Vernon B. Mountcastle

(1918–2015)

Discoverer of the repeating organization of neurons in the mammalian cortex.

Vernon Benjamin Mountcastle pioneered the study of the physiological properties of single neurons in anaesthetized and awake animals. In so doing, he discovered the columnar organization of a part of the mammalian brain known as the neocortex. His groundbreaking investigations of the neural mechanisms of attention and action led to our modern understanding of how information is represented and processed in the cortex.

Mountcastle, who died on 11 January, was born in 1918 in Shelbyville, Kentucky. When he was three years old his family moved to Virginia, which was always 'home' for him. He was proud to trace his ancestry back to Pocahontas, daughter of the Native American chief Powhatan. His paternal grandfather fought in the American Civil War and survived an operation conducted by his own brothers to remove a bullet. Following in this family tradition, Mountcastle trained at Johns Hopkins School of Medicine in Baltimore, Maryland. After graduating in 1942, Mountcastle served as a physician in the US Navy Amphibious Forces during the Second World War.

He had two diplomatic successes after demobilizing in 1946: a schoolteacher named Nancy Clayton Pierpont agreed to marry him, and the neurophysiologist Philip Bard agreed to take him on as a researcher in the department of physiology at Hopkins, despite his never having done an experiment. Mountcastle was motivated by what he called "the expectation of excellence" — others' assumption that he was a better investigator than he thought he was. In the collegial environment of Hopkins, he flourished.

Mountcastle wanted to understand how the information from the sensory receptors in the skin and joints is represented in the mammalian brain. He used a microelectrode to record the responses of one neuron after another in the grey matter of the primary sensory cortex in anaesthetized cats. He discovered that any given neuron responded to only one of three types of stimulus: light touch, pressure or joint movement. These different functional types of neuron, he found, were segregated in a vertical organization, which he called a cortical 'column'. This high degree of order was unexpected. It led Mountcastle to develop the now widely accepted idea that the neocortex is built of repeated units of the same 'canonical' local circuit — the elementary unit of cortical function.

JOHNS HOPKINS MEDICINE

He published a landmark paper describing these discoveries in the *Journal of Neurophysiology* in 1957. This was quickly followed in 1959 by four papers co-authored with Tom Powell, an anatomist at the University of Oxford, UK, showing that the macaque monkey cortex had a similar organization. Mountcastle's discoveries alerted his neighbours at Hopkins, David Hubel and Torsten Wiesel, to look for columns in the primary visual cortices of cats and monkeys, which they found a few years later.

Once Mountcastle had established the existence of cortical columns, the stage was set for him to link the properties of single neurons to perception. He knew that tactile sensation is more acute when a finger is moved over a surface than when it is held motionless against one. Throughout the 1960s, he and his many postdocs explored how the transient and sustained signals sent from the sensory nerves of the hand are processed in human and monkey brains. Mountcastle concluded that our experience of touch is determined mostly by the properties of the peripheral nerves, which are relayed with surprisingly high fidelity to the primary sensory cortex.

In the early 1970s, with the help of neuroscientist Edward Evarts at the US National Institute of Mental Health in Bethesda, Marlyand, Mountcastle learned to record from awake monkeys. During one experiment on the primary sensory cortex, he became so exasperated when the monkey's focus of attention seemed to have no influence on a neuron's activity that he spontaneously moved the microelectrode to a nearby region known as the parietal cortex. Suddenly he saw what he had been hoping for — the activity of the neurons depended on whether the monkey attended to the stimulus.

Mountcastle's fortuitous discovery sparked a new field of research on cortical mechanisms of directed attention, spatial perception and action. It also gave him insights into the syndrome in which damage to the right parietal lobe alters a person's perception of space and leads them to neglect the left side of their body and the surrounding space.

Vernon's commitment to his experiments remained undiminished throughout his career — even after becoming director of the Hopkins physiology department in 1964 and accumulating numerous chief editorships for, among others, the *Journal of Neurophysiology* and the textbook *Medical Physiology*. In 1969, he was elected president of the newly formed Society for Neuroscience.

Vernon said that with the help of his administrator, Mary Hilda Counselman, he could clear his desk by 9 a.m. and head for the laboratory. He regarded any neuroscientist who worked less than 60 hours a week as a 'part-timer', but as an old-school physiologist, he did not leave his assistants to do his experiments for him. Fledgling scientists found him "fierce — but very kind" and experienced the same "strong pull from above" that he said he had felt from his own mentors.

A reviewer of one of Vernon's books once opined that he was "a narrow-minded master". Eric Kandel, a Nobel prizewinner in medicine, replied aptly to such criticism of Vernon's monumental contribution: "You are right, it does not apply to the kidney or the spleen … It only helps to explain the workings of the mind." ■

Kevan Martin *is co-director of the Institute of NeuroInformatics at the University of Zurich and the Swiss Federal Institute of Technology Zurich, Switzerland.*
e-mail: kevan@ini.uzh.ch