

Aphasia Insights!

Wilder G. Penfield: *The Cartographer of the Cerebral Cortex.*

By Tom Broussard, Ph.D.

This is the next in a series of articles about the science/scientists behind stroke, aphasia, and recovery.

Wilder Graves Penfield, OM CC CMG FRS was born in Spokane,

Washington and died in Montreal, Quebec, Canada, (1/26/1891-4/5/1976) at 85 years old. He was an American-Canadian neurosurgeon who mapped various areas of the brain to investigate their functions.

He grew up in Wisconsin, graduated from Princeton University in 1913 and obtained a Rhodes Scholarship to Merton College, Oxford in 1915. He studied neuropathology under Sir Charles Scott Sherrington and Sir William Osler, a renowned Canadian physician and one of the founders of Johns Hopkins Hospital. Osler was often described as the Father of Modern Medicine, and as Penfield acknowledged, “makes me, mentally, worship him” (Lewis, 1981, pp 52).

At the end of his first term at Merton, Penfield went to France on break where he worked as a soon-to-be doctor in a military hospital outside of

Paris, “doing the work of a sure-enough doctor who has gone up to the front” (Lewis, 1981, pp 59). While traveling by ferry back to school in March 1916, his ship, the SS Sussex, was torpedoed resulting in him being badly wounded. He had been standing on the deck above the point where the torpedo exploded and the entire bow was destroyed in the attack (picture).

After 18 months in England, he was accepted to Johns Hopkins School of Medicine and graduated with his medical degree in 1918. He returned to Merton College in 1919 and spent two more years completing his Rhodes Scholarship studies. He then returned to America

only to discover that he needed to learn more tools, taking him back to Europe, this time to Spain.

Wilder wrote to his mother, “The changes in the brain itself I did not understand and have only begun to study. I can get no farther until I learn something about neuroglia cells in Madrid--and here we are in mid-Ocean. --and where are we going as far as the future is concerned?” (Lewis, 1981, pp 96).

His letter continued, “I’ve done nothing but prepare and still I am preparing. I do not see the way toward ... any worthwhile problems and so I go on trying to learn, hoping the method will become apparent. ...and still reaching out for new



**Wilder G. Penfield
(1891-1976)**

April 2023
Volume 5, Issue 06
April 11, 2023

“The material used by William James in his reasoning was psychological or philosophical, rather than neurophysiological. The ‘stream of consciousness,’ he said, ‘is a river, forever flowing through a man’s conscious waking hours. **”

“** As an undergraduate, majoring in philosophy at Princeton, I was much impressed by my reading of William James’s *The Principles of Psychology*. That was, I suppose, the beginning of my curiosity about the brain and the mind of man” (Penfield, 1975, pp. 49).

Penfield, Wilder. *Mystery of the Mind: A Critical Study of Consciousness and the Human Brain*. Princeton University Press, Princeton, New Jersey, 1975.

Aphasia Nation, Inc. is committed to educating the wider public about stroke and aphasia and the “*Aim High for Aphasia!*” international Aphasia Awareness campaign.

Stroke Educator, Inc.
4 Aspen Drive
Brunswick, ME 04011
207-798-1449
tbroussa@comcast.net
www.strokeeducator.com
www.aphasianation.org
FB: DrTomBroussard
FB: StrokeEducatorInc
FB: AphasiaNationInc

weapons.... Anyway, our bridges are burned Only by finding it shall I succeed” (Lewis, 1981, pp 96).

In order to see how the brain cells appear at the cellular level, he needed to learn the silver and gold impregnation technique. He visited the world-renowned neuroscientist, Santiago Ramon y Cajal in Madrid and worked for five months with Pío del Río Hortega, a disciple of Cajal’s, studying a certain type of glial cells (Rapport, 2005).

Next, Penfield learned how to use anesthesia to keep brain surgery patients awake, and worked with famed neurosurgeon Dr. Otrfid Foerster for six months in Breslau, Germany (Penfield, 1977).

After all of his “preparing”, Penfield moved to Montreal to teach at McGill University and work as the city's first neurosurgeon, at Royal Victoria Hospital. For the next ten years he treated people with epilepsy and mapped the brain over the course of his 163 operations (Penfield, Boldrey, 1937, pp. 389).

Before starting each operation, Penfield would stimulate the brain with electrical probes while the patients were conscious to measure their responses. In this way, he could target and limit the areas of the brain responsible for seizures while destroying as little of the surrounding brain matter as possible. He and his colleagues called it the "Montréal Procedure" (Ladino et al, 2018).

Penfield continued to refine his procedure and was constantly “tinkering” with his patient’s “brain mechanism” (Penfield, 1975). In one operation, he realized that the area of

the epilepsy was very close to the Broca’s area and “in order to avoid the danger of producing permanent aphasia, I undertook to map out the exact position of his speech area. We have found that a gentle electrical current interferes with the function of the speech mechanism” (Penfield, 1975, pp. 51).

While the patient is still conscious, aware and able to communicate, Penfield “touches the cortex with a stimulating electrode and, since the brain is not sensitive, the patient does not realize that this has made him aphasiac until he tries to speak, or to understand speech, and is unable to do so” (Penfield, 1975, pp. 51).

It wasn’t until the mapping was done when Penfield remarked, “removed my interfering electrode from the cortex, he explained the whole experience with a feeling of relief, using words that were appropriate to his thoughts” (Penfield, 1975, pp. 53).

As a result of his work, Penfield developed a *homunculus* (in Latin, ‘little man’), a model of the neural representation in proportion to the parts of the body, based on a "map" of the areas of the motor and sensory functions.



© Can Stock Photo / shumpc

He spent half his life pursuing and acquiring the tools needed to map the ancient arborization of the brain and became the cartographer of the cerebral cortex (Snyder & Whitaker, 2013).

Signed: *The Johnny Appleseed of Aphasia Awareness*



Penfield’s cross-channel ferry "Sussex" at Boulogne in 1916, showing the effect of torpedo attack by the German U-boat UB-29. Public domain.

The author is a three-time stroke survivor and aphasia. He could not read, write or speak well and it took him years to recover.

He is Founder and President, Aphasia Nation, Inc., a non-profit organization whose mission is educating the wider public, national and international, about aphasia and plasticity, the foundation of all learning.

- Ladino D, Rizvi S, Tellez-Zenteno J. The Montreal procedure: The legacy of the great Wilder Penfield. *Epilepsy & Behavior*, Vol. 83, June 2018, Pages 151-161.
- Lewis, Jefferson. *Something Hidden, A Biography of Wilder Penfield*. Doubleday Canada Limited, Toronto, Ontario, 1981.
- Penfield W, Boldrey E. Somatic motor and sensory representation in the cerebral cortex of man as studied by electrical stimulation. *Brain*, Volume 60, Issue 4, 1 December 1937, pp. 389-443.
- Penfield, Wilder. *Mystery of the Mind: A Critical Study of Consciousness and the Human Brain*. Princeton University Press, Princeton, New Jersey, 1975.
- Penfield, Wilder. *No Man Alone: A Neurosurgeon's Life*. Little, Brown & Company, Boston/Toronto, 1977. (Foreword by Lord Adrian).
- Rapport, Richard. *Nerve Endings, The Discovery of the Synapse*. W.W. Norton & Company, New York, London (2005).
- Snyder P, Whitaker H. Neurologic Heuristics and Artistic Whimsy: The Cerebral Cartography of Wilder Penfield. *Journal of the History of the Neurosciences*, Vol. 22, 2013-Issue 3, pp 277-291.

