

# Berkeley Aging Cohort Study Newsletter

June 2017



**Berkeley**  
UNIVERSITY OF CALIFORNIA

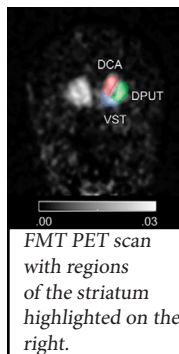
## Dopamine, Aging, and Cognitive Flexibility

Anne Berry is a postdoctoral fellow in the Jagust Lab who has been focusing her research on aging and dopamine. She published a paper titled “Aging affects dopaminergic neural mechanisms of cognitive flexibility” in the *Journal of Neuroscience* in December 2016.

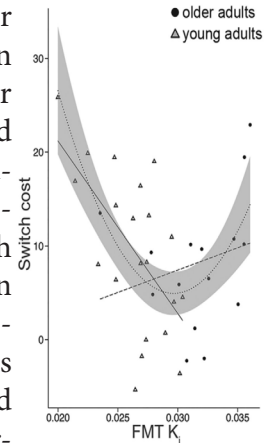


Dopamine is a neurotransmitter, or a molecule in the brain that is released by neurons to send information between cells. Dopamine is important for the proper functioning of an area of the brain called the striatum, which is thought to be involved in the ability to adapt to new rules while performing a task. Being able to successfully adapt when the rules change is one measure of a skill called “cognitive flexibility”. As people age, the dopamine system can decline and lead to trouble with tasks like this. The goal of Anne’s study was to understand more about how the dopamine system can change with age and how those changes affect behavior.

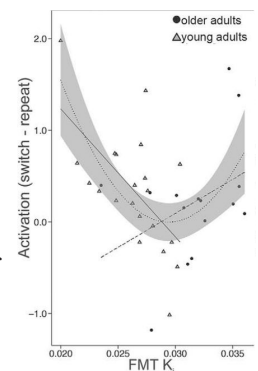
Anne used FMT PET imaging to measure dopamine production in the striatum and an fMRI task to measure cognitive flexibility. In the fMRI task, participants answered questions based on a set of rules they were given. When the rules changed, participants had to adjust their strategy for answering the questions. Rule-switch trials were compared to rule-repeat trials to measure cognitive flexibility performance.



One interesting finding was that older adults were producing more dopamine than younger adults on average, a finding that has been seen in other studies. This isn’t necessarily bad and could be one way the brain is compensating for other brain changes that can happen with age. When both younger and older adults were examined as one group, a U-shaped relationship was found between dopamine production and “switch cost”, a measure of the *decline* in performance on rule-switch trials. This means mid-range levels of dopamine production seemed to be the most beneficial for performance.



Efficiency in the brain, or the brain doing less work to accomplish the same thing, can be important for continuing brain health. When examining some regions’ activity during the task across participants, there was a U-shaped relationship between brain activation and dopamine production, showing evidence again that mid-range levels of dopamine production may be the most beneficial.



Anne suggested future work in this field may try examining how drugs that affect the dopamine system change task performance to help understand more about dopamine in the aging brain. Perhaps in the future there will even be studies working toward a drug intervention. Anne is currently working on a project looking at how memory is affected by dopamine. Stay tuned for more updates about her work!

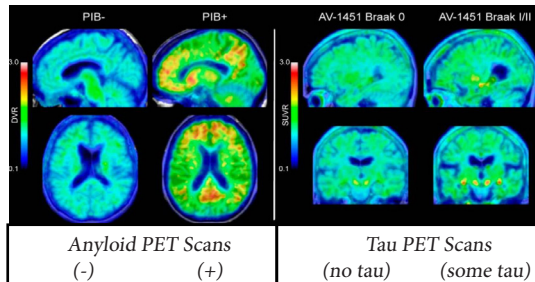
# Tau, Beta-Amyloid, and Memory

## Encoding

Shawn Marks is a PhD student in the Jagust Lab whose thesis work has been focused on memory and biomarkers of Alzheimer's Disease (AD). He published a paper this year titled "Tau and beta-amyloid are associated with medial temporal lobe structure, function and memory encoding in normal aging". Participants in this study completed an fMRI task, an amyloid (PIB) PET scan, and a tau (AV1451) PET scan.



Amyloid and tau are proteins associated with AD, but they are often found in the brains of cognitively normal older adults in smaller amounts. Both proteins have been found to have some negative impact on cognitive functioning, but the extent of this in normal older adults is an active area of investigation.



Shawn's fMRI task involved pattern separation, or the ability to discriminate between two similar memories. The task required looking at pictures and deciding whether the picture was seen before, never seen before, or was similar to something seen before. Other studies have found that older adults tend to have more trouble on tasks like this. Shawn

was interested in how amyloid and tau play a role in this seemingly age-related phenomenon.

When presented with a picture that was "similar", older adults were more likely to say it was the same as a previously shown object than to correctly identify it as "similar" on average. However, this was not the case for younger adults.

While participants were trying to store the images in memory, some patterns of activation in the hippocampus, a region of the brain important for memory, were found to be related to the amount of amyloid and tau pathology in the brain. Shawn combined these activation patterns into a composite measure he called "pathological activation". Older adults with a higher pathological activation score performed worse on the memory discrimination task. Additionally, they had thinner gray matter in a region of the brain that is a major input to the hippocampus.

This work shows that amyloid and tau are related to some memory deficits even in cognitively normal older adults and that this is due in part to disruption of the activity in the hippocampus. Future studies could look more closely at how memory decline is associated with patterns of AD pathology as they change over time. See an exciting update about Shawn below!

## Lab News

### Graduation

After being a research assistant and a graduate student, Shawn Marks is graduating this year with his PhD!

### New Job

Samuel Lockhart got a new job as an assistant professor at the Wake Forest Alzheimer's Disease Center.

### Graduate School

Vyoma Shah will start a PhD at UC Berkeley in the psychology department this fall.

### Graduate School

Rachel Bell will be starting a master's degree in public health at UC Berkeley this fall.

### Medical School

Sharada Narayan will be starting medical school this fall in a UCB/UCSF combined program.

### Passed Quails

Joe Winer and Jenna Adams, both graduate students in the lab, have passed their qualifying exams which means they are on track to continue work on their thesis research projects and work towards completing PhDs!

