Brain morphology, cognition, and Beta amyloid in older adults with superior memory performance

Tessa Harrison is a postdoctoral fellow in the lab who is interested in unusually successful cognitive aging trajectories and the avoidance of normal age-related brain changes. Her recent paper, “Brain morphology, cognition, and B-amyloid in older adults with superior memory performance” was published in Neurobiology of Aging in July of 2018.

While cognitive decline is a common feature of normal aging, aging trajectories vary widely across individuals. In fact, some older adults who avoid cognitive decline are able to perform similarly to much younger individuals on neuropsychological tests. The goal of Tessa’s study was to better understand the underlying factors that contribute to these individuals’ unusually successful aging patterns.

Tessa’s study included participants enrolled in the Berkeley Aging Cohort Study (BACS). In order to investigate the underlying mechanisms of successful aging, she divided participants into two groups based on their scores on a neuropsychological memory test. Participants with superior memory performance were labeled successful agers (SA), and those with typical performance were labeled typical older adults (TOA). Next, Tessa looked at the participants’ MRI and PET images in order to identify differences between SA and TOA.

One interesting finding was that SA and TOA differed in brain morphology (brain structure). SA exhibited greater cortical thickness (important for information processing), greater hippocampal volume (important for memory consolidation), and fewer white matter hypointensities (a pathology often used to measure cerebrovascular disease). This suggests that greater cortical thickness, hippocampal volume, and white matter integrity contribute to the superior memory performance observed in SA.

A second finding was that the amount of amyloid, a protein associated with Alzheimer’s Disease, did not differ between SA and TOA. Although the amount of amyloid pathology did not differ, more amyloid was positively associated with faster memory decline in TOA, but not in SA. This suggests that the unique brain structure observed in SA may help protect the brain from cognitive decline in the presence of amyloid, and contribute to unusually successful aging trajectories.

Tessa suggests that future research in this area should focus on understanding the mechanisms that allow SA to maintain these structural benefits (e.g., greater cortical thickness and hippocampal volume) and resist white matter hypointensities. For a link to the entire paper, visit the publications section of the Jagust Lab website!

Sleep Monitoring in BACS!

Joe Winer is a graduate student who splits his time between our lab and the Berkeley Center for Human Sleep Science. He is interested in the relationship between sleep, brain changes, and cognitive function in the context of aging. In order to better understand these relationships, we have added a sleep monitoring portion to our study. Interested participants will be sent home from their cognitive testing session with a sleep monitoring motion wristwatch, which they will wear for 7 days before mailing back to us at our expense. The entire lab, and especially Joe, is very excited to use the data to deepen our understanding of the alterations in sleep that occur with age.

jagustlab.neuro.berkeley.edu
Relationships Between Tau and Glucose Metabolism Reflect Alzheimer’s Disease Pathology in Cognitively Normal Older Adults.

Jenna Adams is a graduate student in the lab who uses tau-PET and fMRI to study the spread of tau in the brain. She recently published a paper titled, “Relationships Between Tau and Glucose Metabolism Reflect Alzheimer’s Disease Pathology in Cognitively Normal Older Adults”, in Cerebral Cortex.

Glucose hypometabolism (decreased glucose metabolism in the brain) is characteristic of Alzheimer’s disease (AD), and thought to be a sign of reduced neural activity that results from neurodegeneration. Recent evidence suggests that this reduction in glucose metabolism may be driven by the deposition of tau tangles, another hallmark characteristic of AD. However, these tangles are not only found in AD patients. In fact, they are present in the medial temporal lobes of most cognitively normal older adults, and seem to spread to other brain regions during the presymptomatic stages of AD. In order to better understand this progression from normal cognition to AD, Jenna decided to investigate the relationship between early tau deposition and glucose metabolism in normal older adults.

Jenna’s study included participants from the Berkeley Aging Cohort Study who had undergone PET scans within the past year. She divided the subjects into two groups based on the amount of amyloid (another protein associated with AD) present in their brain. Participants with more amyloid pathology were labeled amyloid-positive and participants with minimal amyloid pathology were labeled amyloid-negative. Next, she looked at the relationships between tau and glucose metabolism in the two groups.

In amyloid-negative participants, the presence of tau was associated with widespread increases in glucose metabolism. However, in amyloid-positive participants, tau in the medial temporal lobe (the first area tau appears) was associated with hypometabolism. Interestingly, the relationship between tau and glucose metabolism in amyloid-positive participants also varied by brain region. This means that tau deposition in one area of the brain may drive neurodegenerative processes in other brain regions. These spatial relationships may provide insight into the pattern of tau-related neurodegeneration that occurs during AD onset.

AAIC 2018

Last month, several lab members traveled to Chicago to attend the 2018 Alzheimer’s Association International Conference. They presented research from the lab, met with colleagues in the field, and had the chance to reunite with lab alumni. Two of our postdocs, Tessa Harrison and Renaud La Joie even had the opportunity to chair a session together!

Lab News!

Katie Arnemann, graduated with her PhD in neuroscience in May. Shortly after graduation, she moved to New Jersey where she now works as a postdoc in a computational neuroscience lab at Rutgers-Newark.

Anne Berry, a postdoc in the lab, recently accepted a position as an assistant professor of psychology at Brandeis University. Beginning next Summer, Anne will continue her research as the principal investigator of her own lab!

Kaitlin Swinnerton, a research associate in the lab, was accepted into the UC Berkeley Data Science Program. Kaitlin will continue to work in the lab while she takes online courses to work towards her master's degree.

Bill Jagust, our benevolent dictator, spent the beginning of the year on sabbatical in Europe where he worked with researchers from Cambridge and Gothenburg. The lab is very happy to have him back in Berkeley!

Comings and Goings

Taylor Mellinger, a research associate in the lab, recently accepted a job as a research coordinator at the UCSF Memory and Aging Center. She is looking forward to gaining more clinical research experience!

Anne Maass, a postdoc in the lab, returned to Germany where she will continue her research on age related memory changes. Stay tuned for the published results of Anne’s fMRI study, which many BACS subjects participated in!

Victoria Tennant recently joined the lab. She will be taking over for Taylor, helping with cognitive testing, MRIs, and PET scans. She is excited to learn more about aging, and to prepare for graduate school!

Molly Lapoint is our newest graduate student. She is interested in how the brain changes during aging and disease. Her research will focus on the association between amyloid, brain structure, and cognitive performance.