which the nitrogenous bases are attached. These molecules range in composition from fewer than 100 to several thousand nitrogenous bases, and vary in shape from helical to uncoiled. RNA is the primary agent of protein formation, and processes genetic information from deoxyribonucleic acid (DNA) molecules into enzymes necessary for life.

### Right-brain hemisphere

The hemisphere of the brain that neurologically controls the left side of the body and is thought to control spatial tasks, musical and artistic endeavors, body control and awareness, and creativity and imagination.

In normal human adults, each hemisphere of the brain, working in concert with the other, performs certain types of functions more efficiently than the other. While the left-brain hemisphere is dominant in the areas of language and logic, the right-brain hemisphere is the center of nonverbal, intuitive, holistic modes of thinking. Each hemisphere mostly receives perceptions from and controls the activities of the opposite side of the body. Scientists have been aware of the specialized functioning of the hemispheres—also known as lateralization—for over one hundred years, having discovered that language skills are controlled by the left side of the brain in approximately 95 percent of right-handed people and about two thirds of left-handed individuals. In the nineteenth century, however, this discovery led to the assumption that all higher reasoning ability resided in the left-brain hemisphere, which was thus regarded as dominant overall. The right brain hemisphere was thought to possess only lower-level capabilities and was considered subordinate to the left.

Research conducted in the 1950s and 1960s established that the two hemispheres of a normally functioning brain—connected by the corpus callosum, a thick cable of nerves—operate in a complementary fashion with both hemispheres involved in higher cognitive functioning. The primary difference between them was found to involve the mode rather than the level of thinking. A research group under the direction of Roger Sperry at the California Institute of Technology observed and tested patients who had undergone a surgical procedure in which the corpus callosum was severed to control epileptic seizures. In this procedure, the two hemispheres of the brain, which normally have a strong tendency to work together, were uncoupled, and each side of the brain remained ignorant of information received by the other. Thus, right-handed people had no trouble writing, which is usually governed by the left-brain hemisphere in righthanders, but were unable to draw, as the left brain was cut off from the spatial capacity of the right. When a special apparatus was used to present the image of a spoon only to a split-brain patient’s left hemisphere, the subject could name it readily, but when the same image was presented to the right-brain hemisphere, the subject could not, although they were still aware of what it was.

Research on both split-brain and normal subjects since the 1960s has confirmed that both hemispheres of the brain use high-level cognitive modes. That of the left brain is verbal and analytic, while right brain thought processes are rapid, complex, whole-pattern, spatial, and specialized for visualimagery and musical ability. The right temporal lobe, in particular, governs visual and auditory imagery. People in whom this area is damaged have difficulty recognizing familiar melodies, faces, and pictures, and learning to identify new ones. The right brain hemisphere also appears to have special links to emotion. Right-brain damage interferes with both the ability to produce and interpret expressions of emotion. Damage to the front part of the right-brain hemisphere renders people unable to act on or express strong emotions. If the damage is further back in the brain, the person can express emotion but not recognize it in other people or in pictures.

Other general characteristics of right-brain thought processes include the tendency to synthesize rather than analyze, and to relate to things in a concrete rather than a symbolic fashion. Where left-brain thinking tends to represent wholes by abstraction (using one piece of information to represent something larger), the right brain is more likely to interpret data through analogies—seeing relationships between wholes. Right-brain functioning is nontemporal, nonrational, holistic, and intuitive, relying on leaps of insight, hunches, or visual images. Discoveries about the right- and left-brain hemispheres have led some researchers and educators to advocate educational reforms that would allow right-brain modes of thought a greater place in the current educational system, which reflects society’s overall tendency to reward the verbal, analytical left-brain skills. As split-brain researcher Roger Sperry notes, our educational system “tends to neglect the nonverbal form of intellect. What it comes down to is that modern society discriminates against the right hemisphere.” The artistic, creative right brain is relegated to the “minor” subjects of art and music, but the main programs of study do not, as a rule, focus on developing the right-brain skills of imagination, creativity, or visualization.

See also Brain; Handedness; Split-brain technique
Carl Rogers

1902-1987

American psychologist who developed a nondirective, patient-centered method of psychotherapy known as humanistic psychology.

Carl Rogers was born in Oak Park, Illinois. Raised in a fundamentalist Christian home, Rogers attended the University of Wisconsin and studied for the ministry at Union Theological Seminary before deciding to pursue a doctorate in education and clinical psychology at Columbia University. Between 1928 and 1939, Rogers worked as a counselor at the Society for the Prevention of Cruelty to Children in Rochester. In 1940, he was appointed to the faculty of Ohio State University. By this time, he had worked out much of his new client-centered system of therapy, which was set forth in his second book, Counseling and Psychotherapy, published in 1942.

Rogers believed that the mental condition of virtually all patients, whom he referred to as clients, can be improved, given an appropriate psychotherapeutic environment. Central to this environment is a close personal relationship between client and therapist. Rogers's use of the term “client” rather than “patient” expresses his rejection of the traditionally authoritarian relationship between therapist and client, and his view of them as equals. The client determines the general direction of therapy, while the therapist seeks to increase the client’s insightful self-understanding through informal clarifying questions. A hallmark of Rogers's method is the therapist echoing or reflecting the client’s remarks, which is supposed to convey a sense of respect as well as a belief in the patient’s ability to deal with his or her problems. The concept of an alliance between client and therapist has affinities with the methods of Carl Jung, Otto Rank (1884-1939) was also an early influence on the development of Rogers’s system.

Rogersian therapy is a natural consequence of its creator’s belief that a fundamental element of human nature is the drive to fully actualize one’s positive potential, a concept based on an essentially positive view of humanity that contrasts with the psychoanalytic view of human beings as driven by antisocial impulses that are suppressed with difficulty and often at great cost. In Rogers’s view, the primary task of therapy is to remove the client’s obstacles to self-actualization. A further contrast to psychoanalysis lies in the fact that Rogersian therapy emphasizes the current emotions and attitudes of the client rather than early childhood experiences.

After leaving Ohio State in 1945, Rogers served on the faculties of the University of Chicago and the University of Wisconsin. Between 1956 and 1947, he served as president of the American Psychological Association. As Rogers gained increasing acclaim, the popularity of his method grew rapidly. Rogersian therapy was widely practiced in the 1950s and 1960s, when its tenets of antiauthoritarianism and permissiveness gave it a wide appeal to many. Rogers published Client-Centered Therapy: Its Current Practice, Implications, and Theory in 1951 and produced numerous of papers in the decade that followed. In 1956, the American Psychological Association awarded him its Distinguished Scientific Contribution Award. In the 1960s, Rogers was attracted to the human potential movement that had begun in California, and he adopted some of its principles, including its emphasis on frank and open expression of feelings and its use of group therapy. In 1964, he and his wife moved to La Jolla, California, where he continued to write and lecture, and served as a resident fellow at the Western Behavioral Science Institute. On Becoming a Person, published in 1961, became his most widely read book. In the last ten years of his life, Rogers became deeply interested in educational reform. Borrowing a central principle from his therapeutic method, he came to believe that teachers (like therapists) should serve as facilitators rather than judges or mere conveyors of facts.