THE NOBEL PRIZES, 1981

Physiology or medicine

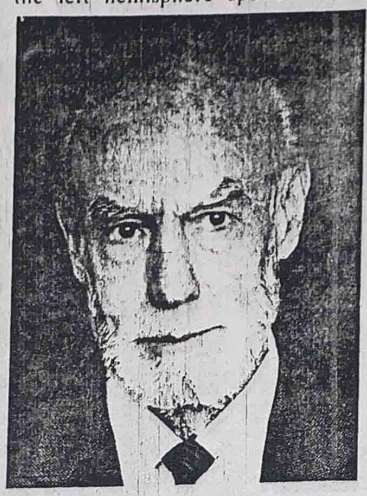
THE Nobel Prize for physiology or medicine this year was awarded to three neurobiologists—Roger W. Sperry, David H. Hubel and Torsten N. Wiesel—for their pioneering studies on the functional organisation of the brain.

Sperry, who receives half the prize, is a professor of psychobiology at the Division of Biology, California Institute of Technology. Sperry did his graduate work at the University of Chicago, and later, after spending some time at the Yerkes Laboratory with Karl Lashley, moved to the California Institute of Technology in the early fifties. He continued his work in three distinct areas—developmental neurobiology, experimental psychology, and investigations into the specialisation of the two halves of the brain on human subjects who had undergone split-brain surgery for epilepsy. Indeed, his contributions to all these areas have been so profound and so fundamental that upon hearing the news of the award his colleagues and students wondered as to what aspects of his work was being rewarded.

All organisms display a distinct bilateral symmetry. The plane of symmetry, passing through the midline and dividing the body into left and right halves, extends right into the brain. This is particularly conspicuous in the mammalian brain, where even a casual glance reveals the division of the cerebral hemisphere (the most prominent part of the brain) into two, left and right, halves with a deep groove extending around its circumference. Of course, the two halves are not entirely unconnected; they are joined together by a bundle of nerves.

Sperry and R. E. Myers carried out experiments on animals with the two halves of the brains surgically disconnected. They demonstrated a certain degree of specialisation for each half and further observed that the information received by one half could not get transferred to the other half.

The crucial evidence in support of the conclusions derived by Sperry and his group from experimentations on the animals, however, has to await the availability of human subjects who had undergone such split-brain surgery to control or minimise epileptic seizures. The studies cited in the Nobel award began in the early sixties, when Joseph E. Bogen suggested split-brain surgery for patients suffering from severe epilepsy. Sperry carried out a series of behavioural tests on such subjects using a variety of stimuli based on sight, sound and touch. The results were startling. Although they supported his conclusions derived from animal experiments, they were in sharp contrast with earlier human work, presumably due to ambiguity in the tests. He demonstrated that the left hemisphere specialises in



Sperry

analytical abilities such as logical thought process, speech, language, and writing. The mute or dumb right brain, earlier regarded as subservient to the more aggressive left half on account of its supposed inability to process verbal communication, specialises in emotions, spatial relations, appreciation of arts and music and indeed looks at the world outside in a holistic perspective. To give an illustration of the kind of tests Sperry carried out, a blind-folded subject is asked to pick up an object from an assorted set—consisting, say, of a pencil, a comb, a cigarette, and a bunch of keys, with his left hand. The patient knows from the 'feel' but cannot communicate verbally as to what the object is, since this perception from the left hand through touch goes to the 'mute' right brain. However, if the subject is permitted to use his right hand to get a 'feel' of the object or allowed to jingle out an object (assuming it is a keybunch giving out sound) he can then readily say what the object is.

Although the Nobel citation refers only to the work on split-brain human subjects, any tribute to Sperry will remain incomplete if one does not mention his fundamental contribution in developmental neurobiology. Working on the regeneration of optic nerves in amphibians and fish, he probed into the question as to what guides the growing axons (the nerve fibre or a process of a neuron) to reach their right destination in the brain. His theory of chemospecificity, although yet to be substantiated, continues to play a provocative role in stimulating experimental investigations.

The other half of the prize has been shared by Hubel and Wiesel, both of the Harvard Medical School, for their work on the organisation of the visual system. Hubel is George Packer Berry Professor of neurobiology. A Canadian by birth, he received his MD degree at the McGill University, Montreal, followed by studies on clinical neurology at the Montreal Neurological Institute. He migrated to the USA in 1954, and, after a brief association with the Johns Hopkins School of Medicine and the Walter Reed Army Institute of Research, he moved to the Harvard Medical School in 1960. Wiesel, Swedish by birth, obtained his MD from the Karolinska Institute, Stockholm. He joined the Harvard Medical School in 1959, and is presently Robert Winthrop Professor and chairman of the Department of Neurobiology there.

The peripheral location of the eye with its functional components—retinal cells and the optic nerve—is readily accessible, and the ease with which it can be subjected to a wide variety of light stimuli have made the visual system a versatile model for neurobiological investigations. Most neurophysiological studies until the early fifties were confined to the 'fish level' of organisation. A general principle that emerged from these investigations was that cells respond to contrast at the edges of a high bar or to onset and cessation of the stimuli. Further, symmetrical receptor fields, comprising light spots of definite sizes, can be assigned to ganglion cells in the retina. Studies on

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