CHAPTER 1

How We Change

> The average species on Earth lasts for only about four million years, so if you wish to be around for billions of years, you must be as fickle as the atoms that made you. You must be prepared to change everything about yourself—your shape, size color, species affiliation, everything—and to do so repeatedly. . . . So at various periods over the last 3.8 billion years you have abhorred oxygen and then doted on it, grown fins and limbs and jaunty sails, laid eggs, flicked the air with a forked tongue, been sleek, been furry, lived underground, lived in trees, been as big as a deer and as small as a mouse, and a million things more. The tiniest deviation from any of these evolutionary shifts, and you might now be licking algae from cave walls or lolling walruslike on some stony shore or disgorging air through a blowhole in the top of your head before diving sixty feet for a mouthful of delicious sandworms.
>
> —Bill Bryson, *A Brief History of Almost Everything*

As psychotherapists, we think a lot about how people change. Our ideas on the subject shape how we practice our professional arts. In many psychotherapies, there is a moment when the patient looks at us and poses the question directly: ''Do you think people can change?'' This is usually a way of asking ''Do you think I can, and that I will?'' Some evidence suggests that the average psychotherapist has more than the usual level of conflict or unhappiness in his or her own family background. Maybe that is what inspires us to try to transform a little of other people's unhappiness into security and contentment and to believe that the answer to the question about can I and will I change is yes.

In our time, three or four relatively independent traditions in science are converging on clinical psychology. By being aware of their intersection, psychotherapists can back up their optimism with solid evidence that people do change and that therapy is effective in helping them do so. Neuroscience, genetics, attachment studies, psychotherapy research, and studies of mindfulness meditation all play a part. In this book we rely on research in neuroscience, psychotherapy research, cognitive and psychodynamic psychology, attachment research, and evidence-based psychotherapeutic practices. The model we present incorporates many assumptions on which psychotherapy has been based for the last 100 years or so—about the importance of the therapeutic alliance and particular techniques with specific disorders. What is relatively new is the emphasis we place on attachment and neuroscience. We argue that a personal and rather mysterious decision by Sigmund Freud separating psychology from biology has had long-lasting and deleterious effects.

Some commentators (Cozolino, 2002) have suggested that psychotherapy could not have survived as a branch of neurology, which is to say that Freud had to cut the umbilical cord uniting the two. The point is well taken. However, Freud's decision also led to a schism in the mental health field, in which psychology has viewed the mind as an entity independent of the brain and biological psychiatry tends to see the brain as if the mind were just a ''ghost in the machine.'' The latter view has been the dominant one in the ''Pax Medica Era,'' which we believe may be coming to an end. In this book, we would like to advance the assumption that the mind and the brain are different manifestations *of a single set of processes*—that mind and experience shape the brain's structure. That is how we change.

NURTURED NATURE

In contemporary neuroscience, the causes of even basic psychological phenomena are often far from simple ones. The genetic contribution to brain functioning is a case in point. Genes commonly are taken as the most deterministic, least environmentally influenced element in our lives—for all intents and purposes as ''nature.'' In fact, this is a serious overstatement, because the gene itself, while influencing behavioral potential, is in turn endlessly shaped by the environment. An obese patient who says ''I got the gene for my waist size from my father!'' means to say he is not responsible for his eating habits any more than he is for his brown eyes. His alibi needs updating. While genes influence our vulnerability not only to obesity but to various psychological disorders as well, people's *experience* typically determines whether pathogenic genes are expressed and result in an actual disorder.

Every cell in the human body contains the same set of genetic instructions found in the fertilized egg's DNA. What makes one cell become a neuron and another a part of the bones in the hand? To be expressed, the DNA molecule must be opened up so that it can be copied and transmit its genetic information into proteins within the cell. In practice, the cell's DNA is selectively ''unpacked,'' and accordingly, only some genes are expressed. The chemical regulators of the DNA form an *epigenetic* system that determines what role (if any) a particular gene will have. Animal studies have shown that epigenetic factors are affected by environmental influences such as early abuse or neglect by a parent (Higgins, 2008) and in humans, reactions to environmental trauma such as famine can be transmitted from one generation to another.

Genes are an important factor in understanding how we change. Under certain conditions, they constitute a major influence in the development of such psychological disorders as schizophrenia (where estimates of the heritability of this disorder range as high as 80%), autism, obsessive-compulsive disorder, and social anxiety disorder, among other disturbances. This happens where the individual carries the necessary gene or genes and where the epigenetic system permits the gene to be expressed. The unpacked part of the DNA string is copied, producing a complementary molecule of messenger RNA (mRNA) through a process called *transcription*. The RNA in turn produces proteins in the cell through *translation*. Through transcription and translation, information in an expressed gene becomes the template for the cell's functions. But whether the gene is allowed to express itself is subject to environmental influences.

Like Escher's famous lithograph of a hand drawing itself, genes and environmental responsiveness are cocreating processes. Minor changes in either the environment or the transcription and translation processes may result in significantly altered functioning. Gene expression is fundamental to synaptic plasticity, the process that allows the brain to remodel itself, to change how it functions in order to adapt to novel or changing conditions (Black, 1998; Kandel, 2000). Recent science suggests an übergenetic, or epigenetic, system that changes in response to environmental exposure (e.g., to famine) and has the power to switch the expression of specific genes on or off. Although the percentage varies widely depending on the precise gene, roughly speaking, genes control about 50 percent of the variance in most traits. People who carry a gene that influences the trait of shyness are much more likely to feel shy and behave accordingly than people who lack this predisposition *if* their shy gene gets expressed. Inevitably the gene's expression will be moderated by environmental influences. A child with a tendency to be shy may learn to modulate her shyness through the support and encouragement of her parents (Kagan, 1998); and adults can modify such a disposition through many different kinds of experiences, including therapy. A person with a family history of affective disorders, who carries a gene that predisposes him to psychopathology, may never develop depression or bipolar disorder and can enjoy a reasonably happy life. A child growing up in an extended and encompassing family of shy people who struggle with a high incidence of major depression, however, will be challenged on both the nature and nurture fronts.

Early studies of heredity assumed that siblings reared in the same families are exposed to highly similar environments and that differences between siblings must be caused by genetic variation. More recent research shows that things are not that simple. Dunn and McGuire (1994) compared family environments and noted unique factors that often exerted significant influence on development, such as different friends and school experiences. Siblings, even identical twins, do not inhabit the same environments, and even shared experiences may be interpreted quite differently, which in turn may prompt the influential people in their environment—including their parents—to interact with them differently than with their siblings (Pike & Plomin, 1996).

Each step of the way, genetics and experience mutually influence development. Genes set the range of possible developmental paths; experience stimulates the individual to react in ways that are based on learning; and learning changes the likelihood of genetic expression (Guzowski et al., 2001). For example, the manner in which parents respond to their child's temperament produces feedback that results in shaping the growth, interconnections, and massive ''pruning'' (or programmed cell death) of the child's neurons. When a newborn baby first emerges from his mother's womb, he's likely to have twice as many neurons as the obstetrician or midwife assisting in the delivery. Over the course of childhood and through adolescence, these excess neurons die off based in part on how often they are stimulated by the external environment and other neurons. In this way, interplay between a child and parent changes the child's behavior and the influence of gene expression. We explore the interactions and effects of temperament and attachment in this book's companion volume, *Brain-Based Therapy with Children and Adolescents*.

Gene expression, experience, mental activity, and behavior are intertwined and form a transactional set of processes (Rutter et al., 1997). The growth of new synapses (and even new neurons) gives us the capacity to nurture nature—because the functional relationships between neurons play such an important role in determining who we are and how we behave (LeDoux, 2002). In other chapters we explore some of the subtle ways that nature and nuture interplay to produce the kinds of problems found in the panoply of mental disorders cited in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders*. For the time being, let us turn to an examination of how these interactions between genes and environmental ''triggers'' produced the human brain in the first place.

EVOLUTIONARY BACKGROUND

Our genes are the historical record of minute changes in the DNA of our evolutionary ancestors passed down from one generation to another. Comparative studies of human and nonhuman genomes suggest that we share an enormous amount of this heritage with other mammals and almost all of it with the nonhuman primates. Human DNA is 96% identical to the DNA of chimpanzees (Lovgren, 2005). In the awesome timeline of evolutionary history, *Homo sapiens* arrived only recently. Although the common ancestors of humans, the great apes and the Old World monkeys, are believed to have made their first appearance 63 million years ago (and were still around as recently as 13 million years ago), humans have been on the scene for a small fraction of that time. *Homo sapiens idaltu*, dating from about 160,000 years ago, is the oldest known anatomically modern human.

According to one model (known as the Lake Toba Catastrophe theory), between 50,000 and 70,000 years ago a super-volcanic event reduced the world's human population to as few as 1,000 breeding pairs (Ambrose, 2001). With only a few thousand individuals surviving, humans became an endangered species on the brink of extinction. This radical restriction of the breeding population may be why human DNA is remarkably homogenous across different settings. Tumultuous environmental change would have favored genetic shifts in our ancestors' capacities for rapid learning and adaptation. The capacity for rapid adaptation to changing conditions—the capacity for flexible change—was privileged.

Even before the Lake Toba volcanic event, our ancestors' brains had begun to expand, especially the prefrontal cortex. The growth of the neocortex and associated structural and functional changes in the subcortical brain centers took place relatively slowly from about 400,000 years ago until about the time of the Lake Toba events. From 50,000 years ago onward, the record of fossils and cultural artifacts shows startlingly rapid change, suggesting either a dramatic genetic shift or the cumulative effects of interactions between genetically mediated brain potential and an environment in which human culture in itself started to play a dominant role in human evolution. Our ancestors relatively suddenly began producing ever more refined human artifacts, beyond the early fashioning of stone tools. After 50,000 years ago, there is evidence that our progenitors began burying their dead, making animal hides into clothing, and painting symbolic art on the walls of their dwellings. The essential capacities of the modern human brain rather suddenly came on line for creatures confronting massive environmental change.

Paleoanthropologists believe this ''great leap forward'' could only have come about as a result of changes in the neural architecture underlying our ancestors' behavior and capacity for internalized thought in the human neocortex. Of all animal species, humans have the largest prefrontal cortex as a proportion of total brain volume. About 20% of the human brain is comprised of *frontal lobes*; by contrast, frontal lobes comprise about 3.5% of feline brain volume. The most recent addition to our evolutionary development, the frontal lobes are also the last to mature in individual humans, with development not complete until sometime in the third decade of life. The *prefrontal cortex* (at the forefront of the frontal lobes) gives us many of our most complex human cognitive, behavioral, and emotional capacities. It endows us, for example, with the ability to develop and act on a moral system (Dolan, 1999). The prefrontal cortex (PFC) lets us set aside our own agendas and reflect on the needs of others. It is associated with our subjective experience of empathy. When the PFC is damaged, people are likely to engage in behaviors that are antisocial and impulsive or not engage in purposeful behavior at all. At a time when human populations were dispersing out of Africa, a larger PFC constituted an indispensable asset in enhancing the richness of social bonds and attachment.

Underneath the cortex there were other changes in the brains of our immediate ancestors. ''Lower brain'' centers, such as the limbic areas and the cerebellum, changed to support the growth of the human behavioral and emotional repertoire. The cerebellum, an area specialized for motor control in other mammals, also performs sophisticated organizing functions in the human brain, working in tandem with frontal lobes (Grigsby & Stevens, 2000).

The motor area of the brain adjacent to the tongue and lips in the left frontal lobe (now called Broca's area) coevolved with the ability to produce speech (Fuster, 1997), enriching social relationships and internal cognitive processes. Like a new tool, speech changed what the brain could do, and, as we later demonstrate, heightened brain activity leads to further changes in neural architecture.

As our ancestors were subjected to radical new pressures from sudden climate change and as genetic shifts made new behaviors possible, the advantages of social life became even more pronounced for humans. The human brain has a vested interest in the expression of our genetic endowment for empathy, the human ability to ''feel'' what others are thinking and feeling, because mindsight is prerequisite to the brain's very existence. Human infants have very large heads and are born with brains that require, as it were, much home assembly. To survive, the brain must have relationships with caring, attentive, and deliberate caregivers who see the needs of their young as more important than their own. Loving, appreciating the development of those we love, and resolving interpersonal problems with those we are closest to has survival value for the brain. Human evolution has favored the development of these qualities over almost all others, because the survival of the brain itself depends on them.

John Bowlby (1969) applied this evolutionary perspective to observations of infants and children with their caregivers. Looking at the human infant as a young creature whose world is, for all intents and purposes, the maternal environment, Bowlby showed that newborns adapt out of Darwinian necessity to their mothers' personality and circumstances. The infant's capacity for creating and using relationships is carried in the brain's genetic makeup. Within minutes of birth, infants show a preference for gazing at the human face and can imitate facial expressions such as opening the mouth and sticking out the tongue (Meltzoff & Moore, 1998). The infant's hand grasps when something (such as another hand) is placed in its palm. Replete with clever neurodynamic mechanisms for intuiting the mental state of those around us, we are born to be shaped in the context of relationships. The cold evolutionary rationale for this phenomenon may well be that our ancestors faced catastrophic environmental change. Those endowed with a brain that could change rapidly, learn quickly, and maximize the advantages of social networking survived.

The ability to decipher subtle social cues is a contribution of the expanded PFC. The *orbitofrontal cortex* (OFC)—that part of the prefrontal lobes that lies directly above and behind the eyes—enhances the human capacity for social appraisal, allowing us to give complex social interactions an emotional value and think over the likely consequences of risky social moves before we act. Language lets us tell someone who was not there what we witnessed or what we *heard* from someone else about what *he or she* witnessed, vastly expanding the generalizability of individual experience. Together these faculties let us learn from other people's stories as well as our own.

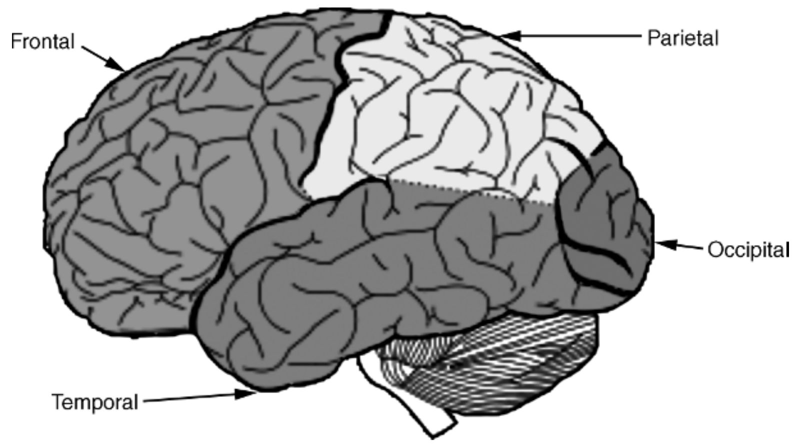

Figure 1.1 Lobes of the Human Brain

Astonishingly, the brain embodies within it the power to be *changed* by these stories, and this may be the human brain's most valuable legacy. Elsewhere in this book we return to the discussion about the interplay of genes and evolutionary history and the difference that the frontal lobes have made in human history. Affect regulation, decision making, and attention are topics of enormous relevance to psychotherapy. But before launching into a more detailed account of what contemporary neuroscience has to tell us as psychotherapists about the brain, let us consider why we *need* to have this discussion at all. How did psychology and brain sciences become estranged in the first place?

REDISCOVERY OF THE BRAIN

Awareness of the astonishing adventure of our evolutionary past was lost to humanity until the late nineteenth century, when Charles Darwin's *Descent of Man, and Selection in Relation to Sex* (1871) exhumed it. Darwin's careful cataloging of how species such as the finches of the Galapagos adapted to food supplies and other environmental variables laid the foundation for our understanding of gene–environmental interactions in biological systems—a model that is at the heart of modern neuroscience. Similarly, his later theory that man and the nonhuman primates descended from common stock opened new fields of inquiry into our history as a species and the selective advantages bestowed by the human brain.

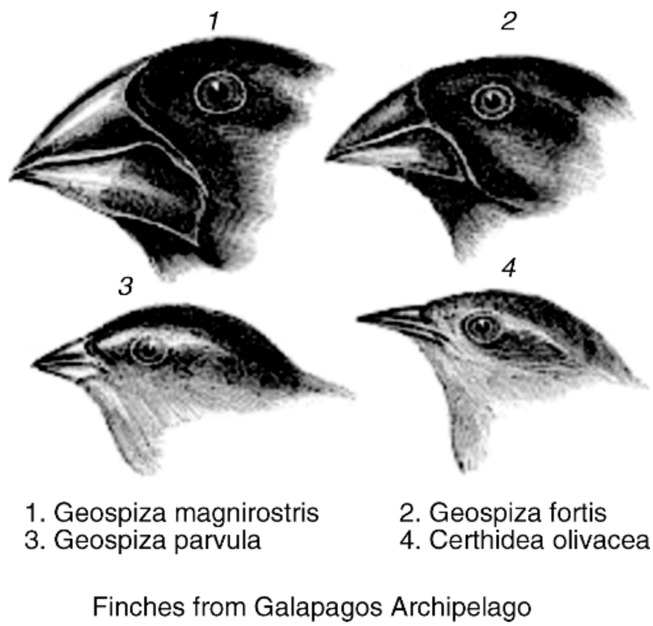

Figure 1.2 Environmental Selection of Biological Fitness

Darwin's insights permeate modern biological thought, neuroscience included. His most enduring contribution is the idea that the environment and existing diverse life forms interact to favor the most ''fit.'' As he put it in *On the Origin Species:*

> As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving, and thus be *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form. (Darwin, 1859, p. 5)

Darwin's theory is sometimes referred to as *selectionism*, and the neuroscientific version of this perspective as ''neural Darwinism'' (Edleman, 1987). Selectionists see the individual brain as a kind of ''second nature'' in which each neuron is subjected to the test of fitness all across the course of development (Edelman, 2006). Operating on neurons and the neurodynamic networks that support thinking and feeling, it is natural selection that ultimately drives enduring psychological change.

Early Psychoanalysis

Sigmund Freud was a younger contemporary of Darwin's. A neurologist by training, he moved from bench work in the laboratory to clinical work with patients with complex somatic symptoms. In 1885, Freud left Vienna for Paris to study with the most renowned neurologist of his day, the great Jean-Martin Charcot, who was using hypnosis to treat hysteria. Compared to the abiding popular view that hysterical phenomena were products of the uterus's wanderings inside the body, Charcot's ideas about the treatment of this disorder were revolutionary. He demonstrated that hysterical symptoms were products of ''reminiscences'' and that even very ill patients could get better through the power of belief in a cure. Charcot's effect on the 29-year-old Freud was electric. When he returned to Vienna, Freud and his mentor, Joseph Breuer, developed a method for treating hysteria that became known as the talking cure.

Victorian hysterical phenomena ran the gamut from simple conversion paralysis to the appearance of subcutaneous markings on the patient's skin that looked like symbols or words. Unlike their colleagues, who presumed these symptoms were the result of malingering or fakery, Breuer and Freud developed a theory that the genesis of hysteria lay in repressed memories of childhood. By bringing these early experiences into awareness via hypnosis, Breuer and Freud believed they could release repressed psychic energy and bring about a cure. One of Breuer's patients, Bertha Pappenheim (or ''Anna O.''), called the technique ''chimney sweeping'' and lovingly attributed unusual powers to her physician (Mitchell & Black, 1995). Breuer modestly said that he deserved no credit for his patient's recovery; the patient had to cure herself. In terms of the later history of psychotherapy, Breuer's idea was prescient; but Freud believed that Breuer had missed a central element in psychoanalysis by denying the reality of his patient's transferential feelings.

Freud continued to do both detailed neurological studies and clinical work. Between 1877 and 1900, he published more than 100 scientific pieces on neurology and neuroscience, only seven of which have appeared in English (Solms & Saling, 1990). Building on his studies of the nervous system of crayfish, nineteenth-century neuroscience, and his own clinical experience with hysterics, in 1895 Freud developed what he called the ''Project for a Scientific Psychology'' (1895/1958). The project set no less a goal than linking the dawning understanding of how the brain functions with Freud's emerging observations about psychopathology. Santiago Cajal and Heinrich Waldeyer had recently dubbed nerve cells ''neurons,'' and Freud added the very important point that the ''contact barriers'' between these cells make mental activities possible (Solms & Saling, 1990). A decade later, Sir Charles Scott Sherrington gave these contact barriers the name *synapses* (Kusurkar, 2004).

Despite these remarkable insights, Freud became discouraged with brain science. His appetite for clinical work and theorizing about the greater meaning of psychological phenomena supplanted his goal of a scientific psychology grounded in brain science. The ambitious ''Project'' fell by the wayside and was never published in his lifetime (Solms & Saling, 1990); yet for the rest of his career Freud seemed to harbor regrets about the decision. In his final work on psychoanalytic theory, published at the end of his life, he said:

> The future may teach us to exercise a direct influence by means of particular chemical substances on the amounts of energy and their distribution on the mental apparatus. (Freud, 1895/1958)

From brain science, Freud gravitated toward a case study method based on mutual introspection. This decision was to have profound effects on the mental health sciences for almost a century afterward.

While Breuer and Freud were elaborating their psychical theories, Darwinian views were taking hold in more general scientific circles, and the two views had much in common. Like psychoanalysts, Darwin and his party took the position that we are as much a product of the drive to mate and survive as are other living creatures. Freud's maturing view of human nature was as dark as Darwin's view of animal life—under the starched petticoats of Victorian Europe, mankind, no less than the naked mole rat, was driven by an instinctual need for sexual success. No doubt Freud would have agreed with Darwin's observation that despite our ''exalted'' and ''noble'' qualities, ''man still bears in his bodily frame the indelible stamp of his lowly origin'' (Darwin, 1871, p. 405). In the psychoanalytic model, change arises from individuals' capacities to look at themselves, ''lowly'' qualities and all. With the help of the relationship with the analyst, successful analysands temper the infantile aspects of their harsh superego judgments about themselves, and go on to live gratifying, less conflicted lives as adults.

Whatever one makes of the specifics of classical psychoanalytic theory, Freud doubtless introduced or synthesized some spectacularly important neurodynamic ideas: that mental life is a product of cellular activity; that nerve cells communicate across the synapses that separate them through a special kind of biological energy; that mental life is a compromise wrought from the interaction of modules in the mind with conflicting agendas and cognitive strategies; that fundamentally important parts of our mental life never attain consciousness; and that our minds, shaped by early relationships, can nevertheless change as a result of a special kind of conversation. That we can change as a product of a relationship is, of all Freud's many contributions, perhaps his most enduringly important one for our profession.

Freud is, if not the father then at least the elderly uncle of modern neurodynamic therapy. In the century since his most important contributions, we have learned more about the brain than was known in all of human history up to that time. For all his provocations of Victorian pretensions to virtue, Freud, more than Darwin, envisioned a brain that was quite different from that of other mammals. Modern neuroscience only partially shares Freud's conception of human consciousness. From the modern perspective, Freud underestimated both the extent of our unconsciousness and how profoundly tied we are to our evolutionary history. Because he had no knowledge of the relationship between the cortex and the subcortical brain, and the architecture of fear in particular, he tended to misunderstand why we are such an anxious species. His respect for our capacity to make conscious what was unconscious led Freud to place undue confidence in introspection and insight as a sufficient basis for therapeutic change. Most impactfully, however, Freud's separation of psychology from its roots in biology had lasting detrimental effects. It helped create a schism in the mental health professions, with psychologists concerned only with the mind, neurologists only with the brain, and psychiatrists unsure (at least until the 1970s) where they belonged in this dualistic perspective. Early in the twentieth century, other psychologists called psychoanalysis to account for some of these shortcomings.

Behaviorism

By the 1920s, behaviorism began redressing the excesses of introspection as a method of scientific inquiry and the fanciful speculations of those who offered up the products of introspection as universal truths. Behaviorists held that psychology must avoid hypothetical constructs in studying human experience and must instead hold fast to empirical observations of what was visible and measureable. We can't see thoughts and feelings; all we can see is what we *do*; thus behavior is the proper subject for science. Behaviorism was attractive to many academics and therapists because of its scientific rigor, empirically based change strategies, and replicable findings (Watson, 1919).

Some early behaviorists asserted that if they had control of all the contingencies in a learning situation, they could change almost any desired behavior or personality characteristic (Watson, 1930). Compared to the dark picture of a human nature at the mercy of instincts and the unconscious, behaviorism's stance seems one of cheerful environmentalism. By focusing on the apparently mundane phenomena of conditioned reflexes and learning, the behaviorist B. F. Skinner taught pigeons Ping-Pong and rats to play basketball. Behaviorists wasted no time speculating on what the rodents were feeling or thinking while they waited for reinforcement. They got things done. One of behaviorism's founders, John B.Watson, was so successful at applying the technology to people that after leaving a successful career in academia, he went to work in advertising, where he helped condition several generations of Americans to associate sophistication and sexual success with smoking cigarettes.

Cognitive Psychology

An effective change strategy, behaviorism's insistence on dealing with the observable products of psychological life puts vital parts of the brain—and the mental experience associated with them—outside its sphere of study. Cognitive psychologists, like the behaviorists, rejected Freud's reliance on introspection, and for the same reason: it was too unreliable. However, in contrast to the classical behaviorists, who tended to regard the skull as a black box or as a stimulus-response machine, cognitivists were interested in internal mental states and were clever in designing experiments to elucidate them.

Although its roots go back to the great European gestalt psychologists Max Wertheimer, Wolfgang Kohler, and Kurt Kofka, the term *cognitive psychology* first appeared in the title of a 1967 book by Ulrich Neisser. Neisser characterized people as dynamic information-processing systems and described mental operations in computational terms. Computational models envision the mind as an information processor, and symbols, such as words, as by-products of neurodynamic patterns that contain information and create affect (Pinker, 1997). Perception, memory, decision making, and psycholinguistics are primary topics of interest. Language in particular was a kind of Trojan horse that effectively smuggled ''the self'' inside the laboratories of cognitive psychologists. Looking at language reintroduced a vital part of the subjective mental life that had been until then the province of psychologists championing introspection.

In the late 1980s, cognitive researchers and theorists began to address the existence of ''hidden units'' in human cognition. As the term implies, hidden units are aspects of the cognitive process that are not available to consciousness. Their ''discovery'' reestablished unconscious mental process as a topic of interest, but on different terms from those set by Freud. From a cognitive perspective, nonconscious processing is a matter of necessity. The task of processing sensory and perceptual stimuli is so vast that it proceeds more efficiently if we do not pay attention to it. Consciousness would add nothing to the final product, while nonconsiousness conserves conscious resources needed for executive functions such as decision making and for working memory.

The father of cognitive-developmental psychology, Jean Piaget, seems to have assumed the existence of an unconscious all along. His ''assimilative processes'' can be conscious or unconscious, or somewhere in between on a spectrum of awareness. But for many American cognitive scientists, this ''cognitive unconsciousness'' opened a seemingly new domain of study (Kihlstrom, 1987). Psychological laboratories documented the multitude of perceptions, decisions, and behaviors that occur outside of conscious awareness. Studies showed that familiar input is associated with pleasurable affect, while unfamiliar sensory stimuli frequently are experienced as less pleasing or even unpleasant. Other research showed that where there is dissonance between an old perceptual or cognitive construct and new experience, there is a drive to reduce it (Wexler, 2006; Zajonc, 1968). In neither instance is the subject's bias a matter of conscious choice; it is simply part of how the mind processes the data. The first defense against dissonance is avoidance. Thus, we gravitate toward what is familiar and when we cannot avoid dissonance, we move to reconcile the differences by favoring what we already know. If the new information is not yet overwhelming and consistent, we tend to discredit, deny, reinterpret, or even forget it. Generally, we look for agreement with our long-standing beliefs and perceptions.

Many behaviors (and the cognitive protocols that make them possible) simply run on autopilot. We can make ourselves aware of the behaviors and perhaps some part of the protocols, but we do not need to. Driving down Interstate 80 talking to our spouse, we make decisions about how fast to go, what lane we want to be in, and whether the car in the next lane may try to merge, all the while considering and responding to our spouse's complaints about our driving. This is an example of a kind of nonconscious functioning that can be brought to consciousness readily. If the driver of the tractor-trailer ahead of us unexpectedly hits his brakes, we are jarred out of the discussion with our partner and compelled to consider what we must do to keep ourselves intact. Should we veer off the road? Are there cars to either side of us? Is the driver behind us aware of what's happening? Other mental processes can never become conscious—for example, how we maintain an upright posture while walking, how we chew and swallow our food, or how we coordinate the several neural systems involved in uttering a word and how we put words together to make a grammatically correct and properly pronounced sentence. One of the reasons it is exhausting for nonnative speakers to speak a foreign language is that they have to think about things native speakers do nonconsciously when speaking their own tongue.

BRAIN-BASED THERAPY

Darwinism, psychoanalysis, behaviorism, cognitive science: each generates its own theory about how people change. Darwin's perspective on how we change may be the most durable of the four we have examined. But few clinicians think of themselves as looking at a microcosm of natural selection sitting in the chair opposite them. Of the purely psychological approaches, each began by taking a stance that was provocatively innovative and at odds with prevailing psychological theory. Psychoanalysts emphasized unconscious process, behaviorists focused on conditioned learning, and cognitive psychologists concerned themselves with conscious and nonconscious thought. Each school, over time, has had to move back toward the center—psychoanalysis acknowledging its subjectivity, behaviorists accepting the importance of an internal mental life, and cognitive science coming to terms with the fact that thought is closely intertwined with emotion.

In the 1950s, in what must at the time have seemed a development unrelated to the lofty concerns of the three dominant theoretical schools, researchers began to explore the question of how one specific change process—psychotherapy—worked. Surprisingly, they found common factors underlying therapies conducted on very different theoretical principles, factors that pointed to principles of change that were more important than the surface differences between antagonistic schools of practice (Lambert & Barley, 2002). Similarly, psychologists such as Piaget and Mary Ainsworth (1969) highlighted important commonalities in the cognitive and emotional development of children. The work of these psychologists laid the cornerstone for a new consensus in approaching clinical work with our patients.

Most recently, neuroscience has started to exert a unifying influence on theories about how we change. It might occur to a neuroscience graduate student these days that the three dominant psychological schools of the last half of the twentieth century all made the same kind of error: each looked at a circumscribed aspect of the brain-mind and denigrated the significance of the remainder, mistaking a part for the whole. A contemporary doctoral student would understand that in complex systems such as the brain, the functional transactions *between* parts are more important than the parts themselves in determining what happens. Moreover, it might strike the young neuroscientist as testimony to the enduring influence of Freud over our field that psychotherapists seemed to stop thinking about the brain after 1895 and did not pay much attention to it for the next 100 years. Now we are back to being able to think in an integrated way about what the brain and the mind have to do with each other.

As the model of embodied mind has emerged, integration across disciplines has acquired momentum. Modern cognitive science has converged with behaviorism to create *cognitive behavioral therapy*, and with neuroscience to produce *cognitive neuroscience*. *Neurodynamics* is a hot topic in psychoanalytic training centers. After decades of cacophony, there is suddenly the possibly of harmonizing major theories. A new perspective, *affective neuroscience*, places the roots of emotional experience in the brain at the center of this synthesis (Panksepp, 1998). Similar approaches focusing on the *sociophysiology* of the doctor–patient relationship (Adler, 2002; Gardiner, 1997), and the *social neuroscience* (Adolphs, 2003) of development have also emerged. An entire recent issue of the journal *Archives of General Psychiatry* (2006) was devoted to the effect of psychotherapy on the brain. And according to neuropsychiatrist Nancy Andreason:

> We can change who and what we are by what we see, hear, say, and do. It is important to choose the right activities for our brain to be well trained. . . . [B]rain plasticity explains how and why psychiatric treatments that are not ''biological,'' the various types of psychotherapy, can be effective for relieving the symptoms of illnesses such as depression or anxiety. These treatments, which we tend to think of in the false polarity between physical and psychological (or brain and mind), help people reframe their emotional and cognitive responses and approaches. This reframing can only occur, however, as a consequence of biological processes in the brain—a form of activity-dependent learning. (2001, p. 50)

In a happy coincidence (and perhaps more than that, a sign of a sea change in the mental health professions), advances in imaging technology now allow us to *see* the effects of psychotherapy on the brains of depressed patients before and after treatment (Goldapple et al., 2004). These images of the effects of psychological treatment indicate that psychotherapy and antidepressant therapy work in different and complementary ways to help the patient. Evidence that talk therapy results in measurable neurodynamic change in the brain has the potential for creating a different way of diagnosing psychological distress and building bridges between psychology and the more biologically oriented disciplines, almost a century after Freud inadvertently severed the two. These images suggest a new perspective on the question ''how do people change?'' They suggest we have inherited the capacity to do so. They demonstrate that we cannot alter the pattern of our thoughts and feelings without changing the brain, and our brains are exquisitely adapted to changing in response to the attuned and compassionate interest of another human being.