Researchers say they resolved century-old argument about brain

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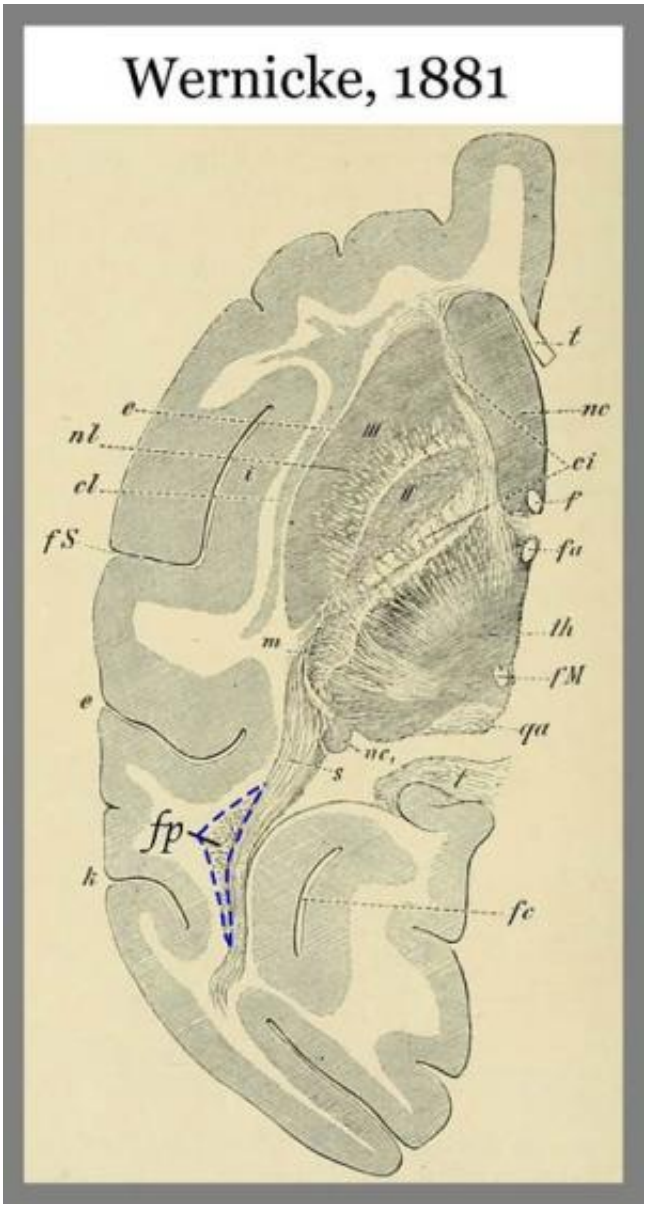

Whether the vertical occipital fasciculus, a fiber bundle outlined by the dashed

blue line, exists has been a matter of some controversy. Credit: Courtesy of PNAS

What started a few years ago as a brain-imaging study turned into a scientific mystery that eventually ended in the basement of the Lane Medical Library, within the pages of a book first published in 1881 and last checked out in 1912.

That journey, described in a paper published online Nov. 17 in the *Proceedings of the National Academy of Sciences*, revealed the long and contentious history of an otherwise innocuous tract of nerve fibers of the visual system, running from just below to just above the ear. It also revealed the many ways scientific knowledge has been gained and lost over the centuries, and in some cases written out of history through a combination of scientific in-fighting or poor record-keeping.

The journey began when Jason Yeatman, co-lead author of the paper, was carrying out brain-imaging studies to better understand how kids learn to read. Yeatman, then a graduate student in the lab of Brian Wandell, PhD, professor of psychology, noticed that all the brain images in his study contained a structure that he couldn't find in any texts.

Had he discovered a new brain pathway?

Driven by curiosity

Kevin Weiner, PhD, a postdoctoral scholar and the paper's other lead author, had been working with Yeatman on the imaging studies. Weiner, who is in the lab of Kalanit Grill-Spector, PhD, associate professor of psychology, said that he had long been interested in science history, and this mystery piqued his interest.

"Jason and I decided for our own curiosity to understand what happened to this pathway," Weiner said.

A few things could have led to brain structures being discovered and forgotten. In the late 1800s and early 1900s, Weiner had learned, the roughly 30,000 names of brain structures in various languages were consolidated into a list of 4,500 as part of an effort to create a universal nomenclature. "In trying to make it easier to remember names, some got written out of history," Weiner said.

In this case, consolidation wasn't the reason for the region's disappearance from the literature. The region was the source of controversy between its discoverer—Carl Wernicke, a German neuropsychiatrist—and Theodor Meynert, a German-Austrian neuroanatomist and psychiatrist.

Meynert strongly believed that all of the brain's association pathways ran from front to back—horizontally. But the pathway in question, which Wernicke had called the vertical occipital fasciculus, ran vertically. Although Yeatman and Weiner found references to the VOF under a variety of different names in texts published for about 30 years after Wernicke's original discovery, Meynert never accepted the VOF, and references to it became contentious before largely disappearing from the literature entirely over the next century.

Into the archives

Although the VOF disappeared, Wernicke's publication of its discovery still existed in the archives of the School of Medicine's Lane Library, where Yeatman and Weiner eventually tracked it down.

"That was a really cool experience that most people don't have any more, when you have to check your belongings at the door because the book

you are about to look at is worth thousands of dollars per page," Weiner said. "You are literally smelling 100-year-old ink as you find the images you have been searching for."

Yeatman said the journey gave him an education in early neuroscience research. "There are a lot of gems in the literature that have been forgotten over the years," he said. "This project made me appreciate the detail and precision of these classic pieces of work."

Reproducible science

Both Yeatman and Wandell said this work also highlights the value of modern techniques for reproducing results. No longer can a field simply disregard findings that don't fit a prevailing idea. "Now we can record our methodologies and software algorithms to be distributed with our papers, allowing any researcher in the world to reproduce our results," Yeatman said. And indeed, the researchers concluded that the VOF exists and is functionally important.

"The library material was hard to find and required someone with passion for the effort," said Wandell, the paper's senior author and the Isaac and Madeline Stein Family Professor. "Modern tools should help with sharing, transparency and reproducibility of research, and hopefully what we relearned won't be forgotten."

The idea of sharing data to speed scientific progress is a cause Wandell has championed at the Center for Cognitive and Neurobiological Imaging, which he directs, and that he has been promoting in his work helping the Stanford Neurosciences Institute plan the computing strategy for its new facility.

With shared data and labs worldwide attempting to reproduce published results, the teams said it is less likely that modern neuroscience findings

today will be lost due to differences of opinion over a discovery's relevance.

Other Stanford co-authors of the paper are postdoctoral scholars Ariel Rokem, PhD, and Aviv Mezer, PhD; and former research associate Franco Pestilli, PhD.

The brain imaging that resulted in the rediscovery of the earlier work was funded by the National Science Foundation and the National Institutes of Health.

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