



Figure 2.17
Human Chromosomes

Chromosomes are composed of DNA (deoxyribonucleic acid). Each human cell contains twenty-three pairs of chromosomes. The twenty-third pair determines sex. In males the twenty-third pair contains one X and one Y chromosome. In females the twenty-third pair contains two X chromosomes. As you can see, the person whose chromosomes are shown here is a male.

working in complex combinations and together with forces in the environment, ultimately determine many aspects of our biological makeup.

Most cells in the human body contain forty-six chromosomes, existing in pairs. When such cells divide, the chromosome pairs split; then, after the cells have separated, each chromosome replicates itself so that the full number is restored. This kind of cell division is known as **mitosis**. In contrast, sperm and ova—the male and female sex cells, or gametes—contain only twenty-three chromosomes. Thus, when they join to form a fertilized ovum from which a new human being will develop, the full number (forty-six) is attained. For each of us, then, half of our genetic material comes from our mother and half from our father.

These basic mechanisms explain why persons who are related resemble one another more than persons who are totally unrelated, and also why the closer the familial tie between individuals, the more similar they tend to be physically. The closer such links, the greater the proportion of chromosomes and genes family members share. And because genes determine many aspects of physical appearance, similarity increases with closeness of relationship. Thus, siblings (children of the same parents) tend to be more alike than cousins (the children of siblings). In the case of identical twins, or *monozygotic* twins, a single fertilized egg splits in two and forms two embryos; in contrast, nonidentical or *fraternal* twins grow from two eggs fertilized by two different sperm. Identical twins, sharing all of their genes, are usually remarkably similar in appearance. They are surprisingly similar in other respects as well, including—amazingly—their religious beliefs, their television-viewing preferences, and even their grief responses.

Impressive progress has been made toward determining the role of genetic factors in a wide range of physical and mental disorders. For example, researchers have discovered the gene that causes **Huntington's disease**, a rare, progressive neuromuscular disorder. Persons afflicted with Huntington's disease experience a gradual onset of uncontrollable, jerky movements in their limbs. Unfortunately, there is at present no cure for

Mitosis: Cell division in which chromosome pairs split and then replicate themselves so that the full number is restored in each of the cells produced by division.

Huntington's Disease: A genetically based fatal neuromuscular disorder characterized by the gradual onset of jerky, uncontrollable movements.

this disease (Pinel, 1993). Children of an affected person have a 50 percent chance of inheriting the gene that causes the disorder. Ironically, the onset of symptoms usually appears after age forty—long after many parents have their children, and therefore too late for them to reconsider their decision to start a family. Although scientists are not yet sure how the gene actually causes the disease, it is now possible to detect its presence before the onset of symptoms and, more importantly, in time to let parents avoid passing the lethal gene to their children.

Merely possessing a particular gene, however, does not always mean that a specific effect will follow. Genes do not control behavior or other aspects of life directly. Rather, they exert their influence indirectly, through their impact on chemical reactions in the brain or other organs. These reactions, in turn, may depend on, or be strongly influenced by, environmental conditions. One example is **phenylketonuria (PKU)**, a genetically based disorder in which persons lack the enzyme necessary to break down *phenylalanine*—a substance present in many foods. Affected persons on a normal diet tend to accumulate phenylalanine in their bodies. This, in turn, interferes with normal development of the brain and leads to mental retardation, seizures, and hyperactivity. Altering environmental conditions, however, can prevent this chain of events. Hospitals now routinely screen infants' blood for high levels of phenylalanine. If PKU is detected during the first few weeks of life, babies placed on a diet low in phenylalanine do not develop the PKU symptoms. Dietary restrictions can then be relaxed in late childhood after the majority of brain development is complete. So, as we'll note repeatedly in the rest of this book, biology is not necessarily destiny where human beings are concerned. Our genes do predispose us toward showing certain patterns of behavior or developing certain physical conditions or characteristics, but the environments in which we live play a major role in determining whether, and to what extent, such tendencies become reality. Moreover, most human traits are determined by more than one gene. In fact, hundreds of genes, acting in concert with environmental forces, may be involved in shaping complex physical or cognitive abilities (Lerner, 1993; McClearn et al., 1991). So, while there is increasing evidence for the role of genetic factors in many aspects of human behavior, heredity is only part of the total story.

Phenylketonuria

(PKU): A genetically based disorder in which persons lack the enzyme to break down phenylalanine, a substance present in many foods. The gradual buildup of body phenylalanine levels contributes to subsequent outcomes that include retardation.

Disentangling Genetic and Environmental Effects: Research Strategies

If both heredity and environment influence human behavior, the next question is obvious: "How do we separate these factors in order to determine the relative contribution of each to any particular aspect of behavior?" This question relates, of course, to the *nature–nurture controversy* described in Chapter 1, and psychologists use many different methods to address it. Two of these, however, have been most useful: *twin studies* and *adoption studies*.

Twin studies are helpful in disentangling the relative roles of genetic and environmental factors in a given form of behavior because of the fact mentioned above: Identical twins share all the same genes, while fraternal twins do not. Under normal conditions, however, both kinds of twins are raised in environments that, if not identical, are at least very similar. After all, twins generally are raised in the same home, attend the same schools, and so on. Thus, if a given aspect of behavior is strongly influenced by genetic factors, we'd expect identical twins to resemble each other more closely in this respect than fraternal twins. If an aspect of behavior is not influenced by genetic factors, however, we would not anticipate such differences.

A major problem with such twin studies, however, is obvious: The environments in which twins are raised are often not precisely identical. This is especially true for fraternal twins, who may differ in gender, and so experience quite different treatment by parents and other persons. For this reason, twin studies, while suggestive, cannot provide conclusive evidence on the relative role of genetic and environmental factors. Actually, no single type of study can provide such evidence; but a second research approach—*adoption studies*—does seem to come closer to this goal. Such research focuses on identical twins who, because they are adopted into different homes, are separated very soon after birth. Because the twins have identical genes, differences between them with respect to various aspects of behavior can reasonably be attributed to environmental factors.

Heritability: The extent to which variations among individuals with respect to a given aspect of behavior or a given trait are due to genetic factors.

Using such methods, psychologists have been able to arrive at estimates of what is known as **heritability** for various traits. This term refers to the extent to which variations among individuals with respect to a given aspect of behavior or a given trait are due to genetic factors. For example, if heritability for a given trait is .50, this means that 50 percent of the variability in this trait appears to be shown by individuals due to genetic factors. Suppose it were found that the heritability of intelligence is .50. This means that 50 percent of the variation in intelligence among individuals in the population for which heritability was estimated is due to genetic factors. It does *not* mean that half of each person's intelligence is determined by genetic factors and half by environmental factors. So heritability estimates should be treated with caution. Still, they do provide a rough index of the extent to which genetic factors influence any aspect of behavior, and so are of considerable interest.

Can information on the role of genetic factors in human behavior be put to practical use? Major projects now under way assume that it can. For information on one of these, see the following **From Science to Practice** section.

Figure 2.18
Identical Twins: More than Mere Look-alikes

Growing evidence suggests that identical twins are highly similar with respect of behavior—not just in the way they look. Moreover, this is so even if they are separated very early in life and raised in different environments. These findings suggest that genetic factors play a role in a much wider range of human behavior than was once believed.



From Science to Practice

Identifying Genetic Factors in Human Disorders: Decoding Iceland

Suppose that we identify ten people around the world, all of whom suffer from deep depression. We examine the DNA of all of them to try to find out whether they share some genetic factor that plays a role in their mental disorder. Will we succeed? Probably not; because these persons come from diverse populations, their DNA will differ in so many ways that we will not be able to determine which of these differences contribute to their mental disorders. But now suppose that we repeat this study with a very homogeneous population—one in which nearly everyone is related to everyone else; further, imagine that instead of 10 participants, our study includes almost 300,000. Finally, suppose that we have computer programs that can analyze the DNA of all these people to look for genetic similarities in persons who develop certain diseases. Will we succeed now?

The people of Iceland are betting on it. They recently voted to allow a private company named Decode to obtain DNA samples from all residents of Iceland, plus access to all medical records (Specter, 1999). Because Iceland experienced little or no immigration for almost a thousand years—not until recent decades—the population is exceptionally homogeneous. Further, medical records are unusually complete and accurate, and have been kept for more than one hundred years. Finally, Decode possess highly sophisticated computer programs for comparing the DNA of all participants in the study, and thus identifying common patterns among those who have developed various illnesses—mental and

otherwise. Given these factors, the scientists who operate Decode are confident that they will soon crack the genetic code of Icelanders and will be able to identify the genetic factors that play a role in many important diseases.

What if they succeed? The next step will be for major drug companies with whom Decode is working to use this information to develop drugs for treating these disorders—everything from depression to various forms of cancer. Of course, it is a big step from identifying genetic factors to developing effective drugs. But knowing which genes, or genetic anomalies (deviations from the norm), are linked to various diseases is an important first step. This huge project has a potential downside, however. Many scientists and citizens in Iceland and elsewhere are concerned about the ethical issues it raises. For instance, suppose the study succeeds in identifying genes that confer longevity—people with these genes live longer than those without them. Insurance companies might then want to test all applicants for life insurance policies so they could reject the people who do not have these long-life genes. Similarly, persons possessing genes that predispose them toward cancer or mental disorders might find themselves eliminated from certain jobs or occupations. As is always the case, scientific progress involves complex ethical and social issues that must be carefully considered. Still, given the potential benefits of the Iceland project, it is not surprising that Icelanders voted for it, and that scientists all around the world are awaiting the results with eager anticipation.

Evolutionary Psychology: Genes in Action

The new field of *evolutionary psychology* suggests that our species, like all others on the planet, has been subject to the process of biological evolution throughout its history. As a result, we now possess a large number of *evolved psychological mechanisms* that help (or once helped) us to deal with important problems relating to survival. These mechanisms have evolved because organisms vary greatly in many different ways, and some of these variations can be passed from one generation to the next through genes. Some of these heritable variations give individuals who possess them an advantage in terms of reproduction, so natural selection ensures that over time these variations become more common in the species.

Clearly, this process is relevant to our discussion of the role of heredity in human behavior; in fact, it describes one mechanism through which genes, acting over immense periods of time, can shape our behavior. More precisely, an evolutionary perspective suggests that we definitely do not inherit specific patterns of behavior; rather, we inherit tendencies or predispositions that may or may not be translated into reality, depending on the environments in which we live.

This new perspective has generated so much interest among psychologists that providing one more seems worthwhile. Let's consider the finding, repeated in many studies, that men and women differ in terms of *dominance motivation*—the desire to attain power and high status in one's society (e.g., Buss, 1999). Specifically, men are higher in dominance motivation. This difference has been observed all around the world in many different countries, so it seems to be quite universal in our species. Why should such a difference exist? Evolutionary psychologists reason as follows. In many species, ranging from insects to primates, dominant males have much greater access to females, and therefore produce more offspring, than nondominant males. They attain this greater access in two ways: Females tend to find them more attractive, and high-dominance males prevent other males from mating with the most desirable (i.e., youngest, most attractive) females. At the present time, monogamy is common in most human societies, so even dominant human males tend to have only one wife. However, they still tend to have more affairs and mate with more women than less dominant males (Buss, 1999). In the past, of course, such restrictions did not exist, and historical records going back more than four thousand years indicate that dominant males in many societies had huge numbers of wives and concubines. So, for men, dominance did translate into more offspring; and according to evolutionary principles, this would produce strong natural selection favoring strong motivation to attain dominance.

The situation is different for females. No matter how many mates they have, they can have only a limited number of offspring. Thus, for them, access to more males carries no obvious reproductive advantage. The result: Natural selection would *not* operate to produce high dominance motivation among females. But such pressures would operate to produce a tendency for females to find dominant males attractive; after all, such males *would* be more likely to provide the resources needed by females for raising their offspring, and females who attained high-dominance mates would be more likely to see their children survive.

This reasoning offers one explanation for the fact that males score higher than females in dominance motivation, but it is largely speculative in nature. We can't go back in time and determine if dominant males did in fact produce more offspring over countless generations, or if the desire to seek dominance is in fact genetically determined. What we can do is to try to determine what personal characteristics are related to dominance and see if these are linked to positive outcomes—which, in turn, might be linked to reproductive success.

Certain findings suggest that dominance—or even the mere appearance of dominance—is linked to positive life outcomes, at least for males. These findings are consistent with predictions from the field of evolutionary psychology.



Figure 2.19

Facial Dominance: A Plus for Success in Some Careers

Findings suggest that dominance—or even the mere appearance of dominance—is linked to positive life outcomes, at least for males. These findings are consistent with prediction from the field of evolutionary psychology.

In sum, evolutionary psychology provides a unique and intriguing perspective on the question of how our genes can, over time, shape our behavior. Whether the explanations it offers will turn out to be valid, however, can only be determined by further careful research.

REVIEW QUESTIONS

- How do psychologists seek to separate the roles of genetic and environmental factors in many forms of behavior?
- What is heritability?
- Why is the DNA of everyone living in Iceland being measured?
- How does evolutionary psychology explain the greater dominance motivation in males than in females?

Food for Thought

In view of the fact that we can't do experiments on many hypotheses offered by evolutionary psychology, is the evolutionary perspective really a valuable one for psychology?

Culture and Behavior

The preceding analysis makes it amply clear that the biological factors determine human experiences and reactions in significant ways. Biological determinism, however, does not take into account the fact that human beings are conscious agents who reflect upon their own behavior and modify it in view of their experiences. Their behaviors are meaningful and not simply reactive or instinctive. Also, if you attend to the range of variations in human behavior observed in different societies and in various ethnic groups in the same society

you will notice that biological factors and processes do not regulate behavior in any conclusive manner. Indeed, people in different societies speak different languages, follow different customs and rituals, value different goals, develop different kinds of political systems, and subscribe to different beliefs. Let us examine some aspects of cultural influences on human behavior.

Cultural diversity in various realms of life has become a common feature in today's societies. We start in an environment which is culturally constituted and live a life in which interactions with various cultural products (e.g., symbols, tools, and artifacts) are inevitable. Even in illiterate societies people develop various rules and practices which, as Bruner (1990) has noted, constitute a kind of folk psychology which is "a cultural account of what makes a human being tick."

The particular cultural environment in which a child is born is populated by various material and symbolic artifacts which constrain or afford our behaviors. Thus culture is part of the experience of every human being but different cultures provide its members with different experiences. By providing diverse experiences cultures constitute an important source of individual differences in people's skills, beliefs, values, and behaviors.

The Concept of Culture

In current usage the term culture carries two different meanings. First, it is used to identify a group of people who belong together in terms of some shared features (e.g., language, country, common heritage) over a period of time. In this case individuals belong to a culture. Second, culture is treated as a system of meanings and practices. It works as an organizer of the experiential world of individuals. In this sense culture belongs to a person. For the present purpose culture may be considered as a system of enduring meanings, beliefs, values, assumptions, institutions, and practices shared by a large group of people and transmitted from one generation to the next.

In its simplest expression culture comprises of humanly created environment. It has subjective or non-material as well as material parts. While subjective part includes values, beliefs, attitudes, norms, roles, etc. the material part consists of tools, artifacts, and sculptures, etc. Our relationship with culture is bidirectional and creative. We create and shape culture and in turn are influenced by the same. Researchers studying culture often use any one of the following strategies. They either focus on one culture or perform comparison of several cultures.

A growing body of cross-cultural research tends to show that important differences exist between the collectivist cultures found in Asia, Latin America, and Africa and the individualistic cultures prevalent in Europe and North America. It has been reported that individualist cultures emphasize on independence, uniqueness, self-goals, spontaneity, and short-term thinking. In contrast, the collectivist cultures emphasize on dependence, conformity, group goals, duties, and long-term thinking (see Triandis, 1990).

The studies focusing on cultural diversity indicate culture specific or emic variations in beliefs, norms, and values. Thus cultures vary in terms of norms and practices about child birth, child rearing or parenting practices, meaning, and significance of marriage, treatment of the elderly, etc. Here it may be useful to note that people often evaluate the customs and practices of other groups according to one's own cultural standards. This tendency is termed as *ethnocentrism*. It often results in prejudice, discrimination, and interethnic conflict.

With diverse ecological context cultures differ in their specific needs and accordingly follow different practices. Thus Japanese mothers emphasize on emotional maturity, social courtesy, and patience and American mothers emphasize on individualistic values. In contrast, Indian mothers emphasize interdependence, relationships, and are indulgent. The Indian concepts of *Samskaras* or life rituals illustrate the role of culture in specific practices.

A close scrutiny of the patterns of human behavior reveals that its major part is intentional and irreducible to biology. It does not show any fixed and deterministic association with genes. Even biologically important motives like hunger and sex lead to different sets of behaviors and are governed by varying norms in different cultures. People satisfy these needs in different ways and show varied preferences. Biology, as Bruner (1990) has pointed out, is a source of constraint and it is only through culture that we are enabled to go beyond these constraints. The cultural tool kit transmitted from earlier generation consists of various signs, symbols, and tools. These tools work as prosthetic devices and enhance the human capacity to imagine, create, and contribute to culture. The cultural transmission occurs through interactions with many people including parents, teachers, and peers in various contexts. We need to pay attention to culture in terms of shared meanings and practices for developing a comprehensive human psychology. Such efforts should be made a major part of research as cultures do not remain static but undergo changes with time.

The Process of Cultural Shaping

The variety, creativity, and complexity evident in human behavior largely owe to the aspects of culture in which people belong and grow. It has been noted that diverse cultures offer different world views, contexts, practices and artifacts. In this way cultures promote varying notions about self and other and the ways of relating to each other. It is through the processes of cultural transmission that a person becomes a full-fledged member of a culture. These processes, however, are prolonged one. They are facilitated by a long period of physical dependency during early years of life followed by social and psychological dependency during subsequent stages in life.

The studies in cross-cultural psychology and cultural psychology indicate that cultural context has a formative role in psychological functioning. The idea of psychic unity or a central processor leading to presumed universal and invariant psychological processes is not acceptable (Shweder, 1991). As Nisbett et al. (2001) have noted the Western and Asian cultures differ in the ways they think. The two approaches include profoundly different social relations, views about the nature of the world and characteristic thought processes. Thus Western thought is analytic and focuses on object and its attributes, uses attributes to categorize, use universal laws about categories to control events, laws are deterministic and linear and implies formal logic. Contrarily, Asian thought is holistic. It focuses on field in which the object is located, emphasizes the relationship between object and field, universal laws are absent and control is difficult, formal logic is replaced by reliance on experiential knowledge and prefers a dialectical approach.

Enculturation:

Encompasses all learning that requires no deliberate teaching.

Acculturation: Cultural change brought about in response to contact other cultures

The Process of Cultural Transmission

As indicated earlier, cultural groups transmit cultures to their new members by helping to develop appropriate behaviors. It is through teaching and learning mechanisms that these groups perpetuate their behavioral features among subsequent generations. In the course of development one learns from other members and institutions. Such learning experiences may originate from own culture or from a different culture. The former involves processes of *enculturation* and *socialization* and the later is called *acculturation*. These processes are critical in maintaining cultural diversity by producing similarities within culture and differences between cultures. Let us examine these processes in some detail.

Enculturation

Enculturation encompasses all learning that occurs in human life because of what is available to be learned without any deliberate teaching. It is primarily based on the cultural surroundings of the individual. It does not involve direct or specific teaching. The behaviors learned through modeling or the effects of conformity provide good examples of enculturation. We also learn various concepts and inculcate values simply because they are present in our environment. Being an integral part of the immediate environment people get ample opportunity to observe, imitate, and adopt culturally acceptable and appropriate ways of behaving. The process of enculturation involves parents, peers, and other adult members forming a network of influences. The process of enculturation enables a new member to become a competent participant in the culture by helping acquire the language, morals, values, and rituals. It incorporates children into the culture and through which a child acquires culturally apt behaviors.

Socialization

Socialization refers to the process by which an individual is led to develop actual behaviors which are confined within a much narrower range—one which is customary and acceptable to the group to which the person belongs. At the time of birth human babies are born with very few capacities and cannot survive long without care, nurturance, and guidance of adults. It is through intense interaction with others that we become human beings. As we grow and live in a particular social context we learn certain responses to perform. Through participation in cultural activities we gradually learn and internalize the attitudes, values, beliefs, and norms of our culture and develop a sense of self. This is a lifelong process and fosters a significant link between an individual and society. Socialization has two basic phases, i.e., primary and secondary. *Primary socialization*

Figure 2.20
Family—Major Source of Socialization

