Investigating the Dynamics Underlying Memory and Cognitive Control

Elizabeth Johnson, PhD, assistant professor of Medical Social Sciences and Pediatrics

Elizabeth Johnson, PhD, is a faculty member and director of Feinberg's Dynamic Brain Laboratory. Her research aims to uncover the brain dynamics underlying memory and cognitive control with the ultimate goal of advancing basic science and improving people's quality of life.

What are your research interests?
We're interested in the brain dynamics that support memory and cognitive control across the human lifespan. Research in our lab combines cognitive psychology with advanced neuroscientific techniques, including intracranial (invasive) and scalp (noninvasive) EEG, structural neuroimaging, electrical stimulation and eye tracking. Our research is organized into three overlapping areas: neural mechanisms of cognition, cognitive performance enhancement and development and aging. Findings inform models of cognition across the lifespan and translate to better quality of life by revealing how, and in whom, decline may be prevented or remediated.

What is the ultimate goal of your research?
I am a scientist out of sheer curiosity, yet the ultimate goal of our research is translational. If we ever understand how the brain supports cognition, we should be able to fix it when it breaks.

How did you become interested in this area of research?
Most of us have known someone who has lost memory function, say, from head trauma, stroke or dementia. Loss of function makes clear how integral memory is to our daily functioning and sense of self. I have long wondered how this organ in our heads enables impressive feats of thinking such as memory.

How is your research funded?
Our lab is funded by grants from the National Institutes of Health BRAIN Initiative and National Institute of Mental Health, and startup funds from the Department of Medical Social Sciences.

Where have you recently published papers?
We publish in neuroscience, biology, and general journals. This year, we published two papers each in *Current Biology* and *NeuroImage*.

What types of collaborations are you engaged in across campus (and beyond)?
Collaboration is critical to our research. We are privileged to conduct research with neurosurgical patients who let us look directly into their brains, and this is made possible by a network of clinical collaborators. At Northwestern, we work with Stephan Schuele, MD, MPH, and Joshua Rosenow, MD. We also launched an innovative pediatric research program at Lurie Children's Hospital, where we work with Joyce Wu, MD, Sandi Lam, MD, Jeffrey Raskin, FAANS, FAAP, David Bieber, MD, and Priscilla Duong, PhD. Our team science approach extends beyond Northwestern, where we exchange data and expertise with labs and clinicians at Wayne State University (Noa Ofen and Eishi Asano), the University of California (Robert Knight, Jack Lin, Olivia Kim McManus, Shifteh Sattar and Kurtis Auguste), Washington University in St. Louis (Peter Brunner and Jarod Roland) and Ohio State University (Ammar Shaikhouni). This list is not exhaustive!

Outside the hospital, we've been doing exciting work challenging the status quo with researchers at Brown University (David Badre), Ruhr University Bochum (Nikolai Axmacher), the University of Nevada-Reno (Marian Berryhill) and the University of California-San Francisco (Kevin Jones, Theodore Zanto and Adam Gazzaley). Last, I'd be remiss not to mention Joel Voss, PhD and Rodrigo Braga, PhD, each of whom has been very supportive as we continue to establish our new lab at Feinberg.