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Stalwarts: Wilder Penfield

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Abstract

Wilder Penfeild, professor of neurology and neurosurgery at MC gill revolutionised our understanding of human brain .He was most famous for his experiments where he stimulated the brain of patients who had part of their skull removed during surgery, the Montreal procedure that allowed patients to remain awake during surgery. He recorded experiential responses, hallucinations, illusions, dejavu phenomena and interpretive responses.

He used information gained during this operations to create functional maps called homunculus. He also mapped primary sensory area, motor area, speech area and primary visual area .He also found the physical basis of memory. He was instrumental in construction of Montreal Neurological Institute as per his vision to create an institute where clinicians from different disciplines interact. Penfeild dissector, neurosurgical technique that produces less meningocerebral scar remains in regular use till date. The pioneering clinician and researcher is celebrated nationally and internationally for his miraculous experiments. He was known for his deep integrity and humanity among his colleagues and patients.

Penfeild devoted his thinking to understand whether there was any scientific basis for existence of the human soul.

Introduction

Biography

Wilder Penfeild– was born in Spokane, Washington and spent his youth in Hudson, Wisconsin. Penfeild went to Princeton University. He decided to pursue medicine. He looked forward to beginning his medical education at Oxford. He then devoted the year after graduation to earning money by coaching the Princeton freshman football team and teaching at Galahad school.[1]

In the middle of the year, he received word that the Rhodes scholarship is awarded to him. He was accepted for admission to Merton College which granted him special permission to defer his entrance to fulfil an agreement to coach the Princeton varsity football team.

Wilder Penfield later was a surgical intern at the Peter Bringham hospital as both apprentice and assistant to Harvey Cushing, one of the most gifted brain surgeons in United States.

At Oxford he was influenced strongly by Dr. Charles Sherrington and William Osler. After two years in Oxford, he entered Johns Hopkins medical school and received his M.D. in 1918. During his postgraduate years in Oxford and London, he turned from neurophysiology toward neurosurgery because he believed that neurosurgery could lay bare the living human brain to study and provided a means to influence the brains physiological activity. He began to dream of an institute where neurologists, neurosurgeons and neuropathologists would work together as a team, in a manner similar to that of his football team which he used to coach.[2] He was able to realise this dream in Montreal Canada. He joined as medical faculty in MC Gill University in 1928. A few years after his arrival in Montreal he was called upon to remove a tumour from the brain of his sister Ruth. Finding it malignant, he performed radical operations that most neurosurgeons would not dare to attempt. His application to Rockfeller foundation resulted him a grant of money and the opening in 1934 of the Montreal institute of neurology. While treating 1132 patients during his directorship, he perfected the surgical operation for severe epilepsy and observed directly the living brain and mapped responses to electrical stimulation of speech cortex and interpretative cortex.

Contributions to Neurology and Psychiatry

Results of temporal lobe stimulation and observations on temporal lobe epilepsy are described in his book 'Epilepsy and functional anatomy of human brain' (1954). He called hallucinations produced by epilepsy as experiential hallucinations. The term Experiential was used as these hallucinations were recognised by the subject as past experiences. In his studies Penfield reported that while temporal lobe was stimulated with electrodes subjects would recall dreams, combination of visual and auditory hallucinations, out of body experiences, dream and memory recollections. Responses were integrated with sound, memory, movement and colour, distinct from usual memory, unremembered in usual circumstances. The memories were understood as something that happened at that point in time and were felt with its accompanying emotions and sensations. These Penfield called interpretive responses. Stimulating same areas, exact same memory popped up, such as a certain song or the view from a childhood window. A physical basis of memory engram was found. Other stimulations had patients experiencing dejavu, loneliness, fear.[3]

Penfield devoted a lot of his thinking to mental processes including contemplation of whether there was any scientific basis for existence of human soul.

Another major contribution is the understanding of chronic pain. As is known, Pain is a highly subjective matter and extremely difficult to quantify. For example, it has always been difficult to specify just how much chronic pain can be associated with a given lesion. Assessing the degree to which emotional factors are intensifying the patient's complaints is also

complicated. Patients with chronic pain are not motivated to give personal and family history owing to their ignorance. Wilder Penfields experiments could not find any particular area for pain like he found the primary visual cortex. This wisdom helped in evaluation of psychosocial factors in management of chronic pain.[4]

He developed his surgical techniques under Allen O Whipple and organised and pursued research in neurocytology. His research in 1924 provided him metallic staining techniques that yielded new information on glia. In 1928, he learned from German surgeon Otfrid Foerster, the method of excising brain scars to relieve focal epilepsy. Penfield s fascination with brain led to research into tumors, brain scars and various forms of epilepsy. He made important gains in the surgical treatment of focal epilepsy. In doing so he began to map the brain and determine which functions of the body were controlled by which brain segment.

Penfields maps showed considerable overlap between regions (the motor region controlling hand muscles sometimes also controlled upper arm and shoulder muscles) due to fractured somatotrophy of motor cortex. From these results he developed his cortical homunculus map, which is how the brain sees the body from an inside perspective. Penfield through his mapping discovered the sources of memory and dreams. Some of the modern theories of separate functions of two cerebral hemispheres were built up on his findings.[7] His concept of centrencephalic seizures arising from deep midline portions of brain had an important impact on the understanding of relationship between brain structure and consciousness. Under Penfields director ship research at Montreal Neurological institute has led to improved surgical and nursing techniques for management of spinal lesions and development of EEG to treat epilepsy. Penfield was widely known for promoting early second language training. In 1959 Penfield observed that complete recovery of language ability after brain damage was possible in children but not in adults. According to Penfield acquiring a second language beyond the age of 10 years becomes very difficult.[5]

Penfields contributions to neurosurgery

Penfield dissector, neurosurgical technique that produced less injurious meningocerebral scar, became widely accepted in field of neurosurgery and remains in regular use.[9]

Wilder penfeild and Eric Berne: Penfield's research and findings impacted the development of transactional analysis. Penfield's experiments focused on the application of electrical currents to specific regions of the brain. Penfeild discovered that applying current to temporal lobe of live and alert patients would stimulate meaningful memories. These were not only vivid images but also feelings and emotions associated with events.

Penfeild's key conclusions that went on to influence Berne in his transactional analysis include: Human brain acts in many ways like a camera recording events. These can't be consciously recollected but the event always existed in the brain. Both the event and the feelings experienced during the event are stored in the brain, locked together neither one recalled without the other.

When individual replays his / her experiences, he or she can replay them in such vivid form that the individual re-experiences the same emotion he / she felt during the actual experience.

Individuals are able to exist in two states simultaneously. Individuals replaying their memories are able to experience the emotions associated with those events, but they are also able to objectively talk about the events at the same time

These contributions by Penfeild deeply influenced Berne while developing his theories on transactional analysis.[8]

Honors

He was the President of Royal College of Physicians and Surgeons of Canada and of American Neurological Association.

He was also a fellow of the Prestigious Royal Society of London and twenty five other scientific and professional organisations.

He received honorary degrees from many universities including those from Princeton, Oxford, Mc gill and Montreal. He was elected fellow of royal society (FRS) in 1943 and in 1953 was appointed to the Order of Merit, taking the place left vacant by the death of his former master Sir Charles Sherrington.

In 1967 he was appointed Companion of the Order of Canada.[10]

Awards

He was awarded half a dozen prizes at Montreal institute and abroad and was the first recipient of fifty thousand pounds, Royal Bank Centennial Award.

He was also awarded the United States Medal of Freedom, crosses of the French Legion of Honor and the Greek legion of George and British order of merit, which is conferred on only 24 living persons

Publications

Penfield in his 'The Cerebral cortex of man' summarises the results of mapping as principal motor sensory areas of cortex, delineation of a new supplementary motor area and a second sensory area.

In collaboration with Professor Herbert Jaspers he wrote 'Epilepsy and the Functional Anatomy of the Brain' published in 1954. This was but one of the many important books and articles he wrote on his specialty.

He visited Princeton to deliver the vanuxem lectures later published by Princeton university press as 'Speech and Brain Mechanisms'.

He completely rewrote his late mother's novel 'Story of Sari' which was published under the title 'No Other Gods'.

The same year he published 'The Torch' a biographical novel about Hippocrates.

Three years later at age of 72 he brought out 'The Second Career' a collection of essays and addresses reflecting his myriad interests and encouraging others to use retirement for the development of a new career.

His other major books are the 'The difficulty of giving' a biography of Alan Gregg, Director of Medical sciences division of Rockfeller foundation, "Man and his family" reflecting another facet of second career.

In 1974, when he was 83, he completed and dedicated to sir Charles Sherrington "The mystery of mind" published in Princeton press in 1975. This was an account for laymen on brain research where he set out the relationship between human brain and human mind.

Three weeks before death at the age of 85 he completed the draft of his autobiography "No Man Alone" emphasizing on team approach to neurological research. It was published in 1977 as his final work and was dedicated with affection and gratitude to the memory of his mother.[11]

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