

One of the last remaining frontiers in science and medicine is to understand how the human brain functions, both in health and disease. Central to this exploding area of science are new non-invasive tools for imaging the brain. [The Center for Advanced Imaging Research \(CAIR\)](#) began at MUSC in 1995 as a multidisciplinary collaboration of the Departments of Radiology, Neurology and Psychiatry. CAIR serves as a campus-wide resource to facilitate and nurture top quality research that involves advanced imaging technologies. Although this group is largely composed of those interested in the central nervous system, the CAIR serves to promote advanced imaging research of all organs by employing researchers from a variety of disciplines and departments.

Transcranial Magnetic Stimulation

MUSC is particularly well-known for the advances made in combining functional brain imaging with non-invasive brain stimulation, largely using a technology called [Transcranial Magnetic Stimulation \(TMS\)](#). MUSC has been a world leader in combining TMS with functional brain imaging, particularly functional magnetic resonance imaging (fMRI). The use of TMS as a neuroscience tool and a potential treatment has become a mainstream tool for future research and advancement, resulting in review articles featuring this group in Nature and Science within the past year.

Brain Stimulation Laboratory

MUSC also created a clinical translational [Brain Stimulation Laboratory \(BSL\)](#), housed within the Department of Psychiatry and with strong ties to the other clinical neuroscience groups on campus (Neurology, Neurosurgery and Basic Neuroscience). The BSL has been a world leader in developing the potential clinical applications of the stimulation technologies. They have pioneered studies of TMS and Vagus Nerve Stimulation (VNS) in the treatment of depression. They are actively investigating Deep Brain Stimulation (DBS) for the treatment of Parkinson's disease. Finally, they are also investigating whether TMS can improve normal or sleep-deprived cognitive performance.

Brain Imaging Center of Economic Excellence

BICOEE provides an inter-institutional center to foster translational research on brain structure, function, and dysfunction throughout the State of South Carolina. MUSC and the University of South Carolina (USC) are partners in BICOEE, building a world-class brain imaging center and industrial cluster. By bridging together the complementary capabilities in these two universities, a research center in brain imaging will be created that can provide expertise necessary to make MUSC and USC competitive for multi-million dollar federal grants and contracts. This will give the BICOEE the critical mass needed to be the research engine at the center of a technology cluster. This cluster will lead to technological developments in a number of areas of the healthcare industry expected to boom in the near future.

Featured Researcher

[Dr. Mark S. George](#) is a Distinguished Professor of Psychiatry, Radiology and Neurosciences. He is also the director of both CAIR and BSL. Dr. George uses imaging (particularly fMRI) and non-invasive stimulation (TMS or VNS), both separately and in combination, to understand the brain regions involved in emotion regulation in health and disease.

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