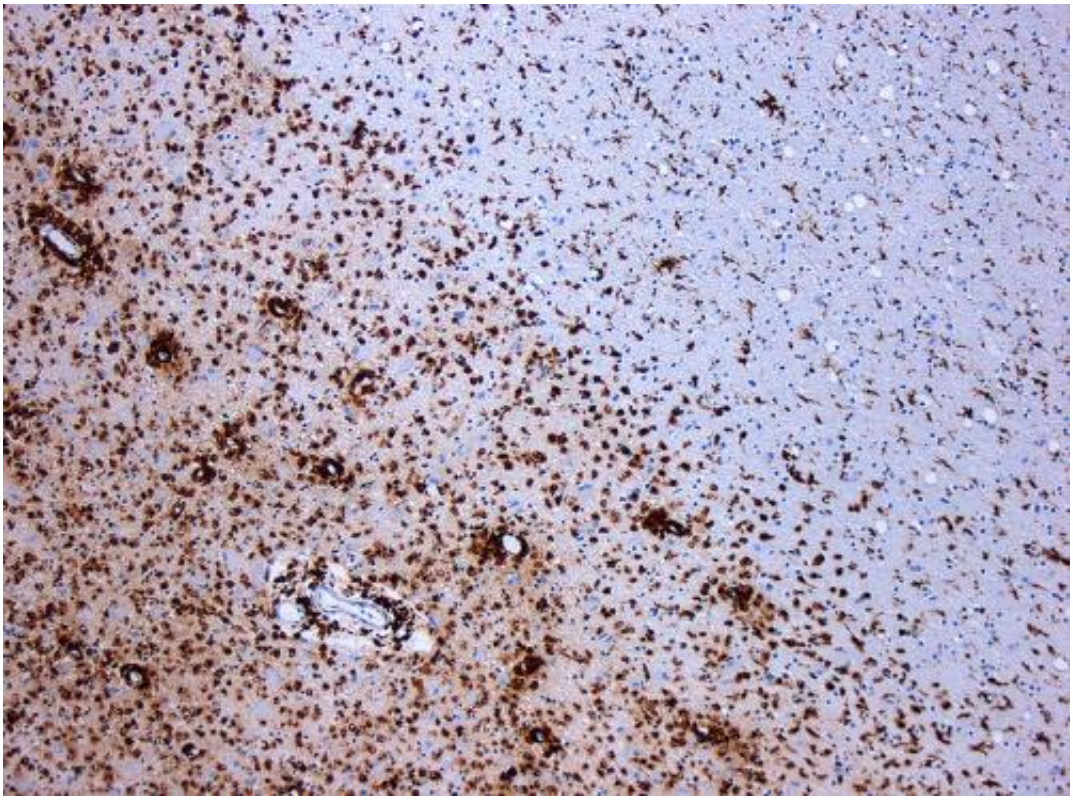
# Brain scientists discover why cognitive speed slows in MS patients

September 11 2015, by Emily Bywaters



Demyelination by MS. The CD68 colored tissue shows several macrophages in the area of the lesion. Original scale 1:100. Credit: CC BY-SA 3.0 Marvin 101/Wikipedia

In the first study of its kind, researchers at the Center for BrainHealth at The University of Texas at Dallas and UT Southwestern Medical Center found that individuals with multiple sclerosis (MS) have decreased

connectivity between key regions of the brain, slowing their cognitive speed and leading to impairments in concentration, attention, memory and judgment.

The new findings were published in *Neuropsychology*. An estimated 2.3 million individuals have multiple sclerosis worldwide, and approximately half of them experience changes in cognition. The researchers believe that the diminished connectivity is likely the result of decreased white matter surrounding the neurons in the brain.

"Our study is the first to really zero in on the physiology of cognitive speed, the central cognitive deficit in MS," said Dr. Bart Rypma, Center for BrainHealth principal investigator, who also holds the Meadows Foundation Chair at UT Dallas. "While white matter is essential to efficient network communication, white matter degradation is symptomatic of MS. This study really highlights how tightly coupled connectivity is to performance and illuminates the larger, emerging picture of white matter's importance in human cognitive performance."

In the study, MS patients, compared to non-MS individuals, showed weaker brain connections between the dorsolateral prefrontal cortex, which is responsible for executing goal-directed thought and action, and posterior brain regions, which carry out tasks related to cognitive speed, such as visual processing, motor execution and object recognition.

Researchers, collaborating with Dr. Elliot Frohman, director of the multiple sclerosis program and clinical center at UT Southwestern, recruited 29 participants with relapsing-remitting MS and 23 non-MS patients. Participants underwent functional magnetic resonance imaging (fMRI) while completing a test of cognitive processing speed.

Participants were given four seconds to view a nine-item key of number and symbol pairs (for example '+' above the number 3) and one number-

symbol pair probe. Participants were asked to indicate whether the probe appeared in the key.

While accuracy was similar for both groups, response times for MS patients were much slower. Analysis of the fMRI data revealed that while completing this measure, MS patients showed weaker functional connections with the dorsolateral prefrontal cortex.

"These findings reveal a diffuse pattern of disconnectivity with executive areas of the brain," said Nicholas Hubbard, the study's lead author and a doctoral candidate at the Center for BrainHealth working with Rypma.

"Importantly, these decreases in connectivity predicted MS-related cognitive slowing both in and out of the fMRI environment suggesting that these results were not specific to our task, but rather were able to generalize to other situations where cognitive speed is required."

The research supports the need for therapies that target white matter structures and white matter proliferation. Rypma and Hubbard are further exploring the physiology of white matter to better understand cognitive speed reductions not only in MS patients, but also in healthy aging individuals.

Provided by University of Texas at Dallas

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