

# I AM || IMAGING | AGING | MEMORY



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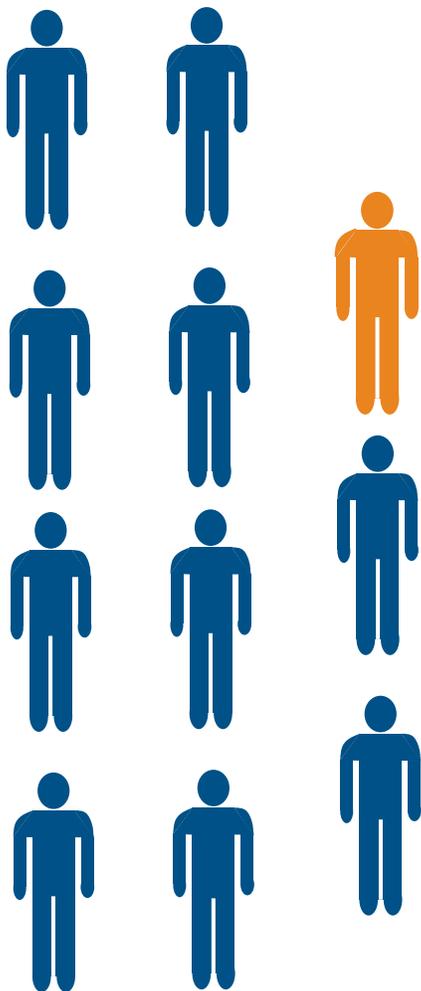


# I AM | IMAGING | AGING | MEMORY

82% OF SENIORS SAY  
IT'S IMPORTANT TO  
HAVE THEIR MEMORY  
CHECKED.

BUT ONLY

16% SAY THEY RECEIVE  
REGULAR COGNITIVE  
ASSESSMENTS



1 IN 11  
MEN

1 IN 6  
WOMEN



ALZHEIMER'S DISEASE  
IS THE 6TH LEADING  
CAUSE OF DEATH IN  
THE U.S.

# ALZHEIMER'S | WHERE WE ARE

*Alzheimer's disease is a degenerative brain disease thought to begin 20 years or more before symptoms arise.*

The small changes that happen in the brain are unnoticeable to the person affected. A person typically lives with Alzheimer's for years before being diagnosed.

Alzheimer's disease affects the nerve cells in the brain that are involved in thinking, learning and memory. When the early changes of Alzheimer's occur, the brain initially compensates for them, enabling individuals to continue to function normally. As the damage to nerve cells continues, the brain can no longer compensate for the changes, and individuals show subtle decline in cognitive function. As time passes, plaques and tangles appear in areas of the brain involved in cognitive function.

**Stages of Alzheimer's Disease:** Current research identifies three stages of Alzheimer's disease: preclinical Alzheimer's disease, mild cognitive impairment (MCI) due to Alzheimer's disease, and dementia

due to Alzheimer's disease. In the last two stages, symptoms are present, but to varying degrees.

## Preclinical Alzheimer's Disease

In this stage individuals have measurable changes in the brain, cerebrospinal fluid and blood that indicate the earliest signs of Alzheimer's disease (biomarkers), but they have not yet developed symptoms such as memory loss.

This stage is our study's area of focus – by identifying Alzheimer's early through biomarkers we can further delay the progress of the disease.

## What is a Biomarker?

A biomarker is a biological factor that can be measured to indicate the presence or absence of a disease, the risk of developing a disease or disease progression. Finding a simple and inexpensive test, such as a blood test, to diagnose Alzheimer's would be ideal for patients, physicians and scientists. Research is underway to develop such a test.

**5.8**  
**MILLION** AMERICANS  
LIVING WITH  
ALZHEIMER'S

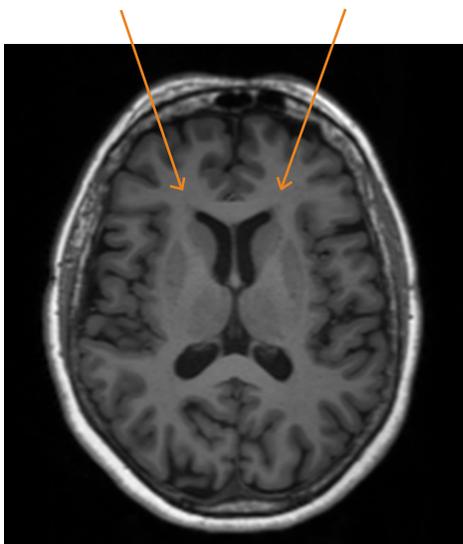
# I AM | EXPLAINED



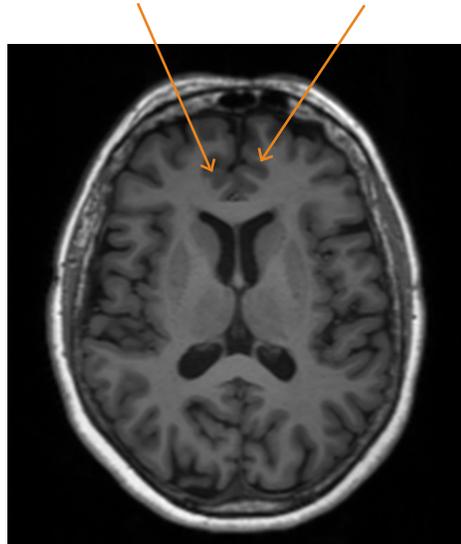
Our research group has expertise in improving the sensitivity with which we can image the degeneration of brain white matter. White matter is a lot like the highways of the brain. These highways connect different parts of the brain and pass information from one part of the brain to another. The better built the highways are, the easier it is to do things and remember things. These connections or highways are called tracts, and each tract will connect different parts of the brain. Changes in white matter naturally occur with age, but these changes worsen early in the course of Alzheimer's disease.

We hope that by developing better imaging technology we will be able to pinpoint where, when, and how these white matter changes result in cognitive decline leading to Alzheimer's disease.

**WHITE MATTER**



**GRAY MATTER**



# I AM || IMAGING | AGING | MEMORY

## Improving MRI Techniques

Here is a sample set of images from one IAM study participant that illustrates how we are improving imaging technology. The connections (also known as “fiber tracts”) are represented in different colors that indicate the directions in which they go: back-to-front (green), top-to-bottom (blue), and left-to-right (pink/red). Here we are looking at fiber tracts at a cross-section of the brain, as if you were looking at the brain from the side.

### Figure A

Is an image created using current state-of-the-art imaging (i.e. Diffusion Tensor Imaging) that estimates what the connections between the different parts of the brain look like. The white arrow highlights the frontal part of the brain.

### Figure B

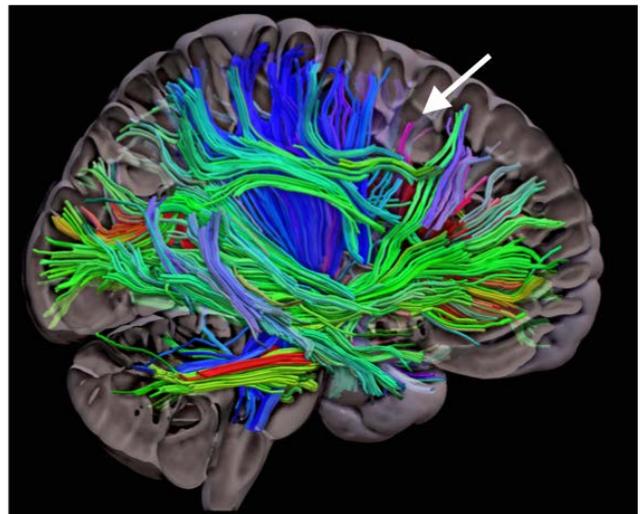
Is an image created using an advanced MRI technique called Fiber Ball Imaging, which was invented by our laboratory. In this figure we are able to show more complex and robust connections in the frontal part of the brain in particular (see white arrow).

### Why does it matter?

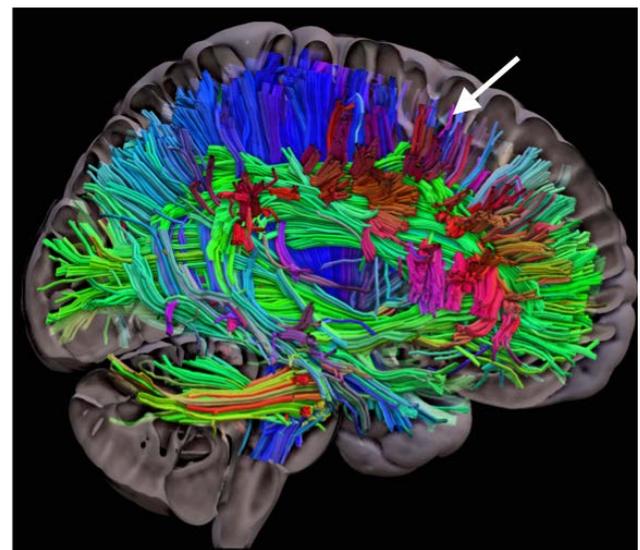
Capturing a better image of this area is important because many important things happen in the frontal part of the brain. Aside from being where lots of complex cognitive processes occur, changes in the

frontal and other parts of the brain occur in normal aging as well as in the earliest stages of Alzheimer’s disease. Using these new and improved tools, we hope to improve our ability to detect changes in these connections much earlier than is currently possible.

## A: DTI



## B: FBI



# I AM | AIMS

## What We Hope:

The Imaging, Aging, and Memory (IAM) study hopes to develop MRI techniques and biomarkers that can help differentiate between a normal aging brain and one deteriorating due to Alzheimer's. This would allow us to detect Alzheimer's at its earliest stages. The project is funded by the National Institutes of Health (NIH) and is only being performed at MUSC.

We have been hard at work recruiting older healthy adults who, by virtue of their age, are at an increased risk for developing Alzheimer's disease. *That is why it is important for us to recruit a higher number of participants over 75 years old.*

*Through our research we hope to:*

- Improve the early detection of Alzheimer's disease using brain MRI.
- Highlight other aspects of how the disease develops.
- Stimulate further research into these and other less-explored causes of Alzheimer's disease in order to find more effective treatments for cognitive decline.

## OUR SISTER STUDY: A.D. CONNECT

Similar to our study, the ADConnect study will use neuroimaging to understand how connections in the brain change in Alzheimer's Disease. These changes will be examined in individuals with Mild Cognitive Impairment (MCI), Alzheimer's Disease (AD), and healthy aging.

**The goal:** To discover which brain changes are present in healthy aging and MCI so that future studies can assess the risk for developing Alzheimer's Disease.

The study involves 4-5 visits to MUSC, including: an initial blood draw to determine eligibility, an MRI, a visit for cognitive testing, a PET scan, and a follow-up visit to repeat cognitive testing and MRI scanning.

If you know anyone diagnosed with Mild Cognitive Impairment (MCI) or Alzheimer's Disease please tell them about this study.

### Contact:

Laura Lohnes  
843-792-7709

For more information on this study!

# I AM | TEAM

Andreana (Anya) Benitez, Ph.D.



*Co-Principal Investigator*

Dr. Benitez is a clinical neuropsychologist who specializes in the dementing diseases of aging. A strong advocate of work-life balance, she is often found exploring the Lowcountry with her family and friends, reading, traveling, or practicing yoga

Joseph Helpern, Ph.D.



*Co-Principal Investigator*

Dr. Helpern has been involved with the development of Magnetic Resonance Imaging (MRI) since the inception of the field focusing mainly in the area of neurodegenerative disorders. As an avid fisherman, his favorite spot is fly-fishing for King Salmon on the Perre Marquette river in Michigan every Fall.

Ericah Kerley



*Study Coordinator*

Ericah is the study coordinator in charge of making sure everything runs smoothly. Her educational background is in health sciences, specifically microbiology and chemistry. She is a Lowcountry native and has worked in research for the last 5 years. She loves cooking and spending time with her family.

Katrina Madden



*Study Coordinator*

Katrina is in charge of study recruitment and scheduling. With an educational background in chemistry and business, she has a passion for the fields of science and marketing. She has been a resident of the Lowcountry for over 20 years but was born and raised in Colorado. She is a mountain girl at heart.

Emmi Scott, Ph.D.



*Post - Doctoral Fellow*

Emmi obtained her Ph.D. from East Carolina University and completed a predoctoral internship in neurorehabilitation psychology at Mount Sinai Hospital in New York, NY prior to joining MUSC. She sees patients clinically in the Cognitive & Behavioral Neurology and Movement Disorders programs and is involved in research focused on identifying early biomarkers of neurodegenerative diseases.

Siddhartha (Sid) Dhiman



*Data Manager*

Sid is a Singapore native with an academic background in biomedical engineering. Sid manages all 0's and 1's of data, as well as processing of dMRI scans. Deep learning, advancing computational genomics, music and video games are some of his hobbies.



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## THE MEDICAL UNIVERSITY OF SOUTH CAROLINA

Founded in 1824 in Charleston, The Medical University of South Carolina is the oldest medical school in the South. Today, MUSC continues the tradition of excellence in education, research, and patient care. MUSC educates and trains more than 3,000 students and residents, and has nearly 13,000 employees, including approximately 1,500 faculty members. As the largest non-federal employer in Charleston, the university and its affiliates have collective annual budgets in excess of \$2.2 billion. MUSC operates a 750-bed medical center, which includes a nationally recognized Children's Hospital, the Ashley River Tower (cardiovascular, digestive disease, and surgical oncology), Hollings Cancer Center (one of 68 National Cancer Institute designated centers), Level I Trauma Center and Institute of Psychiatry.

Changing What's Possible