AGE GRADIENT IN CORTICAL GYRIFICATION:
EVIDENCE FROM AN ACCELERATED LONGITUDINAL DATASET

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- **How does the brain change with age?**
  - Most defining feature of the human cerebral cortex is its **folding structure**; underlying principle of these cortical folds has been a long-standing topic of investigation (Mota & Herculano-Houzel, 2015; Welker, 1990)
  - **Gyrification** is a measure of the cortical folding, the ratio between area of cortical surface and an enclosing surface
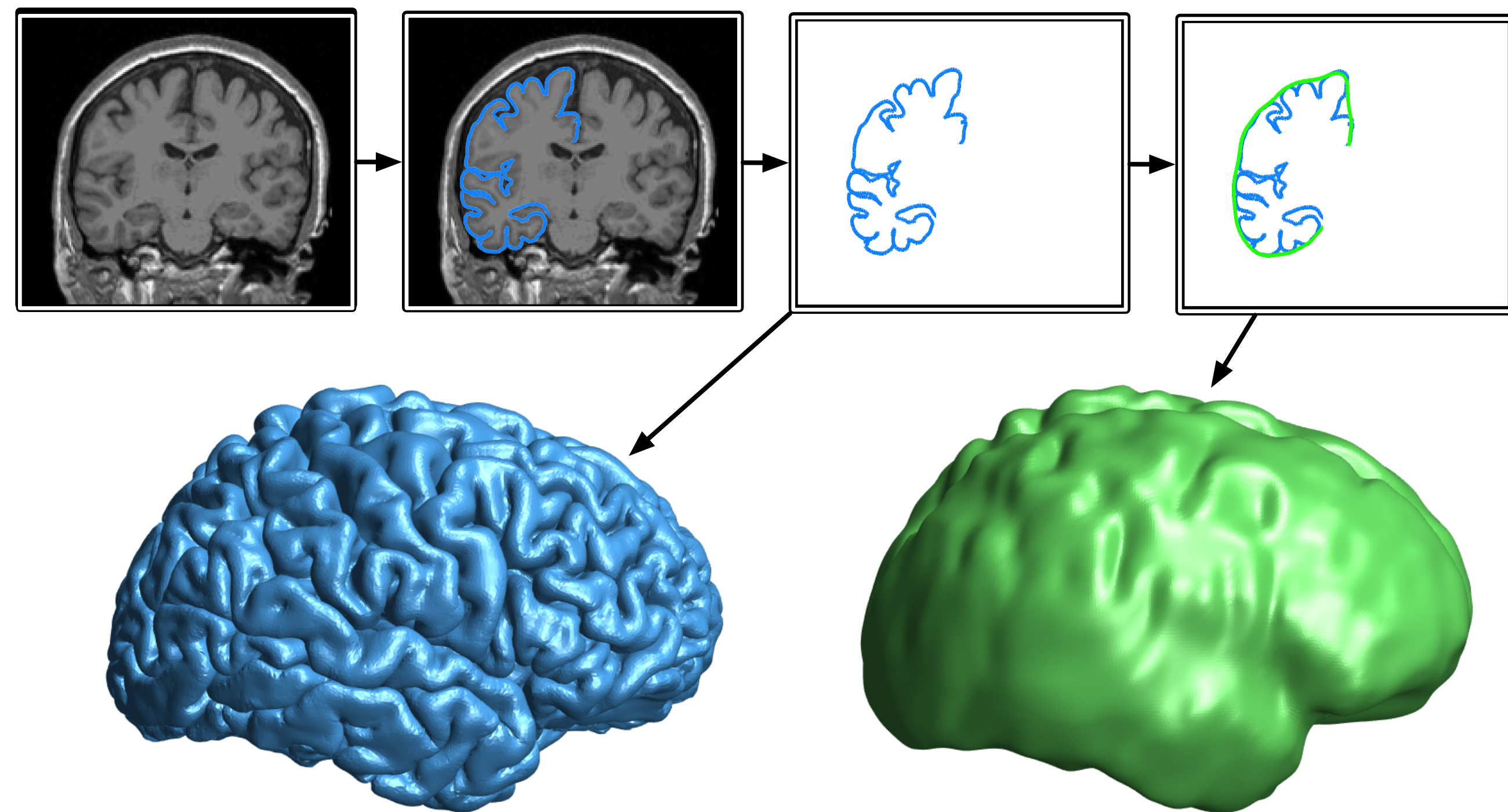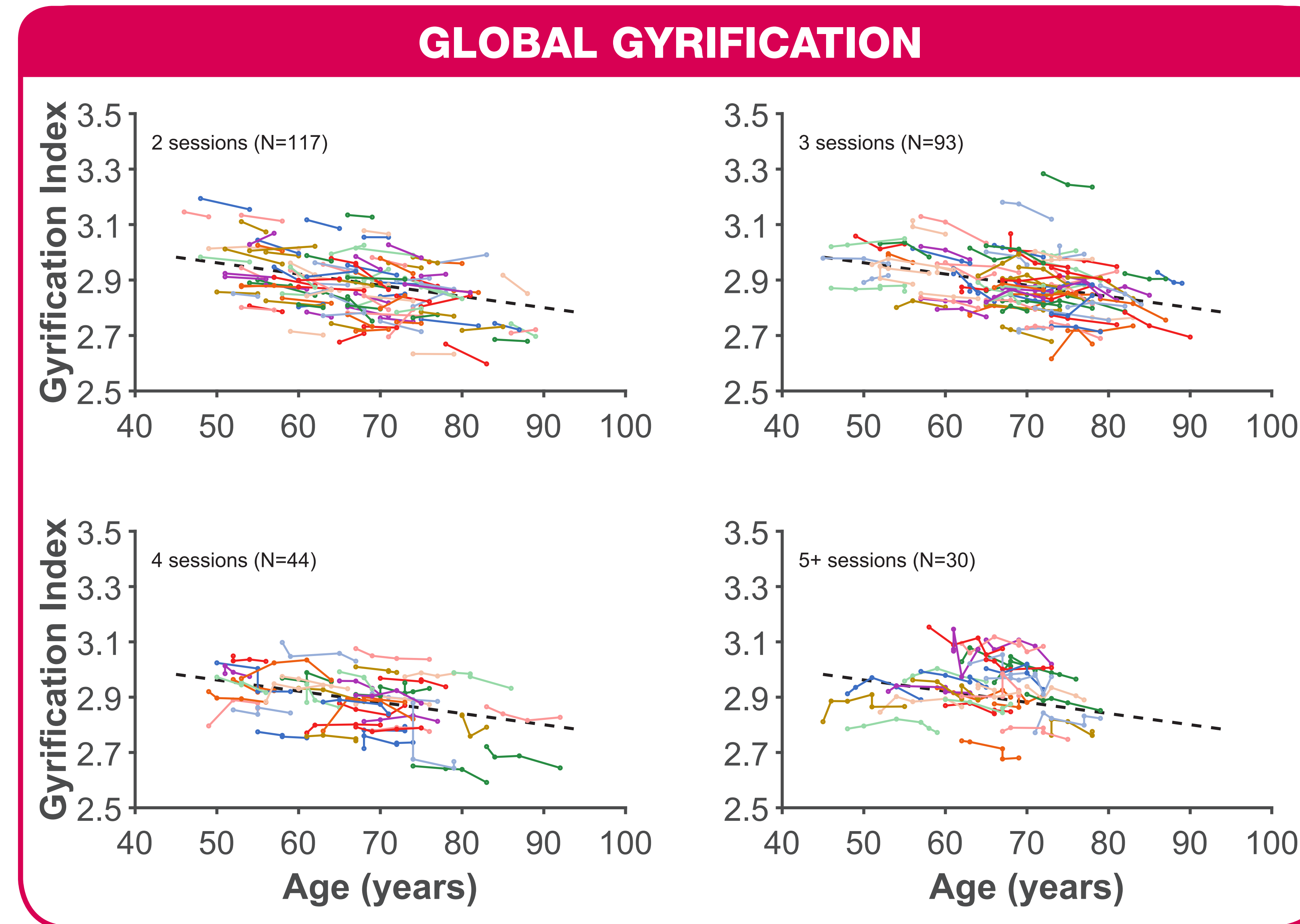

$$GI = \frac{\text{Surface Area}}{\text{Enclosing Area}} = \frac{\text{Area}(\text{\includegraphics{}})}{\text{Area}(\text{\includegraphics{}})} = 2.993$$
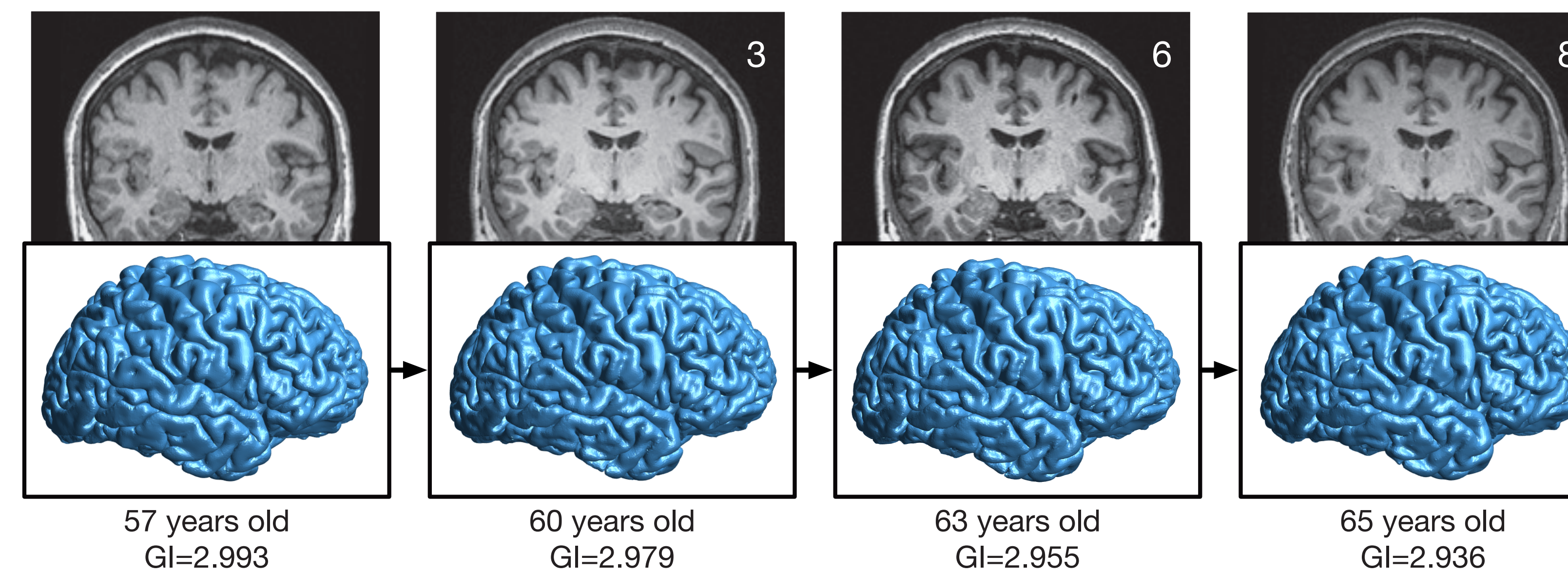
- Several studies have shown age-related decreases in gyrification in cross-sectional data (e.g, Cao et al., 2017; Hogstrom et al., 2013; Madan & Kensinger, 2016, 2018), but it is not clear but what is changing in the cortical structure–perhaps a longitudinal dataset can help
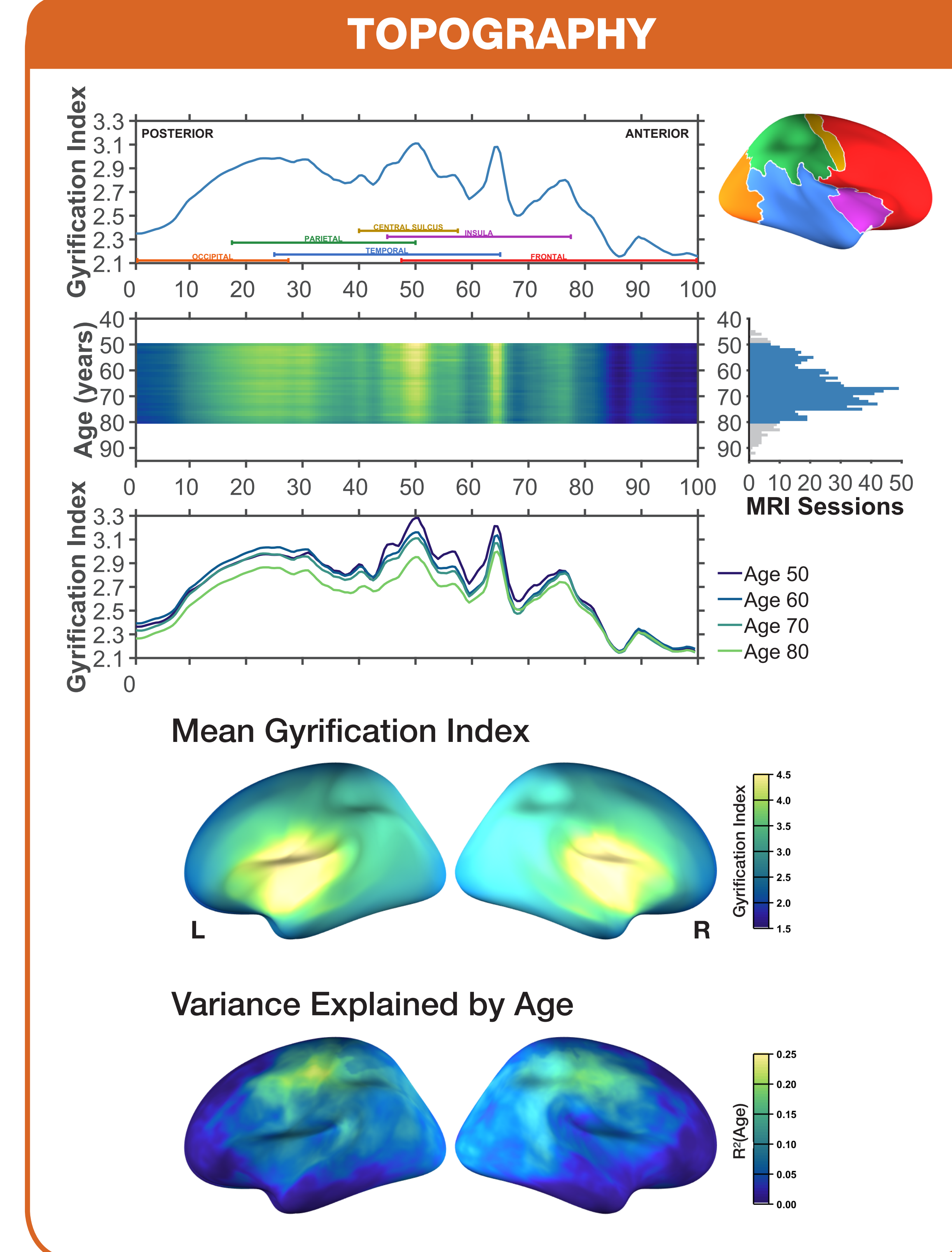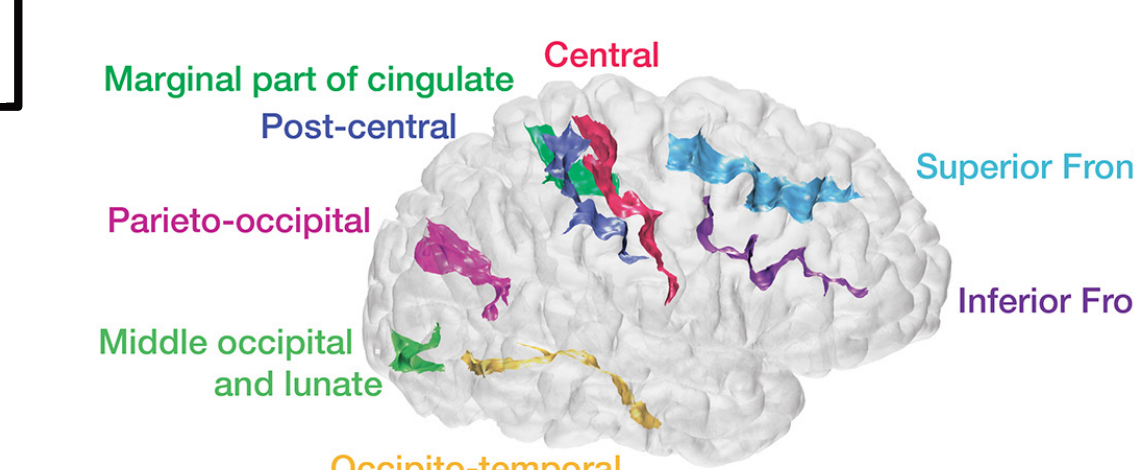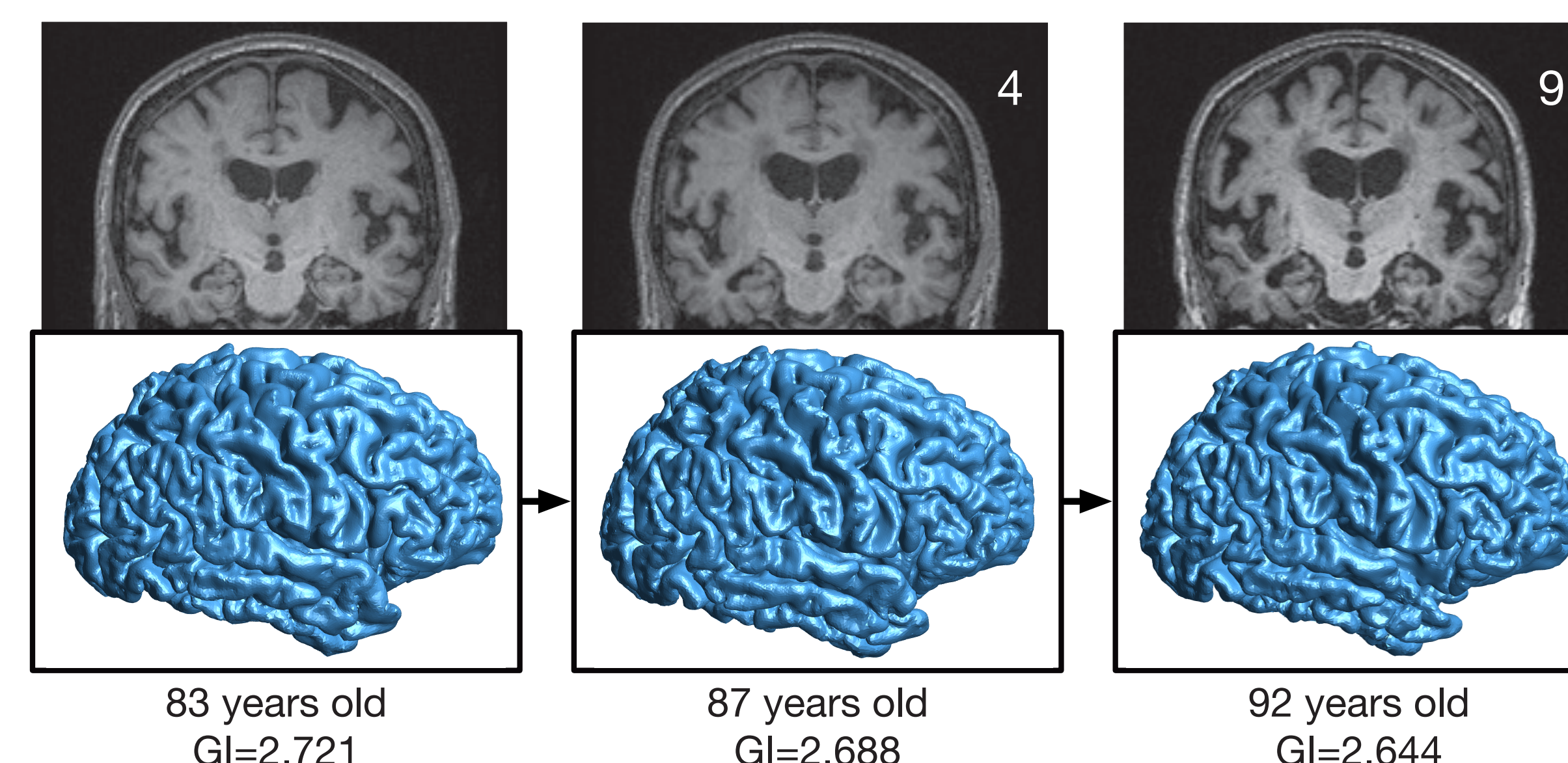
ACCELERATED LONGITUDINAL DATASET

- OASIS-3 dataset (LaMontagne et al., 2019)
- Included if:
  - (1) at least two sessions available
  - (2) interval from first to last session of at least 3 years
  - (3) CDR-0 at every assessment
- 284 healthy adults (aged 45-92), interval from 3-11 years (M±SD = 5.59±2.10 years)
- 117 had 2 timepoints, 93 had 3 timepoints, 44 had 4, and 30 had 5+ (to a maximum of seven); 1177 T1 volumes from 849 MRI sessions were examined

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GLOBAL GYRIFICATION

Participant A [8-year interval]

57 years old GI=2.993   60 years old GI=2.979   63 years old GI=2.955   65 years old GI=2.936

Participant B [9-year interval]

83 years old GI=2.721   87 years old GI=2.688   92 years old GI=2.644

TOPOGRAPHY

Mean Gyrification Index

Variance Explained by Age

Understanding age decreases in gyrification

- From global gyrification and anterior-posterior analyses, is clear that the age decreases in gyrification are gradual
- Anterior-posterior results also show it is not a shift in the distribution of folding, but rather is a global decrease, though some regions are more affected, as highlighted in the topography analyses
- Not surface area or spatial frequency/minor deformations in folds along gyri
- **Sulcal prominence**, returning to early radiological measures of cortical atrophy (can quantify morphology as width and depth) (Madan, 2019)