

in functional psychology, George J. Romanes in animal and comparative psychology, John Hughlings Jackson in sensory-motor psychophysiology, and Ivan P. Pavlov's classical conditioning experiments.

[Many of the people mentioned in this article are the subjects of independent biographical entries.]

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Works by Spencer

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Daniela S. Barberis

SPERRY, ROGER WOLCOTT (1913–1994), American psychologist. A “research program” is broadly defined as a long-term, carefully crafted series of studies that attempt to answer important questions. Roger Sperry formulated the questions that fueled his 50-year program of research during the first day of R. H. Stetson's Introduction to Psychology class at Oberlin College. The questions, which were the themes for the American

Psychological Association's centennial conference, were (1) In what proportion does behavior come from nature or nurture? and (2) What is the purpose of consciousness? These questions reflect the influence of Stetson's own mentor, William James. Interestingly, Sperry had actually read James's *Psychology* as an adolescent after his father had brought the book home from the public library.

To answer these questions, Sperry set out to obtain the necessary skills for research. After obtaining a bachelor's degree in English (1935) and essentially a minor in psychology, he stayed at Oberlin to obtain a master's degree (1937) in psychology with Stetson—the professor who exerted the greatest influence on his thinking. After developing strong ideas about the connections between movement, brain activity, and consciousness, based on the interactions with Stetson, Sperry proceeded to work with Paul Weiss, a prominent neuroembryologist at the University of Chicago. Weiss believed that peripheral nerve functions were malleable. After completing a series of carefully crafted and elegant studies with a variety of species and nerves, Sperry came to the conclusion that Weiss's belief was in need of revision.

After receiving his doctoral degree in zoology in 1941, Sperry went to the Yerkes Laboratories of Primate Biology in Orange Park, Florida, as a postdoctoral fellow to work with Karl Lashley. Lashley had developed critically acclaimed theories of brain functioning—primarily the theory of equipotentiality. This theory suggested that all portions of the cerebral cortex are equally responsible for the acquisition of information and the production of behavior. With similar tenacity, Sperry worked on a series of studies that addressed both equipotentiality and mass action. During these formative years at Yerkes, Sperry interacted with important figures including Frank Beach, Henry Nissen, Austin Riessen, and Donald Hebb.

In 1946, Sperry left the idyllic surroundings of Yerkes to return to the University of Chicago. There he expanded some of his peripheral nerve regeneration studies and began asking similar questions of the central nervous system. Despite his prodigious scholarly output and the beginnings of split-brain research, the department of anatomy failed to grant him tenure. He spent one more year, without tenure but with funding and an appointment from the National Institutes of Health, in the department of psychology before finally leaving Chicago. Thereafter, Sperry spent a year fighting tuberculosis in the Adirondack Mountains with his new bride, Norma Deupree. This difficult time allowed Sperry to further develop his thinking about the brain and consciousness, which received mention in his 1952 paper published in *Neurology*.

On the recommendation of the biologist Norman Horowitz, Sperry was invited to deliver the prestigious

Hixon Lecture in Psychobiology at the California Institute of Technology. The Division of Biology was so impressed with his nerve regeneration research that it offered him the newly created Hixon Chair of Psychobiology—a position he held until his retirement. During the next 4 decades at Caltech, Sperry worked closely with almost 100 graduate students, postdoctoral fellows, and visiting scientists representing every continent and a variety of disciplines ranging from molecular neurobiology to Jungian philosophy.

Throughout the 1950s, 1960s, and 1970s, Sperry added to his nerve regeneration studies and the burgeoning split-brain research. He initially worked with cats, then monkeys, and finally humans. Together with Joseph Bogen, probably his closest colleague, he embarked on what is now considered historic research. Cutting the largest nerve tract of the brain, the corpus callosum, resulted in two cognitively isolated halves of the cerebrum. Together with students and colleagues such as Giovanni Berlucchi, Alice Cronin-Golumb, Robert Doty, Michael Gazzaniga, Harold Gordon, Charles Hamilton, Brenda Milner, Ronald Meyer, Richard Nebes, Colwyn Trevarthen, Theodore Voneida, Eran and Dahlia Zaidel, and others, he performed a series of ingenious studies that revealed that commissurotomy patients appeared to have two independent minds. This work resulted in widespread recognition of hemisphericity and laterality.

Sperry had concluded that the two independent sides of the brain worked in unison, giving rise to one consciousness. In other words, consciousness emerged from the unified working brain. As early as 1964, Sperry had hypothesized (in a lecture to colleagues at Caltech) that this emergent consciousness, in turn, had a downward effect on specific brain function: specifically, downward causation affected neuronal function. Thus, consciousness was, in fact, an emergent quality and a causal force simultaneously. This bimodal model of consciousness was developed further by Sperry during the last two decades of his life. Acceptance of the subjective in brain research had two important outcomes. First, it helped to shift the focus from behaviorism to cognition. For Sperry this was indeed the beginning of the consciousness revolution. Second, acceptance of the subjective in psychology allowed the inclusion of values as the determining agent in the development of consciousness. These values, however, were biologically, not environmentally, based, having evolved for the survival of the organism. Appropriate values could, in turn, address overpopulation, pollution, and other modern crises. Thus, this value-laden consciousness revolution would represent a new *Zeitgeist*, originated by psychology and affecting other sciences as well as the world around us.

Half a century of research, 300 publications, and 100 students and colleagues resulted, not surprisingly,

in many honors and awards for Sperry. He was particularly proud of his recognition by fellow psychologists (the American Psychological Association's Lifetime Achievement Award in 1993) and by scientists (the 1981 Nobel Prize in Physiology, which he shared with David Hubel and Torsten Weisel). Sperry, the only individual to have obtained a graduate degree in psychology who won a Nobel Prize, died of amyotrophic lateral sclerosis in Pasadena, California.

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Antonio E. Puente

SPINAL CORD INJURY. See Rehabilitation Psychology.

SPINOZA, BARUCH (BENEDICTUS DE) (1632–1677), Dutch philosopher. Spinoza was born in Amsterdam on 24 November 1632 into a family of Jewish Marrano immigrants from Portugal. Although his given name was Baruch, he published his most impor-