

Effects of Age and Aging on Neuroanatomy in a Nonhuman Primate Model of Alzheimer's Disease



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Background

- **Age** is the strongest risk factor for **Alzheimer's disease** (AD)¹, yet the neurobiological trajectories distinguishing normal from pathological aging remain poorly understood.
- **Nonhuman primates** (NHPs) offer important opportunities to longitudinally characterize brain aging processes that may parallel humans².
- Here, we examined the main and interactive effects of **age** and **longitudinal aging** on neuroanatomy in female vervet monkeys, a well-validated NHP model of aging and early AD-like neuropathology.

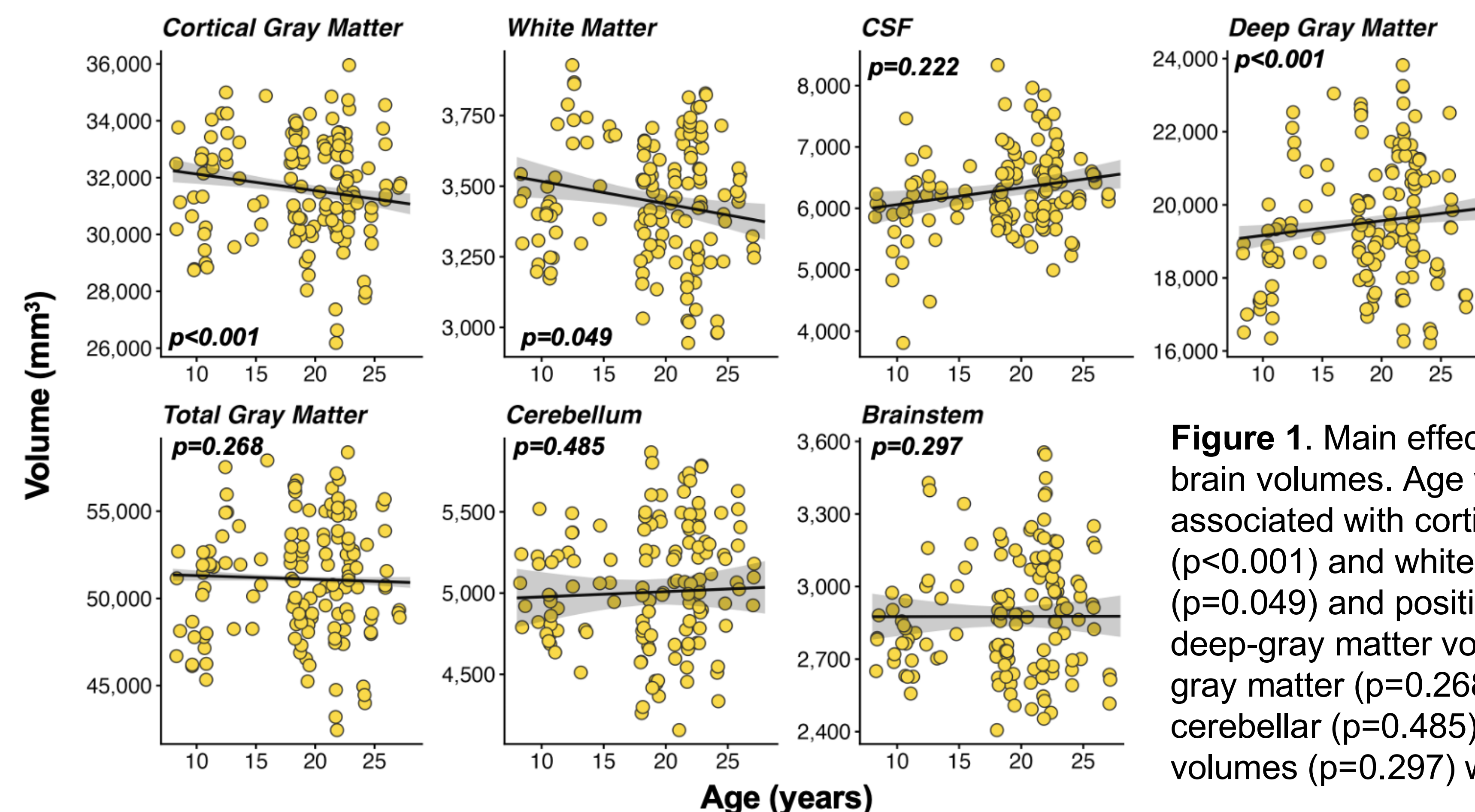
Methods

- **Sample:** N=68 middle- to older-aged female vervet monkeys (*Chlorocebus aethiops sabaeus*) (8.34–29.34y)
- **Neuroanatomy:** Structural MRI (T1-weighted)³
 - N=139 scans; (1-5) scans per subject
 - Regions of Interest: cerebrospinal fluid (CSF), cortical gray matter, deep gray matter, total gray matter, white matter, cerebellum, and brainstem
- **Statistical Approach:** Linear mixed-effects models with main effect of age, main effect of longitudinal aging & interaction term: age-by-aging; ICV as a covariate in models to control for inter-individual variation in head size; Random effect: ID to control for repeated measures

Conclusions

Considering **both age & longitudinal aging** is critical for characterizing changes relevant to AD. NHPs may differ from humans in some brain aging trajectories. Vervets remain useful translational models for investigating vulnerability to AD-associated neuropathology.

Age Effects on Neuroanatomy



Female Vervet Monkey

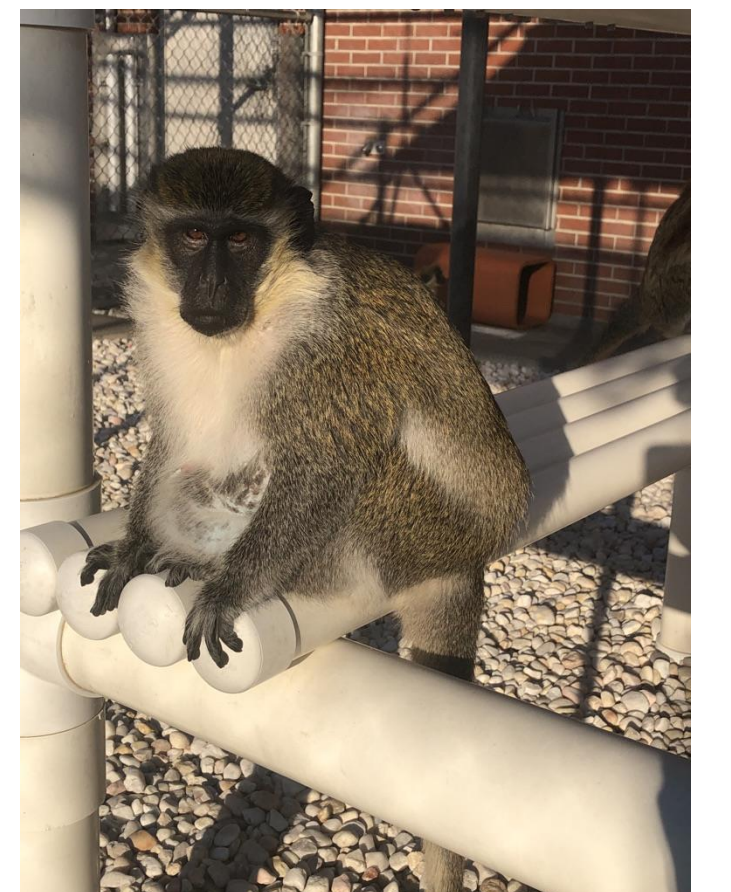


Figure 1. Main effects of age on global brain volumes. Age was negatively associated with cortical gray matter ($p<0.001$) and white matter volumes ($p=0.049$) and positively associated with deep-gray matter volumes ($p<0.001$). Total gray matter ($p=0.268$), CSF ($p=0.222$), cerebellar ($p=0.485$), and brain stem volumes ($p=0.297$) were unrelated to age.

Age x Aging Effects on Neuroanatomy

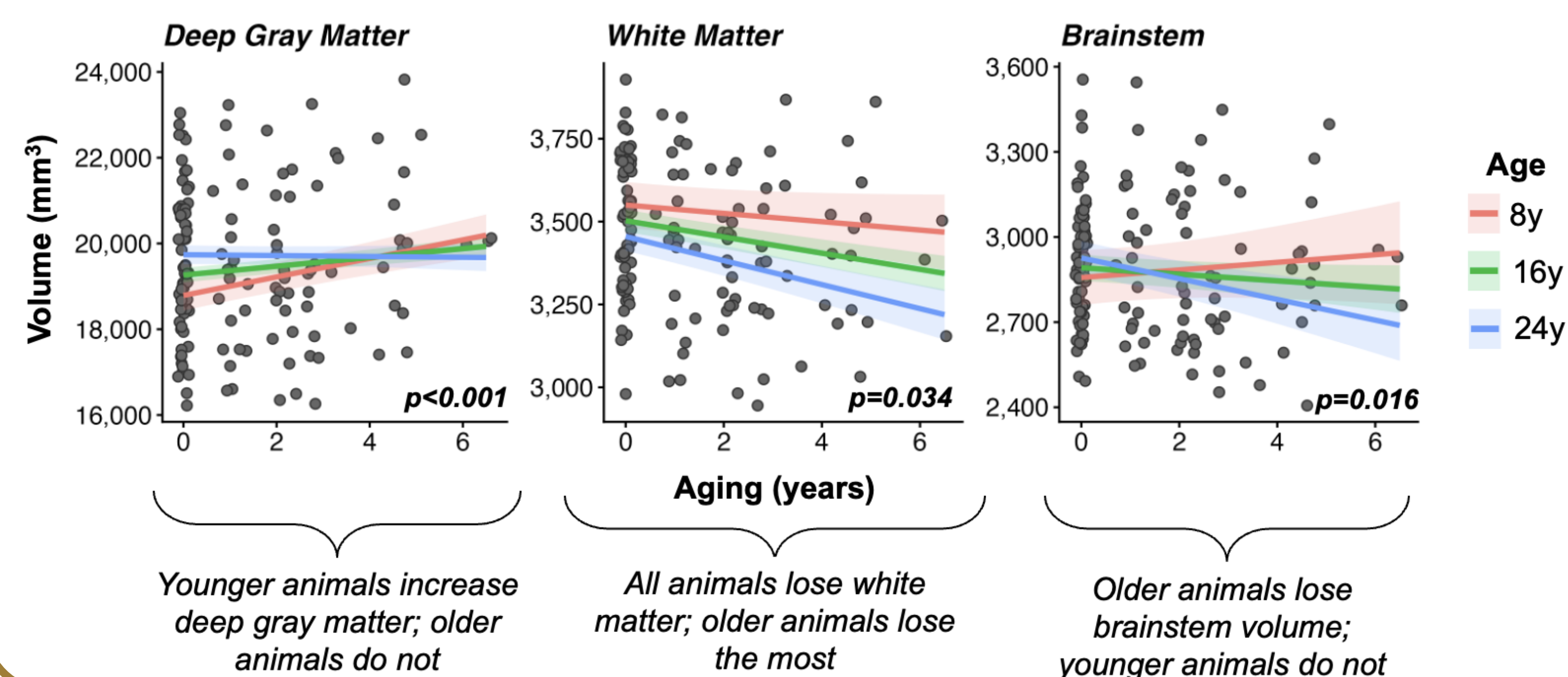


Figure 2. Significant age x aging interaction effects on global brain volumes: deep gray matter ($p<0.001$), white matter ($p=0.034$), and brainstem ($p=0.016$). These interactions illustrate how age and aging interact in complex, region-specific ways to shape neuroanatomical trajectories in female vervets.

References & Funding

1) Alzheimer's Association. (2026). 2026 Alzheimer's disease facts and figures; 2) Shively et al. (2021). Nonhuman primates at the intersection of aging biology, chronic disease, and health. doi:10.1002/ajp.23309; 3) Frye et al. (2021). Aging-related Alzheimer's disease-like neuropathology and functional decline in captive vervet monkeys. doi:10.1002/ajp.23260 **Funding:** R24AG073199, P30AG072947, P40-OD010965

