NINETEENTH CENTURY PHYSIOLOGY

The idea that the body, including the brain, is a machine, amenable to scientific study, helped to promote the science of physiology—the study of the body's machinery. By the beginning of the nineteenth century, considerable progress had been made in this endeavour, and during that century discoveries were made about the nervous system that contributed significantly to the origins of scientific psychology.

Increased Understanding of Reflexes

One especially important development for the later emergence of psychology was an increased understanding of reflexes. The basic arrangement of the nervous system—consisting of a central nervous system (brain and spinal cord) and peripheral nerves that connect the central nervous system to sense organs and muscles—was well understood by the beginning of the nineteenth century. In 1822 in France, François Magendie demonstrated that nerves entering the spinal cord contain two separate pathways: one for carrying messages into the central nervous system from the skin's sensory receptors and one for carrying messages out to operate muscles. Through experiments with animals, scientists began to learn about the neural connections that underlie simple reflexes, such as the automatic withdrawal response to a pin prick, and found brain areas that, when active could either enhance or inhibit such reflexes.

Some of these physiologists began to suggest that all human behaviour occurs through reflexes involving higher parts of the brain. One of the most eloquent proponents of this view, known as *reflexology*, was the Russian physiologist I.M. Sechenov. In his monograph *Reflexes of the Brain*, Sechenov (1863/1935) argued that every human action, "be it a child laughing at the sight of toys, or … Newton enunciating universal laws and writing them on paper," can in theory be understood as a reflex. All human actions, he claimed, are initiated by stimuli in the environment. The stimuli act on a person's sensory receptors, setting in motion a chain of events in action. Sechenov's work inspired another Russian physiologist, Ivan Pavlov (1849-1936), whose work on reflexes played a critical role in the development in North America, of a school of thought in psychology called *behaviourism*.

The Concept of Localization of Function in the Brain

Another important advance in nineteenth-century physiology was the concept of localization of function in the brain, the idea that specific parts of the brain serve specific functions in the production of mental experience and behaviour. In Germany, Johannes Miller (1838/1965) proposed that the different qualities of sensory experience come about because the nerves from different sense organs excite different parts of the brain. Thus we experience vision when one part of the brain is active, hearing when another part is active, and so on. In France, Pierre Flourens (1824/1965) performed experiments

with animals showing that damage to different parts of the brain produces different kinds of deficits in animal's ability to move. And Paul Broca (1861/1965), also in France, published evidence that people who suffer injury to a very specific area of the brain's left hemisphere lose the ability to speak but do not lose other mental abilities. All such evidence about the relationships between mind and brain helped lay the groundwork for a scientific psychology because it gave substance to the idea of a material basis for mental processes.