of which is made up of two strands of DNA connected in a double helix.

Genetically speaking, every other human is close to being your identical twin. Human **genome** researchers have discovered the common sequence within human DNA. It is this shared genetic profile that makes us humans, rather than chimpanzees or tulips.

"Your DNA and mine are 99.9 percent the same. . . . At the DNA level, we are clearly all part of one big worldwide family."

Francis Collins, Human Genome Project director, 2007

Actually, we aren't all that different from our chimpanzee cousins; with them we share about 96 percent of our DNA sequence (Mikkelsen et al., 2005). At "functionally important" DNA sites, reports one molecular genetics team, the human-chimpanzee DNA similarity is 99.4 percent (Wildman et al., 2003). Yet that wee difference matters. Despite some remarkable abilities, chimpanzees grunt. Shakespeare intricately wove some 24,000 words to form his literary masterpieces. And small differences matter among chimpanzees, too. Two species, common chimpanzees and bonobos, differ by much less than 1 percent of their genomes, yet they display markedly differing behaviors. Chimpanzees are aggressive and male-dominated. Bonobos are peaceable and female led.

"We share half our genes with the banana."

Evolutionary biologist Robert May, president of Britain's Royal Society, 2001

Geneticists and psychologists are interested in the occasional variations found at particular gene sites in human DNA. Slight person-to-person variations from the common pattern give clues to our uniqueness—why one person has a disease that another does not, why one person is short and another tall, why one is outgoing and another shy.

Most of our traits are influenced by many genes. How tall you are, for example, reflects the size of your face, vertebrae, leg bones, and so forth—each of which may be influenced by different genes interacting with your environment. Complex traits such as intelligence, happiness, and aggressiveness are similarly influenced by groups of genes. Thus our genetic predispositions—our genetically influenced traits—help explain both our shared human nature and our human diversity.

Twin and Adoption Studies

To scientifically tease apart the influences of environment and heredity, behavior geneticists would need to design two types of experiments. The first would control the home environment while varying heredity. The second would control heredity while varying the home environment. Such experiments with human infants would be unethical, but happily for our purposes, nature has done this work for us.

Identical Versus Fraternal Twins

Identical twins, who develop from a single fertilized egg that splits in two, are *genetically* identical (FIGURE 4.2 on the next page). They are nature's own human clones—indeed, clones who share not only the same genes but the same conception, uterus, birth date, and usually the same cultural history. Two slight qualifications:

- Although identical twins have the same genes, they don't always have the same *number of copies* of those genes. That may help explain why one twin may be more at risk for certain illnesses (Bruder et al., 2008).
- Most identical twins share a placenta during prenatal development, but one of every three sets has two separate placentas. One twin's placenta may provide slightly better nourishment, which may contribute to identical twin differences (Davis et al., 1995; Phelps et al., 1997; Sokoll et al., 1995).

Fraternal twins develop from separate fertilized eggs. They share a fetal environment, but they are genetically no more similar than ordinary brothers and sisters.

Fraternal Olsen twins The actresses Mary Kate and Ashley Olsen have often been mistaken for identical twins. As babies and then preschoolers, they even played the same young character (trading places when one would tire or get fussy) in the late 1980s and early 1990s TV show "Full House." But they are actually fraternal twins, having formed from two separate eggs, so they share no more genes than any other sibling pair.

FIGURE 4.2

Same fertilized egg, same genes; different eggs, different genes. Identical twins develop from a single fertilized egg, fraternal twins from two.

Shared genes can translate into shared experiences. A person whose identical twin has Alzheimer's disease, for example, has a 60 percent risk of getting the disease; if the affected twin is fraternal, the risk is only 30 percent (Plomin et al., 1997).

Are identical twins, being genetic clones of one another, also behaviorally more similar than fraternal twins? Studies of thousands of twin pairs in Sweden, Finland, and Australia provide a consistent answer: On both extraversion (outgoingness) and neuroticism (emotional instability), identical twins are much more similar than fraternal twins.

If genes influence traits such as emotional instability, might they also influence the social effects of such traits? To find out, Matt McGue and David Lykken (1992) studied divorce rates among 1500 same-sex, middle-aged twin pairs. Their result: If you have a fraternal twin who has divorced, the odds of your divorcing go up 1.6 times (compared with having a not-divorced twin). If you have an identical twin who has divorced, the odds of your divorcing go up 5.5 times. From such data, McGue and Lykken estimate that people's differing divorce risks are about 50 percent attributable to genetic factors.

"It will inevitably be revealed that there are strong genetic components associated with more aspects of what we attribute to human existence including personality subtypes, language capabilities, mechanical abilities, intelligence, sexual activities and preferences, intuitive thinking, quality of memory, willpower, temperament, athletic abilities, etc."

Genomics researcher, J. Craig Venter, 2006


Ethel Wolvitz/The ImageWorks


ACE Stock Limited/Alamy


Peter Arnold, Inc./Alamy

More twins. Curiously, twinning rates vary by race. The rate among Caucasians is roughly twice that of Asians and half that of Africans. In Africa and Asia, most twins are identical. In Western countries, most twins are fraternal, and fraternal twins are increasing with the use of fertility drugs (Hall, 2003; Steinhauer, 1999).

When John Loehlin and Robert Nichols (1976) gave a battery of questionnaires to 850 U.S. twin pairs, identical twins, more than fraternal twins, also reported being treated alike. So, did their experience rather than their genes account for their similarity? No, said Loehlin and Nichols; identical twins whose parents treated them alike were not psychologically more alike than identical twins who were treated less similarly. In explaining individual differences, genes matter.

Separated Twins

Imagine the following science fiction experiment: A mad scientist decides to separate identical twins at birth, then rear them in differing environments. Better yet, consider a *true* story:

On a chilly February morning in 1979, some time after divorcing his first wife, Linda, Jim Lewis awoke in his modest home next to his second wife, Betty. Determined that this marriage would work, Jim made a habit of leaving love notes to Betty around the house. As he lay in bed he thought about others he had loved, including his son, James Alan, and his faithful dog, Toy.

Jim was looking forward to spending part of the day in his basement woodworking shop, where he had put in many happy hours building furniture, picture frames, and other items, including a white bench now circling a tree in his front yard. Jim also liked to spend free time driving his Chevy, watching stock-car racing, and drinking Miller Lite beer.

Jim was basically healthy, except for occasional half-day migraine headaches and blood pressure that was a little high, perhaps related to his chain-smoking habit. He had become overweight a while back but had shed some of the pounds. Having undergone a vasectomy, he was done having children.

What was extraordinary about Jim Lewis, however, was that at that same moment (I am not making this up) there existed another man—also named Jim—for whom all these things (right down to the dog's name) were also true.[1] This other Jim—Jim Springer—just happened, 38 years earlier, to have been his womb-mate. Thirty-seven days after their birth, these genetically identical twins were separated, adopted by blue-collar families, and reared with no contact or knowledge of each other's whereabouts until the day Jim Lewis received a call from his genetic clone (who, having been told he had a twin, set out to find him).

One month later, the brothers became the first twin pair tested by University of Minnesota psychologist Thomas Bouchard and his colleagues, beginning a study of

Sweden has the world's largest national twin registry—140,000 living and dead twin pairs—which forms part of a massive registry of 600,000 twins currently being sampled in the world's largest twin study (Wheelwright, 2004; www.genomeutwin.org).

Twins Lorraine and Levinia Christmas, driving to deliver Christmas presents to each other near Flitcham, England, collided (Shepherd, 1997).

Bouchard's famous twin research was, appropriately enough, conducted in Minneapolis, the "Twin City" (with St. Paul), and home to the Minneapolis Twins baseball team.

[1]Actually, this description of the two Jims errs in one respect: Jim Lewis named his son James Alan. Jim Springer named his James Allan.

Identical twins are people two. Identical twins Jim Lewis and Jim Springer were separated shortly after birth and raised in different homes without awareness of each other. Research has shown remarkable similarities in the life choices of separated identical twins, lending support to the idea that genes influence personality. ▲

"In some domains it looks as though our identical twins reared apart are . . . just as similar as identical twins reared together. Now that's an amazing finding and I can assure you none of us would have expected that degree of similarity."

Thomas Bouchard (1981)

separated twins that extends to the present (Holden, 1980a,b; Wright, 1998). Given tests measuring their personality, intelligence, heart rate, and brain waves, the Jim twins—despite 38 years of separation—were virtually as alike as the same person tested twice. Their voice intonations and inflections were so similar that, hearing a playback of an earlier interview, Jim Springer guessed "That's me." Wrong—it was his brother.

Identical twins Oskar Stohr and Jack Yufe presented equally striking similarities. One was raised by his grandmother in Germany as a Catholic and a Nazi, while the other was raised by his father in the Caribbean as a Jew. Nevertheless, they shared traits and habits galore. They liked spicy foods and sweet liqueurs, fell asleep in front of the television, flushed the toilet before using it, stored rubber bands on their wrists, and dipped buttered toast in their coffee. Stohr was domineering toward women and yelled at his wife, as did Yufe before he and his wife separated. Both married women named Dorothy Jane Scheckelburger. Okay, the last item is a joke. But as Judith Rich Harris (2006) notes, it is hardly weirder than some other reported similarities.

Aided by publicity in magazine and newspaper stories, Bouchard and his colleagues (1990; DiLalla et al., 1996; Segal, 1999) located and studied 80 pairs of identical twins reared apart. They continued to find similarities not only of tastes and physical attributes but also of personality, abilities, attitudes, interests, and even fears.

In Sweden, Nancy Pedersen and her co-workers (1988) identified 99 separated identical twin pairs and more than 200 separated fraternal twin pairs. Compared with equivalent samples of identical twins reared together, the separated identical twins had somewhat less identical personalities (characteristic patterns of thinking, feeling, and acting). Still, separated twins were more alike if genetically identical than if fraternal. And separation shortly after birth (rather than, say, at age 8) did not amplify their personality differences.

Stories of startling twin similarities do not impress Bouchard's critics, who remind us that "the plural of *anecdote* is not *data*." They contend that if any two strangers were to spend hours comparing their behaviors and life histories, they would probably discover many coincidental similarities. If researchers created a control group of biologically unrelated pairs of the same age, sex, and ethnicity, who had not grown up together but who were as similar to one another in economic and cultural background as are many of the separated twin pairs, wouldn't these pairs also exhibit striking similarities (Joseph, 2001)? Bouchard replies that separated fraternal twins do not exhibit similarities comparable to those of separated identical twins. Twin researcher Nancy Segal (2000) notes that *virtual twins*—same-age, biologically unrelated siblings—are also much more dissimilar.

Even the more impressive data from personality assessments are clouded by the reunion of many of the separated twins some years before they were tested. Moreover, identical twins share an appearance, and the responses it evokes, and adoption agencies tend to place separated twins in similar homes. Despite these criticisms, the striking twin-study results helped shift scientific thinking toward a greater appreciation of genetic influences.

"We carry to our graves the essence of the zygote that was first us."

Mary Pipher, *Seeking Peace: Chronicles of the Worst Buddhist in the World*, 2009

For behavior geneticists, nature's second type of real-life experiment—adoption—creates two groups: *genetic relatives* (biological parents and siblings) and *environmental relatives* (adoptive parents and siblings). For any given trait, we can therefore ask whether adopted children are more like their biological parents, who contributed their genes, or their adoptive parents, who contribute a home environment. While sharing that home environment, do adopted siblings also come to

The stunning finding from studies of hundreds of adoptive families is that people who grow up together, whether biologically related or not, do not much resemble one another in personality (McGue & Bouchard, 1998; Plomin et al., 1998; Rowe, 1990). In traits such as extraversion and agreeableness, adoptees are more similar to their biological parents than to their caregiving adoptive parents.

The finding is important enough to bear repeating: The environment shared by a family's children has virtually no discernible impact on their personalities. Two adopted children reared in the same home are no more likely to share personality traits with each other than with the child down the block. Heredity shapes other primates' personalities, too. Macaque monkeys raised by foster mothers exhibit social behaviors that resemble their biological, rather than foster, mothers (Maestripieri, 2003). Add all this to the similarity of identical twins, whether they grow up together or apart, and the effect of a shared rearing environment seems shockingly modest.

What we have here is perhaps "the most important puzzle in the history of psychology," contends Steven Pinker (2002): Why are children in the same family so different? Why does shared family environment have so little effect on children's personalities? Is it because each sibling experiences unique peer influences and life events? Because sibling relationships ricochet off each other, amplifying their differences? Because siblings—despite sharing half their genes—have very different combinations of genes and may evoke very different kinds of parenting? Such questions fuel behavior geneticists' curiosity.

The minimal shared-environment effect does not, however, mean that adoptive parenting is a fruitless venture. The genetic leash may limit the family environment's influence on personality, but parents do influence their children's attitudes, values, manners, faith, and politics (Reifman & Cleveland, 2007). A pair of adopted children or identical twins *will*, especially during adolescence, have more similar religious beliefs if reared together (Kelley & De Graaf, 1997; Koenig et al., 2005; Rohan & Zanna, 1996). Parenting matters!

Moreover, in adoptive homes, child neglect and abuse and even parental divorce are rare. (Adoptive parents are carefully screened; natural parents are not.) So it is not surprising that, despite a somewhat greater risk of psychological disorder, most adopted children thrive, especially when adopted as infants (Loehlin et al., 2007; van IJzendoorn & Juffer, 2006; Wierzbicki, 1993). Seven in eight report feeling strongly attached to one or both adoptive parents. As children of self-giving parents, they grow up to be more self-giving and altruistic than average (Sharma et al., 1998). Many score higher than their biological parents on intelligence tests, and most grow into happier and more stable adults. In one Swedish study, infant adoptees grew up with fewer problems than were experienced by children whose biological mothers had initially registered them for adoption but then decided to raise the children themselves (Bohman & Sigvardsson, 1990). Regardless of personality differences between parents and their adoptees, children benefit from adoption.

Nature or nurture or both? When talent runs in families, as with the Williams sisters, how do heredity and environment together do their work?

"Mom may be holding a full house while Dad has a straight flush, yet when Junior gets a random half of each of their cards his poker hand may be a loser."

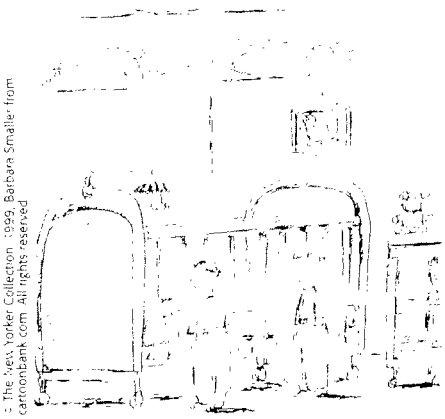
David Lykken (2001)

The greater uniformity of adoptive homes—mostly healthy, nurturing homes—helps explain the lack of striking differences when comparing child outcomes of different adoptive homes (Stoolmiller, 1999).

Temperament and Heredity

As most parents will tell you after having their second child, babies differ even before gulping their first breath. Consider one quickly apparent aspect of personality. Infants' **temperaments** are their emotional excitability—whether reactive, intense, and fidgety, or easygoing, quiet, and placid. From the first weeks of life, *difficult* babies are more irritable, intense, and unpredictable. *Easy* babies are cheerful, relaxed, and predictable in feeding and sleeping. *Slow-to-warm-up* infants tend to resist or withdraw from new people and situations (Chess & Thomas, 1987; Thomas & Chess, 1977).

temperament a person's characteristic emotional reactivity and intensity



"Oh, he's cute, all right, but he's got the temperament of a car alarm."

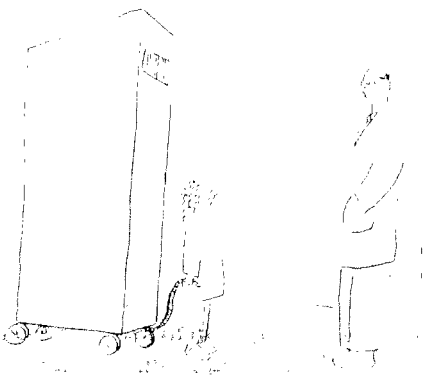
Temperament differences tend to persist. Consider:

- The most emotionally reactive newborns tend also to be the most reactive 9-month-olds (Wilson & Matheny, 1986; Worobey & Blajda, 1989).
- Exceptionally inhibited and fearful 2-year-olds often are still relatively shy as 8-year-olds; about half will become introverted adolescents (Kagan et al., 1992, 1994).
- The most emotionally intense preschoolers tend to be relatively intense young adults (Larsen & Diener, 1987). In one study of more than 900 New Zealanders, emotionally reactive and impulsive 3-year-olds developed into somewhat more impulsive, aggressive, and conflict-prone 21-year-olds (Caspi, 2000).

Heredity predisposes temperament differences (Rothbart, 2007). As we have seen, identical twins have more similar personalities, including temperament, than do fraternal twins. Physiological tests reveal that anxious, inhibited infants have high and variable heart rates and a reactive nervous system, and that they become more physiologically aroused when facing new or strange situations (Kagan & Snidman, 2004). One form of a gene that regulates the neurotransmitter serotonin predisposes a fearful temperament and, in combination with unsupportive caregiving, an inhibited child (Fox et al., 2007). Such evidence adds to the emerging conclusion that our biologically rooted temperament helps form our enduring personality (McCrae et al., 2000, 2007; Rothbart et al., 2000).

What is heritability, and how does it relate to individuals and groups?

Using twin and adoption studies, behavior geneticists can mathematically estimate the **heritability** of a trait—the extent to which variation among individuals can be attributed to their differing genes. As Chapter 10 will emphasize, if the heritability of intelligence is, say, 50 percent, this does *not* mean that *your* intelligence is 50 percent genetic. (If the heritability of height is 90 percent, this does not mean that a 60-inch-tall woman can credit her genes for 54 inches and her environment for the other 6 inches.) Rather, it means that genetic influence explains 50 percent of the observed variation *among people*. This point is so often misunderstood that I repeat: We can never say what percentage of an *individual's* personality or intelligence is inherited. It makes no sense to say that your personality is due *x* percent to your heredity and *y* percent to your environment. Heritability refers instead to the extent to which *differences among people* are attributable to genes.



"The title of my science project is 'My Little Brother: Nature or Nurture.'"

Even this conclusion must be qualified, because heritability can vary from study to study. Consider humorist Mark Twain's (1835–1910) proposal to raise boys in barrels to age 12, feeding them through a hole. If we were to follow his suggestion, the boys would all emerge with lower-than-normal intelligence scores at age 12; yet, given their equal environments, their test score differences could be explained only by their heredity. In this case, heritability—differences due to genes—would be near 100 percent. As environments become more similar, heredity as a source of differences necessarily becomes more important. If all schools were of uniform quality, all families equally loving, and all neighborhoods equally healthy, then heritability would increase (because differences due to environment would decrease). At the other extreme, if all people had similar heredities but were raised in drastically different environments (some in barrels, some in luxury homes), heritability would be much lower.

Group Differences

heritability the proportion of variation among individuals that we can attribute to genes. The heritability of a trait may vary, depending on the range of populations and environments studied.

If genetic influences help explain individual diversity in traits such as aggressiveness, can the same be said of group differences between men and women, or between people of different races? Not necessarily. Individual differences in height and weight, for example, are highly heritable; yet nutritional rather than genetic influences explain why, as a group, today's adults are taller and heavier than those of a century ago. The two groups differ, but not because human genes have changed in a mere century's eyeblink of time.

As with height and weight, so with personality and intelligence scores: Heritable individual differences need not imply heritable group differences. If some individuals are genetically disposed to be more aggressive than others, that needn't explain why some groups are more aggressive than others. Putting people in a new social context can change their aggressiveness. Today's peaceful Scandinavians carry many genes inherited from their Viking warrior ancestors.

Nature and Nurture

Among our similarities, the most important—the behavioral hallmark of our species—is our enormous adaptive capacity. Some human traits, such as having two eyes, develop the same in virtually every environment. But other traits are expressed only in particular environments. Go barefoot for a summer and you will develop toughened, callused feet—a biological adaptation to friction. Meanwhile, your shod neighbor will remain a tenderfoot. The difference between the two of you is, of course, an effect of environment. But it is also the product of a biological mechanism—adaptation. Our shared biology enables our developed diversity (Buss, 1991).

"Men's natures are alike; it is their habits that carry them far apart."

Confucius, *Analects*, 500 B.C.E.

An analogy may help: Genes and environment—nature and nurture—work together like two hands clapping. Genes not only code for particular proteins, they also respond to environments. An African butterfly that is green in summer turns brown in fall, thanks to a temperature-controlled genetic switch. The genes that produce brown in one situation produce green in another. Thus, genes are *self-regulating*. Rather than acting as blueprints that lead to the same result no matter the context, genes react. People with identical genes but differing experiences therefore have similar though not identical minds. One twin may fall in love with someone quite different from the co-twin's love.

As we will see in Chapter 14, at least one known gene will, in response to major life stresses, code for a protein that controls a neurotransmitter involved in depression. By itself, the gene doesn't cause depression, but it is part of the recipe. Likewise, the breastfeeding boost to later intelligence that we noted in Chapter 1 turns out to be true only for the 90 percent of infants with a gene that assists in breaking down fatty acids present in human milk (Caspi et al., 2007). Studies of 1037 New Zealand adults and 2232 English 12- and 13-year olds found no breastfeeding boost among those not carrying the gene. As so often happens, nature and nurture work together.

Thus, asking whether your personality is more a product of your genes or your environment is like asking whether the area of a field is more the result of its length or its width. We could, however, ask whether the differing areas of various fields are more the result of *differences* in their length or their width, and also whether person-to-person personality differences are influenced more by nature or nurture. Human differences result from both genetic and environmental influences. Thus (to give a preview of a future chapter), eating disorders are genetically influenced: Some individuals are more at risk than others. But culture also bends the twig, for eating disorders are primarily a contemporary Western cultural phenomenon.

"Heredity deals the cards; environment plays the hand."
Psychologist Charles L. Brewer (1990)

To say that genes and experience are *both* important is true. But more precisely, they **interact.** Imagine two babies, one genetically predisposed to be attractive, sociable, and easygoing, the other less so. Assume further that the first baby attracts more affectionate and stimulating care than the second and so develops into a warmer and more outgoing person. As the two children grow older, the more naturally outgoing child more often seeks activities and friends that encourage further social confidence.

What has caused their resulting personality differences? Neither heredity nor experience dances alone. Environments trigger gene activity. (Scientists are now exploring environmental influences on when particular genes generate proteins.) The other partner in the dance—our genetically influenced traits—also *evoke* significant responses in others. Thus, a child's impulsivity and aggression may evoke an angry response from a teacher who otherwise reacts warmly to the child's model classmates. Parents, too, may treat their own children differently; one child elicits punishment, another does not. In such cases, the child's nature and the parents' nurture interact. Neither operates apart from the other. Gene and scene dance together.

People respond differently to a Rowan Atkinson (shown at left playing Mr. Bean) than to his fellow actor Zac Efron, right.

Evocative interactions may help explain why identical twins reared in different families recall their parents' warmth as remarkably similar—almost as similar as if they had had the same parents (Plomin et al., 1988, 1991, 1994). Fraternal twins have more differing recollections of their early family life—even if reared in the same family! "Children experience us as different parents, depending on their own qualities," noted Sandra Scarr (1990). Moreover, as we grow older we also *select* environments well suited to our natures.

So, from conception onward, we are the product of a cascade of interactions between our genetic predispositions and our surrounding environments. Our genes affect how people react to and influence us. Biological appearances have social consequences. So, forget nature *versus* nurture; think nature *via* nurture.

What is the promise of molecular genetics research?

Behavior geneticists have progressed beyond asking, "Do genes influence behavior?" The new frontier of behavior-genetics research draws on "bottom-up" **molecular genetics** as it seeks to identify *specific genes* influencing behavior.

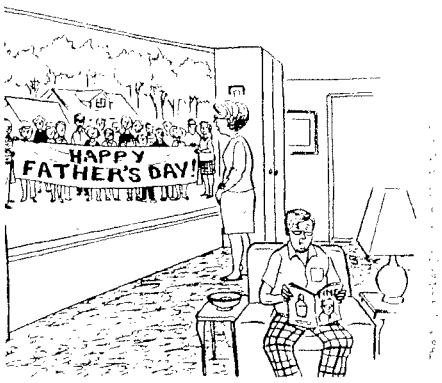
As we have already seen, most human traits are influenced by teams of genes. For example, twin and adoption studies tell us that heredity influences body weight, but there is no single "obesity gene." More likely, some genes influence how quickly the stomach tells the brain, "I'm full." Others might dictate how much fuel the muscles need, how many calories are burned off by fidgeting, and how efficiently the body converts extra calories into fat (Vogel, 1999). The goal of *molecular behavior genetics* is to find some of the many genes that influence normal human traits, such as body

weight, sexual orientation, and extraversion, and also to explore the mechanisms that control gene expression (Tsankova et al., 2007).

Genetic tests can now reveal at-risk populations for at least a dozen diseases. The search continues in labs worldwide, where molecular geneticists are teaming with psychologists to pinpoint genes that put people at risk for such genetically influenced disorders as learning disabilities, depression, schizophrenia, and alcohol dependence. (In Chapter 14, for example, we will take note of a worldwide research effort to sleuth the genes that make people vulnerable to the emotional swings of bipolar disorder, formerly known as manic-depressive disorder.) To tease out the implicated genes, molecular behavior geneticists seek links between certain genes or chromosome segments and specific disorders. First, they find families that have had the disorder across several generations. Then they draw blood or take cheek swabs from both affected and unaffected family members and examine their DNA, looking for differences. "The most powerful potential for DNA," note Robert Plomin and John Crabbe (2000), "is to predict risk so that steps can be taken to prevent problems before they happen."

Aided by inexpensive DNA-scanning techniques, medical personnel are becoming able to give would-be parents a readout on how their fetus' genes differ from the normal pattern and what this might mean. With this benefit come risks. Might labeling a fetus, for example, "at risk for a learning disorder" lead to discrimination? Prenatal screening poses ethical dilemmas. In China and India, where boys are highly valued, testing for an offspring's sex has enabled selective abortions resulting in millions—yes, millions—of "missing women."

Assuming it were possible, should prospective parents take their eggs and sperm to a genetics lab for screening before combining them to produce an embryo? Should we enable parents to screen their fertilized eggs for health—and for brains or beauty? Progress is a double-edged sword, raising both hopeful possibilities and difficult problems. By selecting out certain traits, we may deprive ourselves of future Handels and van Goghs, Churchills and Lincolns, Tolstoys and Dickinsons—troubled people all.



"I thought that sperm-bank donors remained anonymous."

ASK YOURSELF

Would you want genetic tests on your unborn offspring? What would you do if you knew your child would be destined for hemophilia? A learning disability? A high risk of depression? Do you think society would benefit or lose if such embryos were aborted?

TEST YOURSELF 1

What is *heritability?*

Answers to the Test Yourself Questions can be found in Appendix B at the end of the book.

interaction the interplay that occurs when the effect of one factor (such as environment) depends on another factor (such as heredity).

molecular genetics the subfield of biology that studies the molecular structure and function of genes.

evolutionary psychology the study of the evolution of behavior and the mind, using principles of natural selection.

natural selection the principle that, among the range of inherited trait variations, those that lead to increased reproduction and survival will most likely be passed on to succeeding generations.

Evolutionary Psychology: Understanding Human Nature

How do evolutionary psychologists use natural selection to explain behavior tendencies?

BEHAVIOR GENETICISTS EXPLORE THE genetic and environmental roots of human differences. **Evolutionary psychologists** instead focus mostly on what makes us so much alike as humans. They use Darwin's principle of **natural selection** to understand the roots of behavior and mental processes. Richard Dawkins (2007) calls

natural selection "arguably the most momentous idea ever to occur to a human mind." The idea, simplified, is this:

- Organisms' varied offspring compete for survival.
- Certain biological and behavioral variations increase their reproductive and survival chances in their environment.
- Offspring that survive are more likely to pass their genes to ensuing generations.
- Thus, over time, population characteristics may change.

To see these principles at work, let's consider a straightforward example in foxes.

Natural Selection and Adaptation

A fox is a wild and wary animal. If you capture a fox and try to befriend it, be careful. Stick your hand in the cage and, if the timid fox cannot flee, it may make a snack of your fingers. Dmitry Belyaev, of the Russian Academy of Science's Institute of Cytology and Genetics, wondered how our human ancestors had domesticated dogs from their equally wild wolf forebears. Might he, within a comparatively short stretch of time, accomplish a similar feat by transforming the fearful fox into a friendly fox?

To find out, Belyaev set to work with 30 male and 100 female foxes. From their offspring he selected and mated the tamest 5 percent of males and 20 percent of females. (He measured tameness by the foxes' responses to attempts to feed, handle, and stroke them.) Over more than 30 generations of foxes, Belyaev and his successor, Lyudmila Trut, repeated that simple procedure. Forty years and 45,000 foxes later, they had a new breed of foxes that, in Trut's (1999) words, are "docile, eager to please, and unmistakably domesticated. . . . Before our eyes, 'the Beast' has turned into 'beauty,' as the aggressive behavior of our herd's wild [ancestors] entirely disappeared." So friendly and eager for human contact are they, so inclined to whimper to attract attention and to lick people like affectionate dogs, that the cash-strapped institute seized on a way to raise funds—marketing its foxes to people as house pets.

L. N. Trut, *American Scientist* (1999) 87: 160–169

From wary to winsome More than 40 years into the fox-breeding experiment, most of the offspring are devoted, affectionate, and capable of forming strong bonds with people.

When certain traits are *selected*—by conferring a reproductive advantage to an individual or a species—those traits, over time, will prevail. Dog breeders, as Robert Plomin and his colleagues (1997) remind us, have given us sheepdogs that herd, retrievers that retrieve, trackers that track, and pointers that point. Psychologists, too, have bred dogs, mice, and rats whose genes predispose them to be serene or reactive, quick learners or slow.

Does natural selection also explain our human tendencies? Nature has indeed selected advantageous variations from among the **mutations** (random errors in gene replication) and from the new gene combinations produced at each human conception. But the tight genetic leash that predisposes a dog's retrieving, a cat's pouncing, or an ant's nest building is looser on humans. The genes selected during our ancestral history provide more than a long leash; they endow us with a great capacity to learn and therefore to *adapt* to life in varied environments, from the tundra to the jungle. Genes and experience together wire the brain. Our adaptive flexibility in responding to different environments contributes to our *fitness*—our ability to survive and reproduce.

mutation a random error in gene replication that leads to a change.

Evolutionary Success Helps Explain Similarities

Although human differences grab our attention, our deep similarities also demand explanation. And in the big picture, our lives are remarkably alike. Visit the international arrivals area at Amsterdam's Schiphol Airport, a world hub where arriving passengers meet their excited loved ones. There you will see the same delighted joy in the faces of

Indonesian grandmothers, Chinese children, and homecoming Dutch. Evolutionary psychologist Steven Pinker (2002, p. 73) believes it is no wonder that our emotions, drives, and reasoning "have a common logic across cultures." Our shared human traits "were shaped by natural selection acting over the course of human evolution."

Our behavioral and biological similarities arise from our shared human genome. No more than 5 percent of the genetic differences among humans arise from population group differences. Some 95 percent of genetic variation exists within populations (Rosenberg et al., 2002). The typical genetic difference between two Icelandic villagers or between two Kenyans is much greater than the *average* difference between the two groups. Thus, noted geneticist Richard Lewontin (1982), if after a worldwide catastrophe only Icelanders or Kenyans survived, the human species would suffer only "a trivial reduction" in its genetic diversity.

And how did we develop this shared human genome? At the dawn of human history, our ancestors faced certain questions: Who is my ally, who my foe? What food should I eat? With whom should I mate? Some individuals answered those questions more successfully than others. For example, some women's experience of nausea in the critical first three months of pregnancy predisposes their avoiding certain bitter, strongly flavored, and novel foods. Avoiding such foods has survival value, since they are the very foods most often toxic to embryonic development (Schmitt & Pilcher, 2004). Early humans disposed to eat nourishing rather than poisonous food survived to contribute their genes to later generations. Those who deemed leopards "nice to pet" often did not.

Similarly successful were those whose mating helped them produce and nurture offspring. Over generations, the genes of individuals not so disposed tended to be lost from the human gene pool. As genes contributing to success continued to be selected, behavioral tendencies and thinking and learning capacities emerged that prepared our Stone Age ancestors to survive, reproduce, and send their genes into the future.

Outdated Tendencies

As inheritors of this prehistoric genetic legacy, we are predisposed to behave in ways that promoted our ancestors' surviving and reproducing. We love the taste of sweets and fats, which once were hard to come by but which prepared our ancestors to survive famines. With famine now rare in Western cultures, and sweets and fats beckoning us from store shelves, fast-food outlets, and vending machines, obesity has become a growing problem. Our natural dispositions, rooted deep in history, are mismatched with today's junk-food environment (Colarelli & Dettman, 2003). We are, in some ways, biologically prepared for a world that no longer exists.

Despite high infant mortality ar rampant disease in past millenni not one of your countless ancest died childless.

Evolutionary Psychology Today

Charles Darwin's theory of evolution has been an organizing principle for biology for a long time. Jared Diamond (2001) notes that "virtually no contemporary scientists believe that Darwin was basically wrong." Today, Darwin's theory lives on in "the second Darwinian revolution": the application of evolutionary principles to psychology. In concluding *On the Origin of Species*, Darwin (1859, p. 346) anticipated this, foreseeing "open fields for far more important researches. Psychology will be based on a new foundation."

Evolutionary psychologists have addressed questions such as these:

- Why do infants start to fear strangers about the time they become mobile?
- Why are biological fathers so much less likely than unrelated boyfriends to abuse and murder the children with whom they share a home?
- Why do so many more people have phobias about spiders, snakes, and heights than about more dangerous threats, such as guns and electricity?

Those who are troubled by a apparent conflict between scient and religious accounts of huma origins may find it helpful to rec (Chapter 1) that different perspe of life can be complementary. Fo example, the scientific accou attempts to tell us *when* and *ho* religious creation stories usuall to tell about an ultimate *who* an As Galileo explained to the Gran Duchess Christina, "The Bible te how to go to heaven, not how t heaven goes."

- Why do humans share some universal moral ideas?
- How are men and women alike? How and why do men's and women's sexuality differ?

We will address such questions in later chapters. To see how evolutionary psychologists think and reason, let's pause now to explore that last question.

How might an evolutionary psychologist explain gender differences in mating preferences?

Having faced many similar challenges throughout history, men and women have adapted in similar ways. Whether male or female, we eat the same foods, avoid the same predators, and perceive, learn, and remember similarly. It is only in those domains where we have faced differing adaptive challenges—most obviously in behaviors related to reproduction—that we differ, say evolutionary psychologists.

Gender Differences in Sexuality

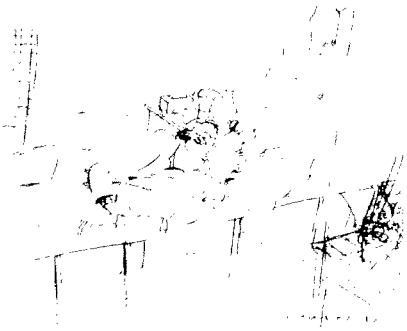
Differ we do, report psychologists Roy Baumeister, Kathleen Catanese, and Kathleen Vohs (2001). They invite us to consider whether women or men have the stronger sex drive. Who desires more frequent sex, thinks more about sex, masturbates more often, initiates more sex, and sacrifices more to gain sex? The answers, they report, are *men, men, men, men,* and *men.* For example, in one BBC survey of more than 200,000 people in 53 nations, men everywhere more strongly agreed that "I have a strong sex drive" and "It doesn't take much to get me sexually excited" (Lippa, 2008).

Indeed, "with few exceptions anywhere in the world," report cross-cultural psychologist Marshall Segall and his colleagues (1990, p. 244), "males are more likely than females to initiate sexual activity." This is among the largest of **gender** differences in sexuality (Regan & Atkins, 2007). Consider:

- In a survey of 289,452 entering U.S. college students, 58 percent of men but only 34 percent of women agreed that "if two people really like each other, it's all right for them to have sex even if they've known each other for a very short time" (Pryor et al., 2005). "I can imagine myself being comfortable and enjoying 'casual' sex with different partners," agreed 48 percent of men and 12 percent of women in a survey of 4901 Australians (Bailey et al., 2000).
- In another survey of 3432 U.S. 18- to 59-year-olds, 48 percent of the women but only 25 percent of the men cited affection as a reason for first intercourse. And how often do they think about sex? "Every day" or "Several times a day," acknowledged 19 percent of the women and 54 percent of the men (Laumann et al., 1994). Ditto for the sexual thoughts of Canadians: "Several times a day," agreed 11 percent of women and 46 percent of men (Fischtein et al., 2007).
- In surveys, gay men (like straight men) report more interest in uncommitted sex, more responsiveness to visual sexual stimuli, and more concern with their partner's physical attractiveness than do lesbian women (Bailey et al., 1994; Doyle, 2005; Schmitt, 2007).

Gender differences in attitudes extend to differences in behavior. Gay male couples report having sex more often than do lesbian couples (Peplau & Fingerhut, 2007). And in the first year of Vermont's same-sex civil unions, men were only one-third of those electing this legal partnership (Rothblum, 2007).

Casual, impulsive sex is most frequent among males with traditional masculine attitudes (Pleck et al., 1993). Russell Clark and Elaine Hatfield (1989, 2003) observed



"Not tonight, hon, I have a concussion."

"It's not that gay men are oversexed; they are simply men whose male desires bounce off other male desires rather than off female desires."

Steven Pinker, *How the Mind Works,* 1997

this striking gender difference in 1978 when they sent some average-looking student research assistants strolling across the Florida State University quadrangle. Spotting an attractive person of the other sex, a researcher would approach and say, "I have been noticing you around campus and I find you to be very attractive. Would you go to bed with me tonight?" The women all declined, some obviously irritated ("What's wrong with you, creep? Leave me alone!"). But 75 percent of the men readily agreed, often replying with comments such as "Why do we have to wait until tonight?" (All were then truthfully told this was just an experiment.) Somewhat astonished by their result, Clark and Hatfield repeated their study in 1982 and twice more during the late 1980s, a high-risk AIDS time in the United States (Clark, 1990). Each time, virtually no women, but half or more of the men, agreed to go to bed with a stranger.

Men also have a lower threshold for perceiving warm responses as a sexual come-on. In study after study, men more often than women attribute a woman's friendliness to sexual interest (Abbey, 1987; Johnson et al., 1991). Misattributing women's cordiality as a come-on helps explain—but does not excuse—men's greater sexual assertiveness (Kolivas & Gross, 2007). The unfortunate results can range from sexual harassment to date rape.

gender in psychology, the biologically and socially influenced characteristics by which people define *male* and *female*.

Natural Selection and Mating Preferences

As biologists use natural selection to explain the mating behaviors of many species, so evolutionary psychologists use natural selection to explain a worldwide human sexuality difference: Women's approach to sex is usually more relational, and men's more recreational (Schmitt, 2005, 2007). The explanation goes like this: While a woman usually incubates and nurses one infant at a time, a male can spread his genes through other females. Our natural yearnings are our genes' way of reproducing themselves. In our ancestral history, women most often sent their genes into the future by pairing wisely, men by pairing widely. "Humans are living fossils—collections of mechanisms produced by prior selection pressures," says evolutionary psychologist David Buss (1995).

And what do heterosexual men and women find attractive in the other sex? Some aspects of attractiveness cross place and time. Men in 37 cultures, from Australia to Zambia (**FIGURE 4.3**), judge women as more attractive if they have a youthful appearance (Buss, 1994). Evolutionary psychologists say that men who were drawn to healthy, fertile-appearing women—women with smooth skin and a youthful shape suggesting many childbearing years to come—stood a better chance of sending their genes into the future. And sure enough, men feel most attracted to

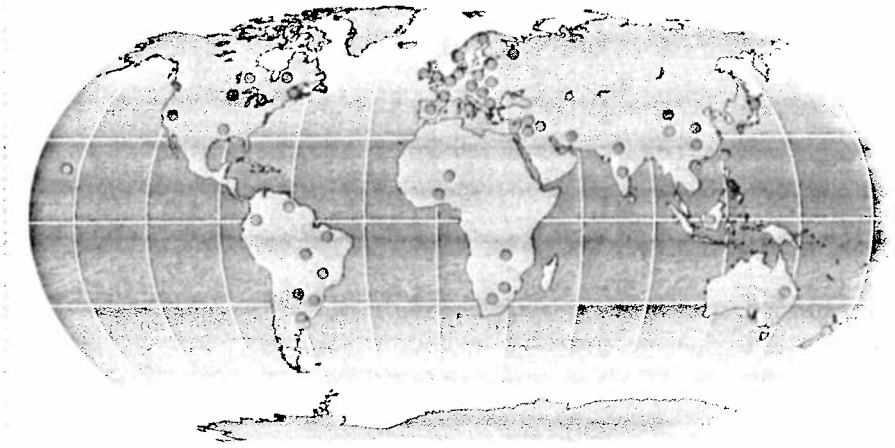
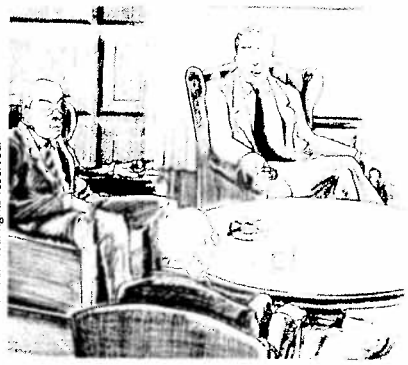
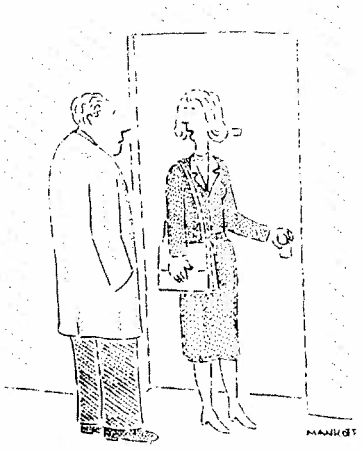


FIGURE 4.3

Worldwide mating preferences In 37 cultures studied (indicated by the red dots), men more than women preferred physical features suggesting youth and health—and reproductive potential. Women more than men preferred mates with resources and social status. Researchers credit (or blame) natural selection (Buss, 1994).



"What about you, Walter—how do you feel about same-age marriage?"



"I had a nice time, Steve. Would you like to come in, settle down, and raise a family?"

women whose waists are (or are surgically altered to be) roughly a third narrower than their hips—a sign of future fertility. Moreover, just as evolutionary psychology predicts, men are most attracted to women who, in the ancestral past (when ovulation began later than today), were at ages associated with peak fertility. Thus teen boys are most excited by a woman several years older than themselves, report Douglas Kenrick and his colleagues (in press). Mid-twenties men prefer women around their own age. And older men prefer younger women. This pattern, they report, consistently appears across European singles ads, Indian marital ads, and marriage records from North and South America, Africa, and the Philippines (Singh, 1993; Singh & Randall, 2007).

Women, in turn, prefer stick-around dads over likely cads. They are attracted to men who seem mature, dominant, bold, and affluent (Singh, 1995). They prefer mates with the potential for long-term mating and investment in their joint offspring (Gangestad & Simpson, 2000). Such attributes, say the evolutionary psychologists, connote a capacity to support and protect (Buss, 1996, 2000; Geary, 1998). In one experiment, women skillfully discerned which men most liked looking at baby pictures, and they rated those men higher as potential long-term mates (Roney et al., 2006).

There is a principle at work here, say evolutionary psychologists: Nature selects behaviors that increase the likelihood of sending one's genes into the future. As mobile gene machines, we are designed to prefer whatever worked for our ancestors in their environments. They were predisposed to act in ways that would leave grandchildren—had they not been, we wouldn't be here. And as carriers of their genetic legacy, we are similarly predisposed.

Critiquing the Evolutionary Perspective

What are the key criticisms of evolutionary psychology?

Without disputing nature's selection of traits that enhance gene survival, critics see problems with evolutionary psychology. It often, they say, starts with an effect (such as the gender sexuality difference) and works backward to propose an explanation. So let's imagine a different observation and reason backward. If men were uniformly loyal to their mates, might we not reason that the children of these committed, supportive fathers would more often survive to perpetuate their genes? Might not men also be better off bonded to one woman—both to increase their odds of impregnation and to keep her from the advances of competing men? Might not a ritualized bond—a marriage—also spare women from chronic male harassment? Such suggestions are, in fact, evolutionary explanations for why humans tend to pair off monogamously. One can hardly lose at hindsight explanation, which is, said paleontologist Stephen Jay Gould (1997), mere "speculation [and] guesswork in the cocktail party mode."

Some also worry about the social consequences of evolutionary psychology. Does it suggest a genetic determinism that strikes at the heart of progressive efforts to remake society (Rose, 1999)? Does it undercut moral responsibility? Could it be used to rationalize "high-status men marrying a series of young, fertile women" (Looy, 2001)?

Much of who we are is *not* hard-wired, agree evolutionary psychologists. What's considered attractive does vary somewhat with time and place. The voluptuous Marilyn Monroe ideal of the 1950s has been replaced by the twenty-first-century, leaner, yet still curvy athletic image. Moreover, cultural expectations can bend the genders. If socialized to value lifelong commitment, men may sexually bond with one partner; if socialized to accept casual sex, women may willingly have sex with many partners.

Social expectations also shape gender differences in mate preferences. Show Alice Eagly and Wendy Wood (1999; Wood & Eagly, 2002, 2007) a culture with gender inequality—where men are providers and women are homemakers—and they will show

you a culture where men strongly desire youth and domestic skill in their potential mates, and where women seek status and earning potential in their mates. Show Eagly and Wood a culture with gender equality, and they will show you a culture with smaller gender differences in mate preferences.

Evolutionary psychologists reassure us that the sexes, having faced similar adaptive problems, are far more alike than different. They stress that humans have a great capacity for learning and social progress. (We come equipped to adapt and survive, whether living in igloos or tree houses.) They point to the coherence and explanatory power of evolutionary principles, especially those offering testable predictions (for example, that we will favor others to the extent that they share our genes or can later reciprocate our favors). And they remind us that the study of how we came to be need not dictate how we *ought* to be. Understanding our propensities sometimes helps us overcome them.

REVIEW YOUR LEARNING

ASK YOURSELF

Whose reasoning do you find most persuasive—that of evolutionary psychologists or their critics? Why?

TEST YOURSELF 2

What are the three main criticisms of the evolutionary explanation of human sexuality?

Answers to the Test Yourself Questions can be found in Appendix B at the end of the book.

Parents and Peers

To what extent are our lives shaped by early stimulation, by parents, and by peers?

WE HAVE SEEN HOW OUR GENES, AS expressed in specific environments, influence our developmental differences. We are not "blank slates," note Douglas Kenrick and his colleagues (in press). We are more like coloring books, with certain lines predisposed and experience filling in our picture. We are formed by nature *and* nurture. But what are the most influential components of our nurture? How do our early experiences, our family and peer relationships, and all our other experiences guide our development and contribute to our diversity?

Parents and Early Experiences

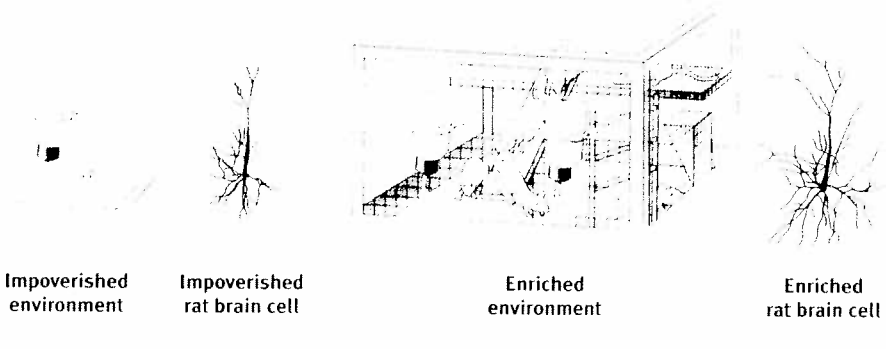
The formative nurture that conspires with nature begins at conception, with the prenatal environment in the womb, as embryos receive differing nutrition and varying levels of exposure to toxic agents (more on this in Chapter 5). Nurture then continues outside the womb, where our early experiences foster brain development.

Experience and Brain Development

Our genes dictate our overall brain architecture, but experience fills in the details, developing neural connections and preparing our brain for thought and language and other later experiences. So how do early experiences leave their "marks" in the brain? Mark Rosenzweig and David Krech opened a window on that process when they raised some young rats in solitary confinement and others in a communal play-

FIGURE 4.4

Mark Rosenzweig and David Krech raised rats either alone in an environment without playthings, or with other rats in an environment enriched with playthings changed daily. In 14 of 16 repetitions of this basic experiment, rats in the enriched environment developed significantly more cerebral cortex (relative to the rest of the brain's tissue) than did those in the impoverished environment.



ground. When they later analyzed the rats' brains, those who died with the most toys had won. The rats living in the enriched environment, which simulated a natural environment, usually developed a heavier and thicker brain cortex (**FIGURE 4.4**).

Rosenzweig was so surprised by this discovery that he repeated the experiment several times before publishing his findings (Renner & Rosenzweig, 1987; Rosenzweig, 1984). So great are the effects that, shown brief video clips of rats, you could tell from their activity and curiosity whether their environment had been impoverished or enriched (Renner & Renner, 1993). Bryan Kolb and Ian Whishaw (1998) noted extraordinary changes after 60 days in the enriched environment; the rats' brain weights increased 7 to 10 percent and the number of synapses mushroomed by about 20 percent.

Such results have motivated improvements in environments for laboratory, farm, and zoo animals—and for children in institutions. Stimulation by touch or massage also benefits infant rats and premature babies (Field et al., 2007). "Handled" infants of both species develop faster neurologically and gain weight more rapidly. By giving preemies massage therapy, neonatal intensive care units now help them to go home sooner (Field et al., 2006).

String musicians who started playing before age 12 have larger and more complex neural circuits controlling the note-making left-hand fingers than do string musicians whose training started later (Elbert et al., 1995).

Both nature and nurture sculpt our synapses. After brain maturation provides us with an abundance of neural connections, our experiences trigger a *pruning process*. Sights and smells, touches and tugs activate connections and strengthen them. Unused neural pathways weaken and degenerate. Similar to pathways through a forest, popular paths are broadened and less-traveled paths gradually disappear. The result by puberty is a massive loss of unemployed connections.

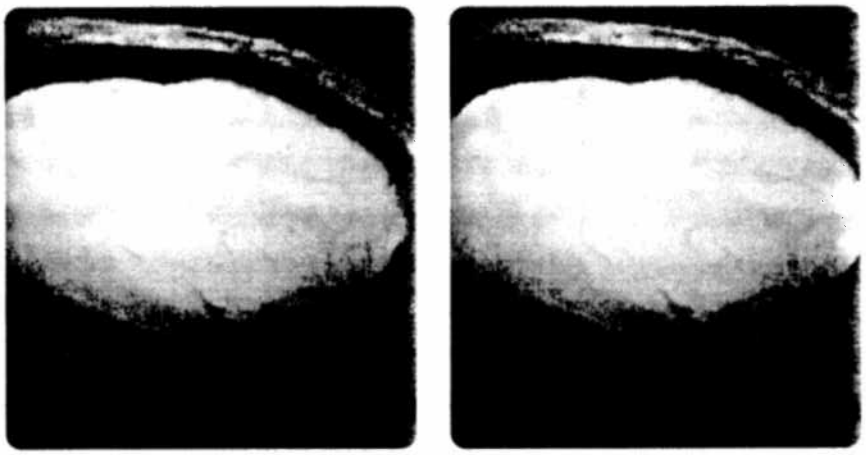
Here at the juncture of nurture and nature is the biological reality of early childhood learning. During early childhood—while excess connections are still on call—youngsters can most easily master such skills as the grammar and accent of another language. Lacking any exposure to language before adolescence, a person will never master any language (see Chapter 9).

Likewise, lacking visual experience during the early years, people whose vision is restored by cataract removal never achieve normal perceptions (see Chapter 6). The brain cells normally assigned to vision have died or been diverted to other uses. For us to have optimum brain development, normal stimulation during the early years is critical. The maturing brain's rule: Use it or lose it.

"Genes and experiences are just two ways of doing the same thing—wiring synapses."

Joseph LeDoux, *The Synaptic Self*, 2002

The brain's development does not, however, end with childhood. As we saw in Chapter 2's discussion of brain plasticity, our neural tissue is ever changing. If a monkey is trained to push a lever with a finger several thousand times a day, the brain tissue controlling that finger will change to reflect the experience. Human brains work similarly (**FIGURE 4.5**). Whether learning to keyboard or skateboard, we perform with increasing skill as our brain incorporates the learning.



Both photos courtesy of Avi Karni and Leslie Ungerleider, National Institute of Mental Health

FIGURE 4.5
A trained brain. A well-learned finger-tapping task activates more motor cortex neurons (orange area, right) than were active in the same brain before training (left). (From Karni et al., 1998.)

How Much Credit (or Blame) Do Parents Deserve?

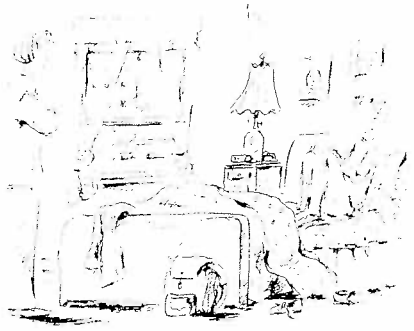
In procreation, a woman and a man shuffle their gene decks and deal a life-forming hand to their child-to-be, who is then subjected to countless influences beyond their control. Parents, nonetheless, feel enormous satisfaction in their children's successes, and feel guilt or shame over their failures. They beam over the child who wins an award. They wonder where they went wrong with the child who is repeatedly called into the principal's office. Freudian psychiatry and psychology have been among the sources of such ideas, by blaming problems from asthma to schizophrenia on "bad mothering." Society reinforces such parent-blaming: Believing that parents shape their offspring as a potter molds clay, people readily praise parents for their children's virtues and blame them for their children's vices. Popular culture endlessly proclaims the psychological harm toxic parents inflict on their fragile children. No wonder that it can seem risky to have and raise children.

Even among chimpanzees, when one infant is hurt by another, the victim's mother will often attack the offender's mother (Goodall, 1968).

But do parents really produce future adults with an inner wounded child by being (take your pick from the toxic-parent lists) overbearing—or uninvolved? Pushy—or ineffectual? Overprotective—or distant? Are children really so easily wounded? If so, should we then blame our parents for our failings, and ourselves for our children's failings? Or does all the talk of wounding fragile children through normal parental mistakes trivialize the brutality of real abuse?

Peter Neubauer and Alexander Neubauer (1990, pp. 20–21) illustrate how, with hindsight, we may inappropriately credit or blame our parents:

> Identical twin men, now age 30, were separated at birth and raised in different countries by their respective adoptive parents. Both kept their lives neat—neat to the point of pathology. Their clothes were preened, appointments met precisely on time, hands scrubbed regularly to a raw, red color. When the first was asked why he felt the need to be so clean, his answer was plain.
>
> "My mother. When I was growing up she always kept the house perfectly ordered. She insisted on every little thing returned to its proper place, the clocks—we had dozens of clocks—each set to the same noonday chime. She insisted on this, you see. I learned from her. What else could I do?"
>
> The man's identical twin, just as much a perfectionist with soap and water, explained his own behavior this way: "The reason is quite simple. I'm reacting to my mother, who was an absolute slob."



"So I blame you for everything—whose fault is that?"

Parents do matter. The power of parenting to shape our differences is clearest at the extremes. Chapter 5 will provide the sharpest examples—the abused who become

"To be frank, officer, my parents never set boundaries."

"If you want to blame your parents for your own adult problems, you are entitled to blame the genes they gave you, but you are not entitled—by any facts I know—to blame the way they treated you. . . . We are not prisoners of our past."

Martin Seligman, *What You Can Change and What You Can't*, 1994

"Men resemble the times more than they resemble their fathers."

Ancient Arab proverb

abusive, the neglected who become neglectful, the loved but firmly handled children who become self-confident and socially competent. The power of the family environment also frequently shows up in children's political attitudes, religious beliefs, and personal manners. And it appears in the remarkable academic and vocational successes of children of the refugee "boat people" fleeing Vietnam and Cambodia—successes attributed to close-knit, supportive, even demanding families (Caplan et al., 1992).

Yet in personality measures, shared environmental influences—including, as we have seen, the home influences siblings share—typically account for less than 10 percent of children's differences. In the words of behavior geneticists Robert Plomin and Denise Daniels (1987), "Two children in the same family [are on average] as different from one another as are pairs of children selected randomly from the population." To developmental psychologist Sandra Scarr (1993), this implies that "parents should be given less credit for kids who turn out great and blamed less for kids who don't." Knowing children are not easily sculpted by parental nurture, perhaps parents can relax a bit more and love their children for who they are.

Peer Influences

As children mature, what other experiences do the work of nurturing? At all ages, but especially during childhood and adolescence, we seek to fit in with groups and are subject to group influences.

Consider the power of peers (Harris, 1998, 2000):

- Preschoolers who disdain a certain food often will eat that food if put at a table with a group of children who like it.
- Children who hear English spoken with one accent at home and another in the neighborhood and at school will invariably adopt the accent of their peers, not their parents. Accents (and slang) reflect culture, "and children get their culture from their peers," notes Harris (2007).
- Teens who start smoking typically have friends who model smoking, suggest its pleasures, and offer cigarettes (J. S. Rose et al., 1999; R. J. Rose et al., 2003). Part of this peer similarity may result from a *selection effect*, as kids seek out peers with similar attitudes and interests. Those who smoke (or don't) may select as friends those who also smoke (or don't).

Howard Gardner (1998) concludes that parents and peers are complementary:

> Parents are more important when it comes to education, discipline, responsibility, orderliness, charitableness, and ways of interacting with authority figures. Peers are more important for learning cooperation, for finding the road to popularity, for inventing styles of interaction among people of the same age. Youngsters may find their peers more interesting, but they will look to their parents when contemplating their own futures. Moreover, parents [often] choose the neighborhoods and schools that supply the peers.

As Gardner points out, parents can influence the culture that shapes the peer group, by helping to select their children's neighborhood and schools. And because neighborhood influences matter, parents may want to become involved in intervention programs for youth that aim at a whole school or neighborhood. If the vapors of a toxic climate are seeping into a child's life, that climate—not just the child—needs reforming. Even so, peers are but one medium of cultural influence.

Peer power As we develop, we play, mate, and partner with peers. No wonder children and youths are so sensitive and responsive to peer influences.

Ask Yourself

To what extent, and in what ways, have your peers and your parents helped shape who you are?

Test Yourself 3

To predict whether a teenager smokes, ask how many of the teen's friends smoke. One explanation for this correlation is peer influence. What's another?

Answers to the Test Yourself Questions can be found in Appendix B at the end of the book.

"It takes a village to raise a child."

African proverb

Cultural Influences

How do cultural norms affect our behavior?

COMPARED WITH THE NARROW PATH taken by flies, fish, and foxes, the road along which environment drives us is wider. The mark of our species—nature's great gift to us—is our ability to learn and adapt. We come equipped with a huge cerebral hard drive ready to receive many gigabytes of cultural software.

Culture is the behaviors, ideas, attitudes, values, and traditions shared by a group of people and transmitted from one generation to the next (Brislin, 1988). Human nature, notes Roy Baumeister (2005), seems designed for culture. We are social animals, but more. Wolves are social animals; they live and hunt in packs. Ants are incessantly social, never alone. But "culture is a better way of being social," notes Baumeister. Wolves function pretty much as they did 10,000 years ago. You and I enjoy things unknown to most of our century-ago ancestors, including electricity, indoor plumbing, antibiotics, and the Internet. Culture works.

As we will see in Chapter 9, primates exhibit the rudiments of culture, with local customs of tool use, grooming, and courtship. Younger chimpanzees and macaque monkeys sometimes invent customs—potato washing, in one famous example—and pass them on to their peers and offspring. But human culture does more. It supports our species' survival and reproduction by enabling social and economic systems that give us an edge.

Thanks to our mastery of language, we humans enjoy the *preservation of innovation*. Within the span of this day, I have, thanks to my culture, made good use of Post-It notes, Google, and a single-shot skinny latté. On a grander scale, we have culture's accumulated knowledge to thank for the last century's 30-year extension of the average life expectancy in most countries where this book is being read. Moreover, culture enables an efficient *division of labor*. Although one lucky person gets his name on this book's cover, the product actually results from the coordination and commitment of a team of women and men, no one of whom could produce it alone.

Across cultures, we differ in our language, our monetary systems, our sports, which fork—if any—we eat with, even which side of the road we drive on. But beneath these differences is our great similarity—our capacity for culture. Culture provides the shared and transmitted customs and beliefs that enable us to communicate, to exchange money for things, to play, to eat, and to drive with agreed-upon rules and without crashing into one another. This shared capacity for culture enables our striking group differences. Human nature manifests human diversity.

If we all lived in homogeneous ethnic groups in separate regions of the world, as some people still do, cultural diversity would be less relevant. In Japan, almost

culture the enduring behaviors, ideas, attitudes, values, and traditions shared by a group of people and transmitted from one generation to the next.

99 percent of the country's 127 million people are of Japanese descent. Internal cultural differences are therefore minimal compared with those found in Los Angeles, where the public schools recently taught 82 different languages, or in Toronto or Vancouver, where minorities are one-third of the population and many are immigrants (as are 13.4 percent of all Canadians and 23 percent of Australians) (Axiss, 2007; Statistics Canada, 2002). I am ever mindful that the readers of this book are culturally diverse. You and your ancestors reach from Australia to Africa and from Singapore to Sweden.

Variation Across Cultures

We see our adaptability in cultural variations among our beliefs and our values, in how we raise our children and bury our dead, and in what we wear (or whether we wear anything at all). Riding along with a unified culture is like biking with the wind: As it carries us along, we hardly notice it is there. When we try riding *against* the wind we feel its force. Face to face with a different culture, we become aware of the cultural winds. Visiting Europe, most North Americans notice the smaller cars, the left-handed use of the fork, the uninhibited attire on the beaches. Stationed in Iraq, Afghanistan, and Kuwait, American and European soldiers alike realized how liberal their home cultures were. Arriving in North America, visitors from Japan and India struggle to understand why so many people wear their dirty *street* shoes in the house.

Each cultural group evolves its own **norms**—rules for accepted and expected behavior. Many South Asians, for example, use only the right hand's fingers for eating. The British have a norm for orderly waiting in line. Sometimes social expectations seem oppressive: "Why should it matter how I dress?" Yet, norms grease the social machinery and free us from self-preoccupation. Knowing when to clap or bow, which fork to pick up first at a dinner party, and what sorts of gestures and compliments are appropriate—whether to greet people by shaking hands or kissing each cheek, for example—we can relax and enjoy one another without fear of embarrassment or insult.

When cultures collide, their differing norms often befuddle. For example, if someone invades our **personal space**—the portable buffer zone we like to maintain around our bodies—we feel uncomfortable. Scandinavians, North Americans, and the British have traditionally preferred more personal space than do Latin Americans, Arabs, and the French (Sommer, 1969). At a social gathering, a Mexican seeking a comfortable conversation distance may end up walking around a room with a backpedaling Canadian. (You can experience this at a party by playing Space Invader as you talk with someone.) To the Canadian, the Mexican may seem intrusive; to the Mexican, the Canadian may seem standoffish.

Culture clash Behavior seen as appropriate in one culture may violate the norms of another group. In Arab societies, but not in Western cultures, men often greet one another with a kiss.

Cultures also vary in their expressiveness. Those with roots in northern European culture have perceived people from Mediterranean cultures as warm and charming but inefficient. The Mediterraneans, in turn, have seen northern Europeans as efficient but cold and preoccupied with punctuality (Triandis, 1981).

Cultures vary in their pace of life, too. People from time-conscious Japan—where bank clocks keep exact time, pedestrians walk briskly, and postal clerks fill requests speedily—may find themselves growing impatient when visiting Indonesia, where clocks keep less accurate time and the pace of life is more leisurely (Levine & Norenzayan, 1999). In adjusting to their host countries, the first wave of U.S. Peace Corps volunteers reported that two of their greatest culture shocks, after the language differences, were the differing pace of life and the people's differing sense of punctuality (Spradley & Phillips, 1972).

Variation Over Time

Consider, too, how rapidly cultures may change over time. English poet Geoffrey Chaucer (1342–1400) is separated from a modern Briton by only 20 generations, but the two would converse with great difficulty. In the thin slice of history since 1960, most Western cultures have changed with remarkable speed. Middle-class people fly to places they once only read about, e-mail those they once snail-mailed, and work in air-conditioned comfort where they once sweltered. They enjoy the convenience of online shopping, anywhere-anytime electronic communication, and—enriched by doubled per-person real income—eating out more than twice as often as did their parents back in the culture of 1960. With greater economic independence, today's women are more likely to marry for love and less likely to endure abusive relationships out of economic need. Many minority groups enjoy expanded human rights.

But some changes seem not so wonderfully positive. Had you fallen asleep in the United States in 1960 and awakened today, you would open your eyes to a culture with more divorce, delinquency, and depression. You would also find North Americans—like their counterparts in Britain, Australia, and New Zealand—spending more hours at work, fewer hours sleeping, and fewer hours with friends and family (Frank, 1999; Putnam, 2000).

Whether we love or loathe these changes, we cannot fail to be impressed by their breathtaking speed. And we cannot explain them by changes in the human gene pool, which evolves far too slowly to account for high-speed cultural transformations. Cultures vary. Cultures change. And cultures shape our lives.

Culture and the Self

How do individualist and collectivist cultural influences affect people?

Cultures vary in the extent to which they give priority to the nurturing and expression of personal identity or group identity. To grasp the difference, imagine that someone were to rip away your social connections, making you a solitary refugee in a foreign land. How much of your identity would remain intact? The answer would depend in large part on whether you give greater priority to the independent self that marks **individualism** or to the interdependent self that marks **collectivism.**

norm an understood rule for accepted and expected behavior. Norms prescribe "proper" behavior.

personal space the buffer zone we like to maintain around our bodies.

individualism giving priority to one's own goals over group goals and defining one's identity in terms of personal attributes rather than group identifications.

collectivism giving priority to goals of one's group (often one's extended family or work group) and defining one's identity accordingly.

Uniform requirements? People in individualist Western cultures sometimes see traditional Japanese culture as confining. But from the Japanese perspective, the same tradition expresses a "serenity that comes to people who know exactly what to expect from each other" (Weisz et al., 1984).

AP Photo/Xinhua Chenxie

This young man is helping a fellow student who became trapped in the rubble that was their school after a devastating earthquake shook China in 2008. By identifying strongly with family and other groups, Chinese people tend to have a collectivist sense of "we" and an accompanying support network of care, which may have helped them struggle through the aftermath of this disaster.

"One needs to cultivate the spirit of sacrificing the *little me* to achieve the benefits of the *big me*."

Chinese saying

If as our solitary traveler you pride yourself on your individualism, a great deal of your identity would remain intact—the very core of your being, the sense of "me," the awareness of your personal convictions and values. Individualists (often people from North America, Western Europe, Australia, or New Zealand) give relatively greater priority to personal goals and define their identity mostly in terms of personal attributes (Schimmack et al., 2005). They strive for personal control and individual achievement. In American culture, with its relatively big "I" and small "we," 85 percent of people say it is possible "to pretty much be who you want to be" (Sampson, 2000).

Individualists share the human need to belong. They join groups. But they are less focused on group harmony and doing their duty to the group (Brewer & Chen, 2007). Being more self-contained, individualists also move in and out of social groups more easily. They feel relatively free to switch places of worship, leave one job for another, or even leave their extended families and migrate to a new place. Marriage is often for as long as they both shall love.

If set adrift in a foreign land as a collectivist, you might experience a greater loss of identity. Cut off from family, groups, and loyal friends, you would lose the connections that have defined who you are. In a collectivist culture, group identifications provide a sense of belonging, a set of values, a network of caring individuals, an assurance of security. In return, collectivists have deeper, more stable attachments to their groups, often their family, clan, or company. In Korea, for example, people place less value on expressing a consistent, unique self-concept, and more on tradition and shared practices (Choi & Choi, 2002).

Valuing communal solidarity, people in collectivist cultures place a premium on preserving group spirit and making sure others never lose face. What people say reflects not only what they feel (their inner attitudes) but what they presume others feel (Kashima et al., 1992). Avoiding direct confrontation, blunt honesty, and uncomfortable topics, people often defer to others' wishes and display a polite, self-effacing humility (Markus & Kitayama, 1991). In new groups, they may be shy and more easily embarrassed than their individualist counterparts (Singelis et al., 1995, 1999). Compared with Westerners, people in Japanese and Chinese cultures, for example, exhibit greater shyness toward strangers and greater concern for social harmony and loyalty (Bond, 1988; Cheek & Melchior, 1990; Triandis, 1994). Elders and superiors receive respect, and duty to family may trump personal career preferences. When the priority is "we," not "me," that individualized latté—"decaf, single shot, skinny, extra hot"—that feels so good to a North American in a coffee shop might sound more like a selfish demand in Seoul (Kim & Markus, 1999).

To be sure, there is diversity within cultures. Even in the most individualistic countries, some people manifest collectivist values. And there are regional differences within cultures, such as the spirit of individualism in Japan's "northern frontier" island of Hokkaido (Kitayama et al., 2006). But in general, people (especially men) in competitive, individualist cultures have more personal freedom, are less geographically bound to their families, enjoy more privacy, and take more pride in personal achievements (**TABLE 4.1**). During the 2000 and 2002 Olympic games, U.S. gold medal winners and the U.S. media covering them attributed the achievements mostly to the athletes themselves (Markus et al., 2006). "I think I just stayed focused," explained swimming gold medalist Misty Hyman. "It was time to show the world what I could do. I am just glad I was able to do it." Japan's gold medalist in the women's marathon, Naoko Takahashi, had a different explanation: "Here is the best coach in the world, the best manager in the world, and all of the people who support me—all of these things were getting together and became a gold medal." Even when describing friends, Westerners tend to use trait-describing adjectives ("she is helpful"), whereas East Asians more often use verbs that describe behaviors in context ("she helps her friends") (Maass et al., 2006).

TABLE 4.1

Value Contrasts Between Individualistic and Collectivist Cultures

Concept	Individualism	Collectivism
Self	Independent (identity from individual traits)	Interdependent (identity from belonging)
Life task	Discover and express one's uniqueness	Maintain connections, fit in, perform role
What matters	Me—personal achievement and fulfillment; rights and liberties; self-esteem	Us—group goals and solidarity; social responsibilities and relationships; family duty
Coping method	Change reality	Accommodate to reality
Morality	Defined by individuals (self-based)	Defined by social networks (duty-based)
Relationships	Many, often temporary or casual; confrontation acceptable	Few, close and enduring; harmony valued
Attributing behavior	Behavior reflects one's personality and attitudes	Behavior reflects social norms and roles

Sources: Adapted from Thomas Schoeneman (1994) and Harry Triandis (1994).

Individualism's benefits can come at the cost of more loneliness, more divorce, more homicide, and more stress-related disease (Popenoe, 1993; Triandis et al., 1988). People in individualist cultures demand more romance and personal fulfillment in marriage, subjecting the relationship to more pressure (Dion & Dion, 1993). In one survey, "keeping romance alive" was rated as important to a good marriage by 78 percent of U.S. women but only 29 percent of Japanese women (*American Enterprise,* 1992). In China, love songs often express enduring commitment and friendship (Rothbaum & Tsang, 1998). As one song put it, "We will be together from now on . . . I will never change from now to forever."

Culture and Child-Rearing

Child-rearing practices reflect cultural values that vary across time and place. Do you prefer children who are independent or children who comply? If you live in a Westernized culture, the odds are you prefer independence. "You are responsible for yourself," Western families and schools tell their children. "Follow your conscience. Be true to yourself. Discover your gifts. Think through your personal needs." A half-century and more ago, Western cultural values placed greater priority on obedience, respect, and sensitivity to others (Alwin, 1990; Remley, 1988). "Be true to your traditions," parents then taught their children. "Be loyal to your heritage and country. Show respect toward your parents and other superiors." Cultures can change.

Many Asians and Africans live in cultures that value emotional closeness. Rather than being given their own bedrooms and entrusted to day care, infants and toddlers may sleep with their mothers and spend their days close to a family member (Morelli et al., 1992; Whiting & Edwards, 1988). These cultures encourage a strong sense of *family self*—a feeling that what shames the child shames the family, and what brings honor to the family brings honor to the self.

Children across place and time have thrived under various child-rearing systems. Upper-class British parents traditionally handed off routine caregiving to nannies, then sent their children off to boarding school at about age 10. These children generally grew up to be pillars of British society, just like their parents and their boarding-school peers. In the African Gusii society, babies nurse freely but spend most of the day on their mother's back—with lots of body contact but little face-to-face and language interaction. When the mother becomes pregnant, the

Cultures vary In Scotland's Orkney Islands' town of Stromness, social trust has enabled parents to park their toddlers outside of shops.

José Luis Pelaez, Inc./Corbis

Parents in every culture facilitate their children's discovery of their world, but cultures differ in what they deem important. Asian cultures place more emphasis on school and hard work than do North American cultures. This may help explain why Japanese and Taiwanese children get higher scores on mathematics achievement tests.

toddler is weaned and handed over to someone else, often an older sibling. Westerners may wonder about the negative effects of this lack of verbal interaction, but then the African Gusii would in turn wonder about Western mothers pushing their babies around in strollers and leaving them in playpens and car seats (Small, 1997). Such diversity in child-rearing cautions us against presuming that our culture's way is the only way to rear children successfully.

Mindful of how others differ from us, we often fail to notice the similarities predisposed by our shared biology. One 49-country study revealed that nation-to-nation differences in personality traits such as conscientiousness and extraversion are smaller than most people suppose (Terracciano et al., 2006). Australians see themselves as outgoing, German-speaking Swiss see themselves as conscientious, and Canadians see themselves as agreeable. Actually, these national stereotypes exaggerate differences that, although real, are modest. Compared with the person-to-person differences within groups, the differences between groups are small. Regardless of our culture, we humans are more alike than different. We share the same life cycle. We speak to our infants in similar ways and respond similarly to their coos and cries (Bornstein et al., 1992a,b). All over the world, the children of warm and supportive parents feel better about themselves and are less hostile than are the children of punitive and rejecting parents (Rohner, 1986; Scott et al., 1991).

Even differences *within* a culture, such as those sometimes attributed to race, are often easily explained by an interaction between our biology and our culture. David Rowe and his colleagues (1994, 1995) illustrate this with an analogy: Black men tend to have higher blood pressure than White men. Suppose that (1) in both groups salt consumption correlates with blood pressure, and (2) salt consumption is higher among Black men than among White men. The blood pressure "race difference" might then actually be, at least partly, a *diet* difference—a cultural preference for certain foods.

And that, say Rowe and his colleagues, parallels psychological findings. Although Latino, Asian, Black, White, and Native Americans differ in school achievement and delinquency, the differences are "no more than skin deep." To the extent that family structure, peer influences, and parental education predict behavior in one of these ethnic groups, they do so for the others as well.

"When someone has discovered why men in Bond Street wear black hats he will at the same moment have discovered why men in Timbuctoo wear red feathers."

G. K. Chesterton, *Heretics*, 1908

So as members of different ethnic and cultural groups, we may differ in surface ways, but as members of one species we seem subject to the same psychological forces. Our languages vary, yet they reflect universal principles of grammar (Chapter 9). Our tastes vary, yet they reflect common principles of hunger (Chapter 11). Our social behaviors vary, yet they reflect pervasive principles of human influence (Chapter 16). Cross-cultural research can help us appreciate both our cultural diversity *and* our human likeness.

Ask Yourself

Which concept best describes you—collectivist or individualist? Do you fit completely in either category, or are you sometimes a collectivist and sometimes an individualist?

Test Yourself 4

How do individualist and collectivist cultures differ?

Answers to the Test Yourself Questions can be found in Appendix B at the end of the book

Gender Development

AS WE WILL SEE IN CHAPTER 9, WE humans share an irresistible urge to organize our worlds into simple categories. Among the ways we classify people—as tall or short, fat or slim, smart or dull—one stands out: At your birth, everyone wanted to know, "Boy or girl?" Our biological sex in turn helps define our *gender*, the biological and social characteristics by which people define male or female. In considering how nature and nurture together create social diversity, gender is the prime case example. Earlier we considered one significant gender difference—in sexual interests and behaviors. Let's recap this chapter's theme—that nature and nurture together create our differences and commonalities—by considering other gender variations.

Gender Similarities and Differences

What are some ways in which males and females tend to be alike and to differ?

Having faced similar adaptive challenges, we are in most ways alike. Men and women are not from different planets—Mars and Venus—but from the same planet Earth. Tell me whether you are male or female and you give me virtually no clues to your vocabulary, intelligence, and happiness, or to the mechanisms by which you see, hear, learn, and remember. Your "opposite" sex is, in reality, your very similar sex. And should we be surprised? Among your 46 chromosomes, 45 are unisex.

But males and females also differ, and differences command attention. Some much talked-about differences are actually quite modest, as Janet Hyde (2005) illustrated by graphically representing the gender difference in self-esteem scores, across many studies (**FIGURE 4.6**). Some differences are more striking. Compared with the average man, the average woman enters puberty two years sooner, lives five years longer, carries 70 percent more fat, has 40 percent less muscle, and is 5 inches shorter. Other gender differences appear throughout this book. Women can become sexually re-aroused immediately after orgasm. They smell fainter odors, express emotions more freely, and are offered help more often. They are doubly vulnerable to depression and anxiety, and their risk of developing eating disorders is 10 times greater. But, then men are some 4 times more likely to commit suicide or suffer alcohol dependence. They are far more often diagnosed with autism, color-blindness,

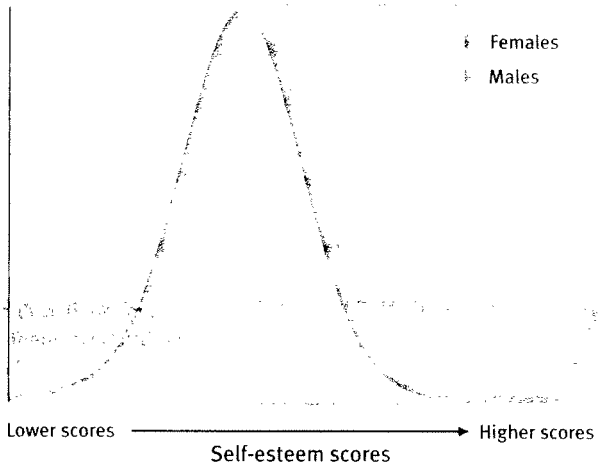


FIGURE 4.6

Much ado about a small difference Janet Hyde (2005) shows us two normal distributions that differ by the approximate magnitude (0.21 standard deviations) of the gender difference in self-esteem, averaged over all available samples. Moreover, though we can identify gender differences, the variation among individual women and among individual men greatly exceeds the difference between the average woman and man.

aggression physical or verbal behavior intended to hurt someone.

attention-deficit hyperactivity disorder (as children), and antisocial personality disorder (as adults). Choose your gender and pick your vulnerability.

How much does biology bend the genders? What portion of our differences are socially constructed—by the gender roles our culture assigns us, and by how we are socialized as children? To answer those questions, let's look more closely at some average gender differences in aggression, social power, and social connectedness.

Gender and Aggression

In surveys, men admit to more **aggression** than do women, and experiments confirm that men tend to behave more aggressively, such as by administering what they believe are more painful electric shocks (Bettencourt & Kernahan, 1997). The aggression gender gap pertains to *physical* aggression (such as hitting) rather than verbal, *relational* aggression (such as excluding someone). The gender gap in physical aggression appears in everyday life at various ages and in various cultures, especially those with gender inequality (Archer, 2004, 2006). In dating relationships, violent acts (such as slaps and thrown objects) are often mutual (Straus, 2008). Violent crime rates more strikingly illustrate the gender difference. The male-to-female arrest ratio for murder, for example, is 10 to 1 in the United States and almost 7 to 1 in Canada (FBI, 2007; Statistics Canada, 2007).

Throughout the world, hunting, fighting, and warring are primarily men's activities (Wood & Eagly, 2002, 2007). Men also express more support for war. The Iraq war, for example, has consistently been supported more by American men than by American women (Newport et al., 2007).

Gender and Social Power

Around the world, from Nigeria to New Zealand, people have perceived men as more dominant, forceful, and independent, women as more deferential, nurturant, and affiliative (Williams & Best, 1990). Indeed, in most societies men *are* socially dominant. When groups form, whether as juries or companies, leadership tends to go to males (Colarelli et al., 2006). Men worldwide place more importance on power and achievement (Schwartz & Rubel, 2005). As leaders, men tend to be more directive, even autocratic; women tend to be more democratic, more welcoming of subordinates' participation in decision making (Eagly & Carli, 2007; van Engen & Willemsen, 2004). When people interact, men are more likely to utter opinions, women to express support (Aries, 1987; Wood, 1987). These differences carry into everyday behavior, where men are more likely to act as powerful people often do—talking assertively, interrupting, initiating touches, staring more, and smiling less (Hall, 1987; Leaper & Ayres, 2007; Major et al., 1990).

Such behaviors help sustain social power inequities. When political leaders are elected, they usually are men, who held 82 percent of the seats in the world's governing parliaments in 2008 (IPU, 2008). When salaries are paid, those in traditionally male occupations receive more.

Gender and Social Connectedness

To Carol Gilligan and her colleagues (1982, 1990), the "normal" struggle to create a separate identity describes Western individualist males more than relationship-oriented females. Gilligan believes females tend to differ from males both in being less concerned with viewing themselves as separate individuals and in being more concerned with "making connections."

These gender differences in connectedness surface early in children's play, and they continue with age. Boys typically play in large groups with an activity focus and little intimate discussion (Rose & Rudolph, 2006). Girls usually play in smaller

Oliver Ehlinger/ zefa/ Corbis

Dex Image/Getty Images

Even men [illegible] tend and befriend. Gender differences in the way we interact with others begin to appear at a very young age.

groups, often with one friend. Their play is less competitive than boys' and more imitative of social relationships. Both in play and other settings, females are more open and responsive to feedback than are males (Maccoby, 1990; Roberts, 1991). Asked difficult questions—"Do you have any idea why the sky is blue?" "Do you have any idea why shorter people live longer?"—men are more likely than women to hazard answers rather than admit they don't know, a phenomenon Traci Giuliano and her colleagues (1998a,b) call the *male answer syndrome*.

Question: Why does it take 200 million sperm to fertilize one egg? *Answer:* Because they won't stop for directions.

Females are more *interdependent* than males. As teens, girls spend more time with friends and less time alone (Wong & Csikszentmihalyi, 1991). As late adolescents, they spend more time on social-networking Internet sites (Pryor et al., 2007). As adults, women take more pleasure in talking face-to-face, and they tend to use conversation more to explore relationships. Men enjoy doing activities side-by-side, and they tend to use conversation to communicate solutions (Tannen, 1990; Wright, 1989). The communication difference is apparent even in student e-mails, from which people in one New Zealand study could correctly guess the author's gender two-thirds of the time (Thomson & Murachver, 2001).

These gender differences are sometimes reflected in patterns of phone communication. In France, women make 63 percent of phone calls and, when talking to a woman, stay connected longer (7.2 minutes) than men do when talking to other men (4.6 minutes) (Smoreda & Licoppe, 2000). So, does this confirm the idea that women are just more talkative? To check that presumption, Matthias Mehl and his colleagues (2007) counted the number of words 396 college students spoke in the course of an average day. (How many words would you guess you speak a day?) They found that talkativeness varied enormously—by 45,000 words between their most and least talkative participants. But contrary to stereotypes of jabbering women, both men and women averaged about 16,000 words daily.

Women worldwide orient their interests and vocation more to people and less to things (Lippa, 2005, 2006; 2008). In the workplace, they often are less driven by money and status and are more likely to choose reduced work hours (Pinker, 2008). In the home, they provide most of the care to the very young and the very old. Women also purchase 85 percent of greeting cards (Time, 1997). Women's emphasis on caring helps explain another interesting finding: Although 69 percent of people say they have a close relationship with their father, 90 percent feel close to their mother (Hugick, 1989). When wanting understanding and someone with whom to share worries and hurts, both men and women usually turn to women, and both report their friendships with women to be more intimate, enjoyable, and nurturing (Rubin, 1985; Sapadin, 1988).

Bonds and feelings of support are even stronger among women than among men (Rossi & Rossi, 1993). Women's ties—as mothers, daughters, sisters, aunts, and grandmothers—bind families together. As friends, women talk more often and more openly (Berndt, 1992; Dindia & Allen, 1992). And when they themselves must cope with stress, women more than men turn to others for support—they *tend and befriend* (Tamres et al., 2002; Taylor, 2002).

As empowered people generally do, men value freedom and self-reliance, which helps explain why men of all ages, worldwide, are less religious and pray less (Benson, 1992; Stark, 2002). Men also dominate the ranks of professional skeptics. All 10 winners and 14 runners-up on the *Skeptical Inquirer* list of outstanding twentieth-century rationalist skeptics were men. In the Science and the Paranormal section of the 2007 Prometheus Books catalog (from the leading publisher of skepticism), one can find 94 male and 4 female authors. In one Skeptics Society survey, nearly 4 in 5 respondents were men (Shermer, 1999). Women, it appears, are more open to spirituality (and are far more likely to author books on spirituality than on skepticism).

Gender differences in power, connectedness, and other traits peak in late adolescence and early adulthood—the very years most commonly studied (also the years of dating and mating). As teenagers, girls become progressively less assertive and more flirtatious; boys become more domineering and unexpressive. But by age 50, these differences have diminished. Men become more empathic and less domineering and women, especially if working, become more assertive and self-confident (Kasen et al., 2006; Maccoby, 1998).

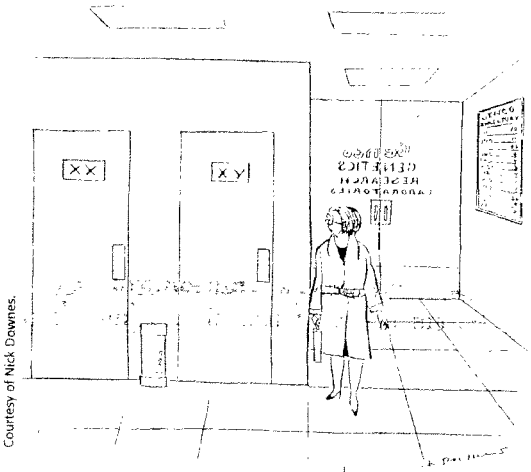
"In the long years liker must they grow; The man be more of woman, she of man."

Alfred Lord Tennyson, *The Princess*, 1847

How do nature and nurture together form our gender?

What explains our gender diversity? Is biology destiny? Are we shaped by our cultures? A biopsychosocial view suggests it is both, thanks to the interplay among our biological dispositions, our developmental experiences, and our current situations (Wood & Eagly, 2002, 2007).

In domains where men and women have faced similar challenges—regulating heat with sweat, developing tastes that nourish, growing calluses where the skin meets friction—the sexes are similar. Even when describing the ideal mate, both men and women put traits such as "kind," "honest," and "intelligent" at the top of their lists. But in domains pertinent to mating, evolutionary psychologists contend, guys act like guys whether they are elephants or elephant seals, rural peasants or corporate presidents. Such gender differences may be influenced genetically, by our differing *sex chromosomes* and, physiologically, from our differing concentrations of *sex hormones*.



Courtesy of Nick Downes.

Males and females are variations on a single form. Seven weeks after conception, you were anatomically indistinguishable from someone of the other sex. Then your genes activated your biological sex, which was determined by your twenty-third pair of chromosomes, the two sex chromosomes. From your mother, you received an **X chromosome.** From your father, you received the one chromosome out of 46 that is not unisex—either another X chromosome, making you a girl, or a **Y chromosome,** making you a boy. The Y chromosome includes a single gene that throws a master switch triggering the testes to develop and produce the principal male hormone, **testosterone.** Females also have testosterone, but less of it. The male's greater output of testosterone starts the development of external male sex organs at about the seventh week.

Another key period for sexual differentiation falls during the fourth and fifth prenatal months, when sex hormones bathe the fetal brain and influence its wiring. Different patterns for males and females develop under the influence of the male's greater testosterone and the female's ovarian hormones (Hines, 2004; Udry, 2000). Recent research confirms male-female differences during development in brain areas with abundant sex hormone receptors (Cahill, 2005). In adulthood, parts of the frontal lobes, an area involved in verbal fluency, are reportedly thicker in women. Part of the parietal cortex, a key area for space perception, is thicker in men. Other studies report gender differences in the hippocampus, the amygdala, and the volume of brain *gray matter* (the neural bodies) versus *white matter* (the axons and dendrites).

Given sex hormones' influence on development, what do you suppose happens when glandular malfunction or hormone injections expose a female embryo to excess testosterone? These genetically female infants are born with masculine-appearing genitals, which can either be accepted or altered surgically. Until puberty, such females tend to act in more aggressive "tomboyish" ways than do most girls, and they dress and play in ways more typical of boys than of girls (Berenbaum & Hines, 1992; Ehrhardt, 1987). Given a choice of toys, they (like boys) are more likely to play with cars and guns than with dolls and crayons. Some develop into lesbians, but most—like nearly all girls with traditionally feminine interests—become heterosexual. Moreover, the hormones do not reverse their gender identity; they view themselves as girls, not boys (Berenbaum & Bailey, 2003).

Is the tomboyish behavior of these girls due to the prenatal hormones? If so, may we conclude that biological sex differences produce behavioral gender differences? Vervet monkeys seem to suggest one answer. Male vervets, like most little boys, will spend more time playing with "masculine" toys such as trucks, and female vervets, like most little girls, will choose "feminine" toys such as dolls (Hines, 2004). Moreover, experiments with many species, from rats to monkeys, confirm that female embryos given male hormones will later exhibit a typically masculine appearance and more aggressive behavior (Hines & Green, 1991). But a more complex picture emerges when we consider social influences. Girls who were prenatally exposed to excess testosterone frequently look masculine and are known to be "different," so perhaps people also treat them more like boys. Thus, the effect of early exposure to sex hormones is both direct, in the girl's biological appearance, and indirect, in the influence of social experiences that shape her. Like a sculptor's two hands shaping a lump of clay, nature and nurture work together.

Further evidence of biology's influence on gender development comes from studies of genetic males who, despite normal male hormones and testes, are born without penises or with very small ones. In one study of 14 who underwent early sex-reassignment surgery (which is now controversial) and were raised as girls, 6 later declared themselves as males, 5 were living as females, and 3 had an unclear sexual identity (Reiner & Gearhart, 2004). In one famous case, the parents of a Canadian boy who lost his penis to a botched circumcision followed advice to raise him as a girl rather than as a damaged boy. Alas, "Brenda" Reimer was not like most other girls. "She" didn't like dolls. She tore her dresses with rough-and-tumble play. At puberty she wanted no part of kissing boys. Finally, Brenda's parents explained what had happened, whereupon this young person immediately rejected the assigned female identity, got a haircut, and chose a male name, David. He ended up marrying a woman, becoming a stepfather, and, sadly, later committing suicide (Colapinto, 2000).

"Sex matters," concludes the National Academy of Sciences (2001). In combination with the environment, sex-related genes and physiology "result in behavioral and cognitive differences between males and females."

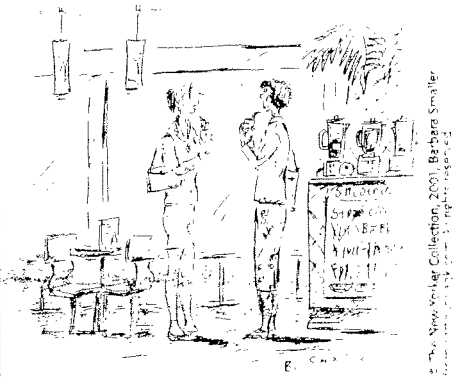
X chromosome the sex chromosome found in both men and women. Females have two X chromosomes; males have one. An X chromosome from each parent produces a female child.

Y chromosome the sex chromosome found only in males. When paired with an X chromosome from the mother, it produces a male child.

testosterone the most important of the male sex hormones. Both males and females have it, but the additional testosterone in males stimulates the growth of the male sex organs in the fetus and the development of the male sex characteristics during puberty.

"Genes, by themselves, are like seeds dropped onto pavement: powerless to produce anything."

Primatologist Frans B. M. de Waal (1999)



"Sex brought us together, but gender drove us apart."

The Nurture of Gender

Although biologically influenced, gender is also socially constructed. What biology initiates, culture accentuates.

Gender Roles

Sex indeed matters. But from a biopsychosocial perspective, culture and the immediate situation matter, too. *Culture,* as we noted earlier, is everything shared by a group and transmitted across generations. We can see culture's shaping power in the social expectations that guide men's and women's behavior. In psychology, as in the theater, a **role** refers to a cluster of prescribed actions—the behaviors we expect of those who occupy a particular social position. One set of norms defines our culture's **gender roles**—our expectations about the way men and women should behave. In the United States 30 years ago, it was standard for men to initiate dates, drive the car, and pick up the check, and for women to decorate the home, buy and care for the children's clothes, and select the wedding gifts.

Gender roles exist outside the home, too. Compared with employed women, employed men in the United States spend about an hour and a half more on the job each day and about one hour less on household activities and caregiving (Amato et al., 2007; Bureau of Labor Statistics, 2004; Fisher et al., 2006). I do not have to tell you which parent, about 90 percent of the time in two-parent U.S. families, has stayed home with a sick child, arranged for the baby-sitter, or called the doctor (Maccoby, 1995). In Australia, women devote 54 percent more time to unpaid household work and 71 percent more time to child care than do men (Trewin, 2001).

Gender roles can smooth social relations, saving awkward decisions about who does the laundry this week and who mows the lawn. But they often do so at a cost: If we deviate from such conventions, we may feel anxious.

Do gender roles reflect what is biologically natural for men and women? Or do cultures construct them? Gender-role diversity over time and space indicates that culture has a big influence. Nomadic societies of food-gathering people have only a minimal division of labor by sex. Boys and girls receive much the same upbringing. In agricultural societies, where women work in the fields close to home, and men roam more freely herding livestock, children typically socialize into more distinct gender roles (Segall et al., 1990; Van Leeuwen, 1978).

Among industrialized countries, gender roles and attitudes vary widely (UNICEF, 2006). Australia and the Scandinavian countries offer the greatest gender equity,

© DPA/The Image Works

The gendered tsunami: In Sri Lanka, Indonesia, and India, the gendered division of labor helps explain the excess of female deaths from the 2004 tsunami. In some villages, 80 percent of those killed were women, who were mostly at home while the men were more likely to be at sea fishing or doing out-of-the-home chores (Oxfam, 2005).

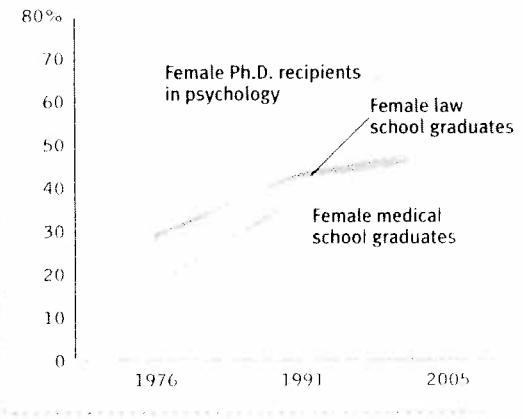


FIGURE 4.7

Women and the professions Law, medicine, and psychology have been attracting more and more women. (Data from professional associations reported by A. Cynkar, 2007.)

role a set of expectations (norms) about a social position, defining how those in the position ought to behave.

gender role a set of expected behaviors for males or for females.

gender identity our sense of being male or female.

gender typing the acquisition of a traditional masculine or feminine role.

social learning theory the theory that we learn social behavior by observing and imitating and by being rewarded or punished.

Middle Eastern and North African countries the least (Social Watch, 2006). And consider: Would you say life is more satisfying when both spouses work for pay and share child care? If so, you would agree with most people in 41 of 44 countries, according to a Pew Global Attitudes survey (2003). Even so, the culture-to-culture differences were huge, ranging from Egypt, where people disagreed 2 to 1, to Vietnam, where people agreed 11 to 1.

Attitudes about gender roles also vary over time. At the opening of the twentieth century, only one country—New Zealand—granted women the right to vote (Briscoe, 1997). By the late 1960s and early 1970s, with the flick of an apron, the number of U.S. college women hoping to be full-time homemakers had plunged. And in the three decades after 1976, the percentage of women in medical, law, and psychology programs roughly doubled (FIGURE 4.7).

Gender ideas vary not only across cultures and over time, but also across generations. When families emigrate from Asia to Canada and the United States, their children tend to grow up with peers from a new culture. Many immigrant children, especially girls, feel torn between the competing sets of gender-role norms presented by peers and parents (Dion & Dion, 2001).

Gender and Child-Rearing

As society assigns each of us to a gender, the social category of male or female, the inevitable result is our strong **gender identity,** our sense of *being* male or female. To varying extents, we also become **gender typed.** That is, some boys more than others exhibit traditionally masculine traits and interests, and some girls more than others become distinctly feminine.

Social learning theory assumes that children learn gender-linked behaviors by observing and imitating and by being rewarded or punished. "Nicole, you're such a good mommy to your dolls"; "Big boys don't cry, Alex." But parental modeling and rewarding of male-female differences aren't enough to explain gender typing (Lytton & Romney, 1991). In fact, even when their families discourage traditional gender typing, children usually organize themselves into "boy worlds" and "girl worlds," each guided by rules for what boys and girls do.

Cognition (thinking) also matters. In your own childhood, as you struggled to comprehend the world, you—like other children—formed *schemas,* or concepts that helped you make sense of your world. One of these was a schema for your own gender (Bem, 1987, 1993). Your *gender schema* then became a lens through which you viewed your experiences. Social learning shapes gender schemas. Before age 1, children begin

"How is it gendered?"

to discriminate male and female voices and faces (Martin et al., 2002). After age 2, language forces children to begin organizing their worlds on the basis of gender. English, for example, uses the pronouns *he* and *she;* other languages classify objects as masculine ("*le* train") or feminine ("*la* table").

Young children are "gender detectives," explain Carol Lynn Martin and Diane Ruble (2004). Once they grasp that two sorts of people exist—and that they are of one sort—they search for clues about gender, and they find them in language, dress, toys, and songs. Girls, they may decide, are the ones with long hair. Having divided the human world in half, 3-year-olds will then like their own sex better and seek out their own kind for play. And having compared themselves with their concept of gender, they will adjust their behavior accordingly ("I am male—thus, masculine, strong, aggressive," or "I am female—therefore, feminine, sweet, and helpful"). The rigidity of boy-girl stereotypes peaks at about age 5 or 6. If the new neighbor is a boy, a 6-year-old girl may just assume he cannot share her interests. For young children, gender looms large.

BEFORE YOU MOVE ON

ASK YOURSELF

Do you consider yourself strongly gender typed or *not* strongly gender typed? What factors do you think have contributed to your feelings of masculinity or femininity?

TEST YOURSELF 5

What are gender roles, and what do their variations tell us about our human capacity for learning and adaptation?

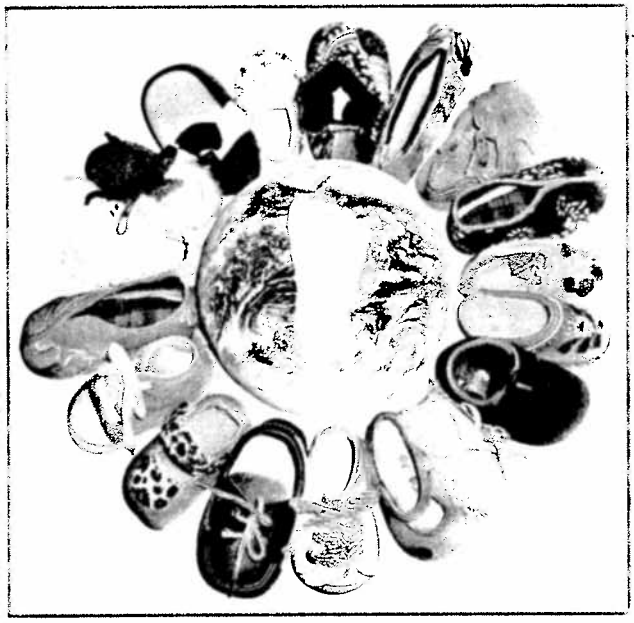
Answers to the Test Yourself Questions can be found in Appendix B at the end of the book.

Reflections on Nature and Nurture

"THERE ARE TRIVIAL TRUTHS AND GREAT truths," reflected the physicist Niels Bohr on some of the paradoxes of modern science. "The opposite of a trivial truth is plainly false. The opposite of a great truth is also true." It appears true that our ancestral history helped form us as a species. Where there is variation, natural selection, and heredity, there will be evolution. The unique gene combination created when our mother's egg engulfed our father's sperm predisposed both our shared humanity and our individual differences. This is a great truth about human nature. Genes form us.

But it also is true that our experiences form us. In our families and in our peer relationships, we learn ways of thinking and acting. Differences initiated by our nature may be amplified by our nurture. If their genes and hormones predispose males to be more physically aggressive than females, culture may magnify this gender difference through norms that encourage males to be macho and females to be the kinder, gentler sex. If men are encouraged toward roles that demand physical power, and women toward more nurturing roles, each may then exhibit the actions expected of those who fill such roles and find themselves shaped accordingly. Roles remake their players. Presidents in time become more presidential, servants more servile. Gender roles similarly shape us.

But gender roles are converging. Brute strength has become increasingly irrelevant to power and status (think Bill Gates and Oprah Winfrey). Thus both women and men are now seen as "fully capable of effectively carrying out organizational roles at



Culture matters. As this exhibit at San Diego's Museum of Man illustrates, children learn their culture. A baby's foot can step into any culture.

all levels," note Wendy Wood and Alice Eagly (2002). And as women's employment in formerly male occupations has increased, gender differences in traditional masculinity or femininity and in what one seeks in a mate have diminished (Twenge, 1997). As the roles we play change over time, we change with them.

* * * * *

If nature and nurture jointly form us, are we "nothing but" the product of nature and nurture? Are we rigidly determined?

We *are* the product of nature and nurture (FIGURE 4.8), but we are also an open system. Genes are all-pervasive but not all-powerful; people may defy their genetic bent to reproduce, by electing celibacy. Culture, too, is all-pervasive but not all-powerful; people may defy peer pressures and do the opposite of the expected. To excuse our failings by blaming our nature and nurture is what philosopher-novelist

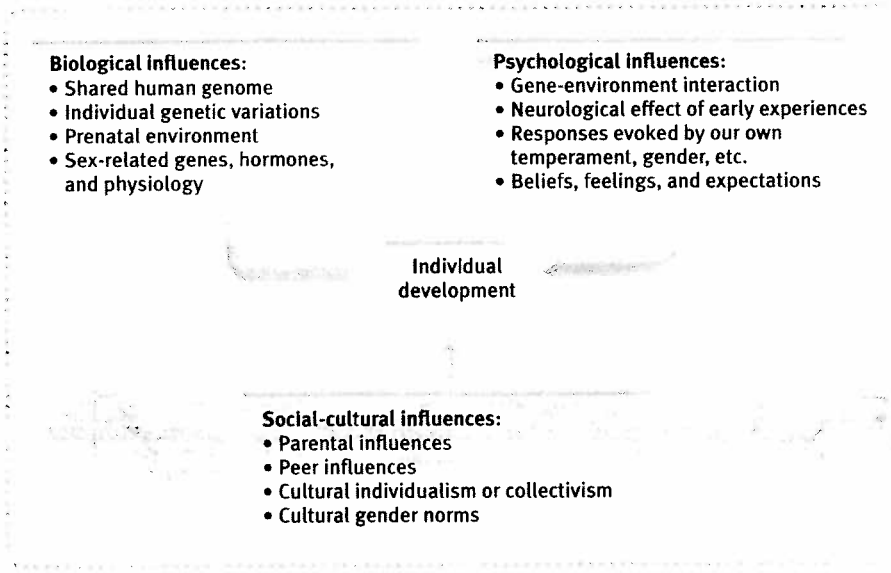


FIGURE 4.8
The biopsychosocial approach to development

Jean-Paul Sartre called "bad faith"—attributing responsibility for one's fate to bad genes or bad influences.

In reality, we are both the creatures and the creators of our worlds. We are—it is a great truth—the products of our genes and environments. Nevertheless (another great truth) the stream of causation that shapes the future runs through our present choices. Our decisions today design our environments tomorrow. Mind matters. The human environment is not like the weather—something that just happens. We are its architects. Our hopes, goals, and expectations influence our future. And that is what enables cultures to vary and to change so quickly.

* * * * *

"Let's hope that it's not true; but if it is true, let's hope that it doesn't become widely known."

Lady Ashley, commenting on Darwin's theory

I know from my mail and from public opinion surveys that some readers feel troubled by the naturalism and evolutionism of contemporary science. Readers from other nations bear with me, but in the United States there is a wide gulf between scientific and lay thinking about evolution. "The idea that human minds are the product of evolution is . . . unassailable fact," declared a 2007 editorial in *Nature*, a leading science magazine. That sentiment concurs with a 2006 statement of "evidence-based facts" about evolution jointly issued by the national science academies of 66 nations (IAP, 2006). In *The Language of God*, Human Genome Project director Francis Collins (2006, pp. 141, 146), a self-described evangelical Christian, compiles the "utterly compelling" evidence that leads him to conclude that Darwin's big idea is "unquestionably correct." Yet a 2007 Gallup survey reports that half of U.S. adults do not believe in evolution's role in "how human beings came to exist on Earth" (Newport, 2007). Many of those who dispute the scientific story worry that a science of behavior (and evolutionary science in particular) will destroy our sense of the beauty, mystery, and spiritual significance of the human creature. For those concerned, I offer some reassuring thoughts.

"Is it not stirring to understand how the world actually works—that white light is made of colors, that color measures light waves, that transparent air reflects light . . . ? It does no harm to the romance of the sunset to know a little about it."

Carl Sagan, *Skies of Other Worlds*, 1988

When Isaac Newton explained the rainbow in terms of light of differing wavelengths, the poet Keats feared that Newton had destroyed the rainbow's mysterious beauty. Yet, notes Richard Dawkins (1998) in *Unweaving the Rainbow*, Newton's analysis led to an even deeper mystery—Einstein's theory of special relativity. Moreover, nothing about Newton's optics need diminish our appreciation for the dramatic elegance of a rainbow arching across a brightening sky.

When Galileo assembled evidence that the Earth revolved around the Sun, not vice versa, he did not offer irrefutable proof for his theory. Rather, he offered a coherent explanation for a variety of observations, such as the changing shadows cast by the Moon's mountains. His explanation eventually won the day because it described and explained things in a way that made sense, that hung together. Darwin's theory of evolution likewise is a coherent view of natural history. It offers an organizing principle that unifies various observations.

Francis Collins is not the only person of faith to find the scientific idea of human origins congenial with his spirituality. In the fifth century, St. Augustine (quoted by Wilford, 1999) wrote, "The universe was brought into being in a less than fully formed state, but was gifted with the capacity to transform itself from unformed matter into a truly marvelous array of structures and life forms." Some 1600 years later, Pope John Paul II in 1996 welcomed a science-religion dialogue, finding it noteworthy that evolutionary theory "has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge."

Meanwhile, many people of science are awestruck at the emerging understanding of the universe and the human creature. It boggles the mind—the entire universe popping out of a point some 14 billion years ago, and instantly inflating to cosmological size. Had the energy of this Big Bang been the tiniest bit less, the universe would have collapsed back on itself. Had it been the tiniest bit more, the result would have

been a soup too thin to support life. Astronomer Sir Martin Rees has described *Just Six Numbers* (1999), any one of which, if changed ever so slightly, would produce a cosmos in which life could not exist. Had gravity been a tad bit stronger or weaker, or had the weight of a carbon proton been a wee bit different, our universe just wouldn't have worked.

What caused this almost-too-good-to-be-true, finely tuned universe? Why is there something rather than nothing? How did it come to be, in the words of Harvard-Smithsonian astrophysicist Owen Gingerich (1999), "so extraordinarily right, that it seemed the universe had been expressly designed to produce intelligent, sentient beings"? Is there a benevolent superintelligence behind it all? Have there instead been an infinite number of universes born and we just happen to be the lucky inhabitants of one that, by chance, was exquisitely fine-tuned to give birth to us? Or does that idea violate *Occam's razor,* the principle that we should prefer the simplest of competing explanations? On such matters, a humble, awed, scientific silence is appropriate, suggested philosopher Ludwig Wittgenstein: "Whereof one cannot speak, thereof one must be silent."

Rather than fearing science, we can welcome its enlarging our understanding and awakening our sense of awe. In *The Fragile Species,* Lewis Thomas (1992) described his utter amazement that the Earth in time gave rise to bacteria and eventually to Bach's *Mass in B-Minor.* In a short 4 billion years, life on Earth has come from nothing to structures as complex as a 6-billion-unit strand of DNA and the incomprehensible intricacy of the human brain. Atoms no different from those in a rock somehow formed dynamic entities that became conscious. Nature, says cosmologist Paul Davies (2007), seems cunningly and ingeniously devised to produce extraordinary, self-replicating, information-processing systems—us. Although we appear to have been created from dust, over eons of time, the end result is a priceless creature, one rich with potential beyond our imagining.

"The causes of life's history [cannot] resolve the riddle of life's meaning."

Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life,* 1999

BEFORE YOU MOVE ON

ASK YOURSELF

How have your heredity and your environment influenced who you are today? Can you recall an important time when you determined your own fate in a way that was at odds with pressure you felt from either your heredity or your environment?

TEST YOURSELF 6

How does the biopsychosocial approach explain our individual development?

Answers to the Test Yourself Questions can be found in Appendix B at the end of the book.

CHAPTER REVIEW

Nature, Nurture, and Human Diversity

Behavior Genetics: Predicting Individual Differences

1: What are genes, and how do behavior geneticists explain our individual differences?

Chromosomes are coils of *DNA* containing *gene* segments that, when "turned on" (expressed), code for the proteins that form our body's building blocks. Most human traits are influenced by many genes acting together. *Behavior geneticists* seek to quantify genetic and *environmental* influences on our traits. Studies of *identical twins*, *fraternal twins*, and adoptive families help specify the influence of genetic nature and of environmental nurture, and the *interaction* between them (meaning that the effect of each depends on the other). The stability of *temperament* suggests a genetic predisposition.

2: What is heritability, and how does it relate to individuals and groups?

Heritability describes the extent to which variation among members of a group can be attributed to genes. Heritable individual differences in traits such as height or intelligence need not explain group differences. Genes mostly explain why some are taller than others, but not why people today are taller than a century ago.

3: What is the promise of molecular genetics research?

Molecular geneticists study the molecular structure and function of genes. Psychologists and molecular geneticists are cooperating to identify specific genes—or more often, teams of genes—that put people at risk for disorders.

Evolutionary Psychology: Understanding Human Nature

4: How do evolutionary psychologists use natural selection to explain behavior tendencies?

Evolutionary psychologists seek to understand how *natural selection* has shaped our traits and behavior tendencies. The principle of natural selection states that variations increasing the odds of reproducing and surviving are most likely to be passed on to future generations. Some variations arise from *mutations* (random errors in gene replication), others from new gene combinations at conception. Charles Darwin, whose theory of evolution has for a long time been an organizing principle in biology, anticipated the contemporary application of evolutionary principles in psychology.

5: How might an evolutionary psychologist explain gender differences in mating preferences?

Men more than women approve of casual sex, think about sex, and misinterpret friendliness as sexual interest. Women more than men cite affection as a reason for first intercourse and have a relational view of sexual activity. Applying principles of natural selection, evolutionary psychologists reason that men's attraction to multiple healthy, fertile-appearing partners increases their chances of spreading their genes widely. Because women incubate and nurse babies, they increase their own and their children's chances of survival by searching for mates with the resources and the potential for long-term investment in their joint offspring.

6: What are the key criticisms of evolutionary psychology?

Critics argue that evolutionary psychologists start with an effect and work backward to an explanation, that the evolutionary perspective gives too little emphasis to social influences, and that the evolutionary viewpoint absolves people from taking responsibility for their sexual behavior. Evolutionary psychologists respond that understanding our predispositions can help us overcome them. They also cite the value of testable predictions based on evolutionary principles, as well as the coherence and explanatory power of those principles.

Parents and Peers

7: To what extent are our lives shaped by early stimulation, by parents, and by peers?

During maturation, a child's brain changes as neural connections increase in areas associated with stimulating activity, and unused synapses degenerate. Parents influence their children in areas such as manners and political and religious beliefs, but not in other areas, such as personality. Language and other behaviors are shaped by peer groups, as children adjust to fit in. By choosing their children's neighborhoods and schools, parents can exert some influence over peer group culture.

Cultural Influences

8: How do cultural norms affect our behavior?

Cultural *norms* are rules for accepted and expected behaviors, ideas, attitudes, and values. Across places and over time *cultures* differ in their norms. Despite such cultural variations, we humans share many common forces that influence behavior.

9: How do individualist and collectivist cultural influences affect people?

Cultures based on self-reliant *individualism*, like those of most of the United States, Canada, Australia, and Western Europe, value personal independence and individual achievement. Identity is defined in terms of self-esteem, personal goals and attributes, and personal rights and liberties. Cultures based on socially connected *collectivism*, like those of many parts of Asia and Africa, value interdependence, tradition, and harmony, and they define identity in terms of group goals and commitments and belonging to one's group. Within any culture, the degree of individualism or collectivism varies from person to person.

Gender Development

What are some ways in which males and females tend to be alike and to differ?

Human males and females are more alike than different, thanks to their similar genetic makeup. Regardless of our gender, we see, hear, learn, and remember similarly. Males and females do differ in body fat, muscle, height, age of onset of puberty, and life expectancy; in vulnerability to certain disorders; and in *aggression*, social power, and social connectedness.

How do nature and nurture together form our gender?

Biological sex is determined by the twenty-third pair of chromosomes, to which the mother contributes an *X chromosome* and the father either an X (producing a female) or a *Y chromosome* (producing a male). A Y chromosome triggers additional *testosterone* release and male sex organs. *Gender* refers to the characteristics, whether biologically or socially influenced, by which people define male and female. Sex-related genes and hormones influence gender differences in behavior, possibly by influencing brain development. We also learn *gender roles*, which vary with culture, across place and time. *Social learning theory* proposes that we learn *gender identity* as we learn other things—through reinforcement, punishment, and observation.

Terms and Concepts to Remember

behavior genetics, p. 134
environment, p. 134
chromosomes, p. 134
DNA (deoxyribonucleic acid), p. 134
genes, p. 134
genome, p. 135
identical twins, p. 135
fraternal twins, p. 135
temperament, p. 139
heritability, p. 140
interaction, p. 142
molecular genetics, p. 142
evolutionary psychology, p. 143
natural selection, p. 143
mutation, p. 144
gender, p. 146
culture, p. 153
norm, p. 154
personal space, p. 154
individualism, p. 155
collectivism, p. 155
aggression, p. 160
X chromosome, p. 162
Y chromosome, p. 162
testosterone, p. 162
role, p. 164
gender role, p. 164
gender identity, p. 165
gender typing, p. 165
social learning theory, p. 165

WEB

Multiple-choice self-tests and more may be found at www.worthpublishers.com/myers