

# The dyslexic brain before and after literacy - unifying structural signs

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## Introduction

Disentangling **neurobiological predisposition** from the **effect of literacy instruction**:

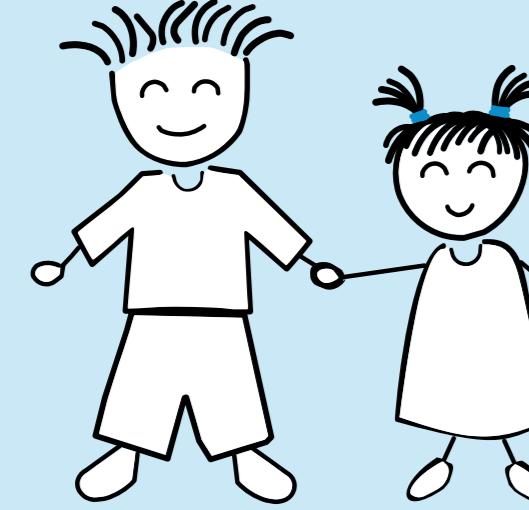
Which cortical features classify as **cause for developmental dyslexia**?  
Changes in which cortical measures are a **consequence of being dyslexic**?



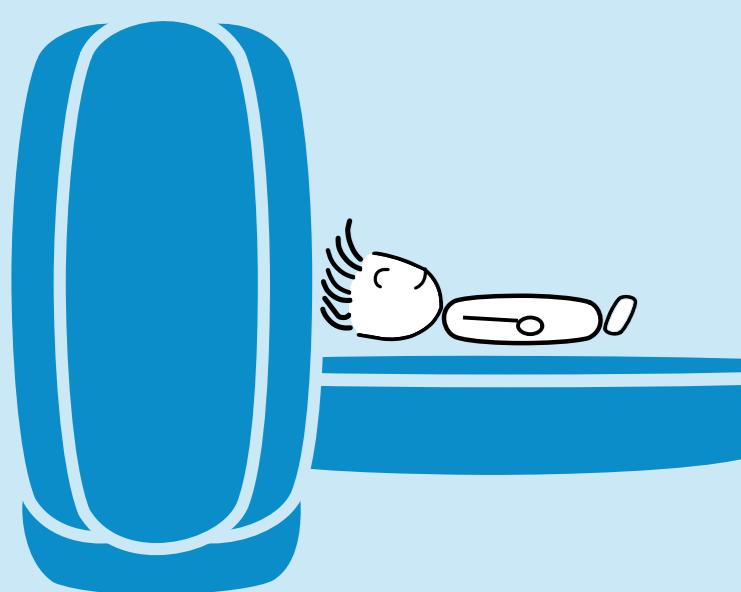
Goswami, 2015

## Design

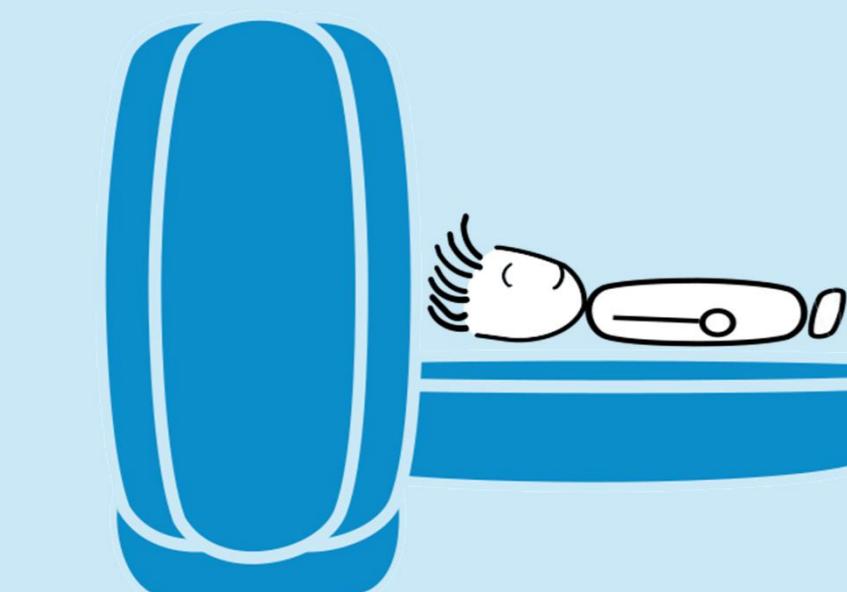
N<sub>DD</sub> = 16  
N<sub>Con</sub> = 16



Before literacy instruction



5y;7±4m



8y;6±3m

Covariates: sex, age, IQ, handedness, parental education, arithmetic ability

adjusted for covariates  
vertex-wise random forest classification  
vertex-wise whole brain accuracy map

## Data processing

CAT12 (Gaser & Dahnke, 2016)

Cortical thickness (CT)

Cortical folding complexity (CF)

Yotter et al., 2011

Gyrification index (GI)

Lüders et al., 2006

Sulcus depth (SD)

Quantitative T1 (T1w)

DPARSF (Yan & Zang, 2010)

Fractional amplitude of low frequency fluctuations (fALFF)

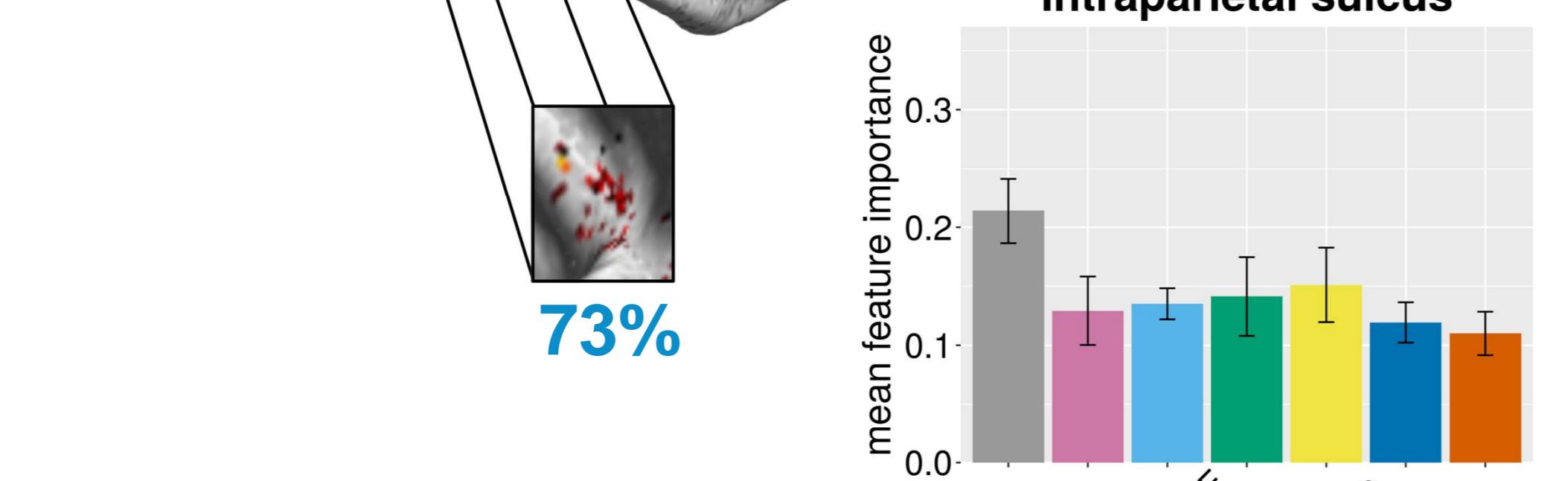
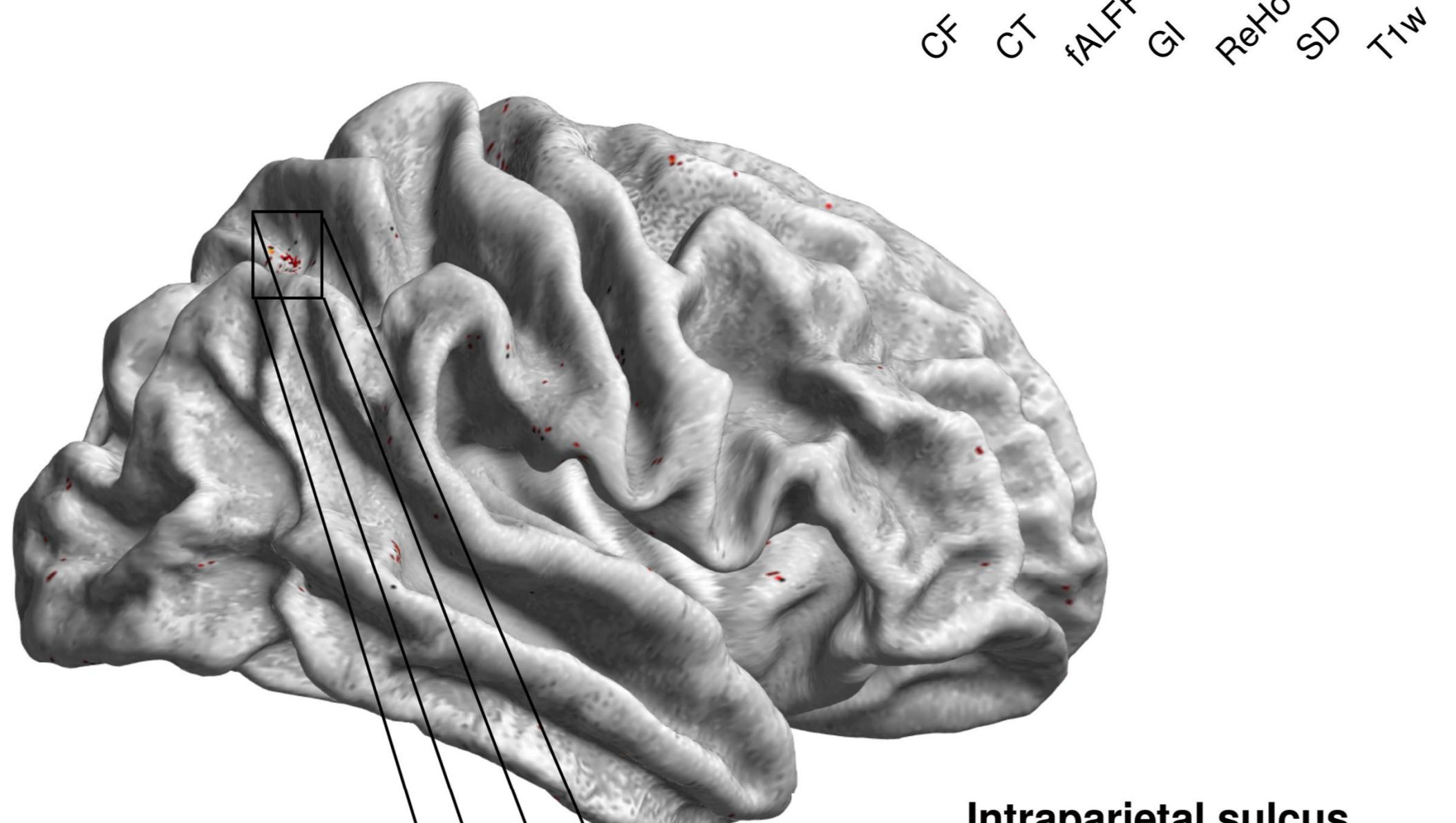
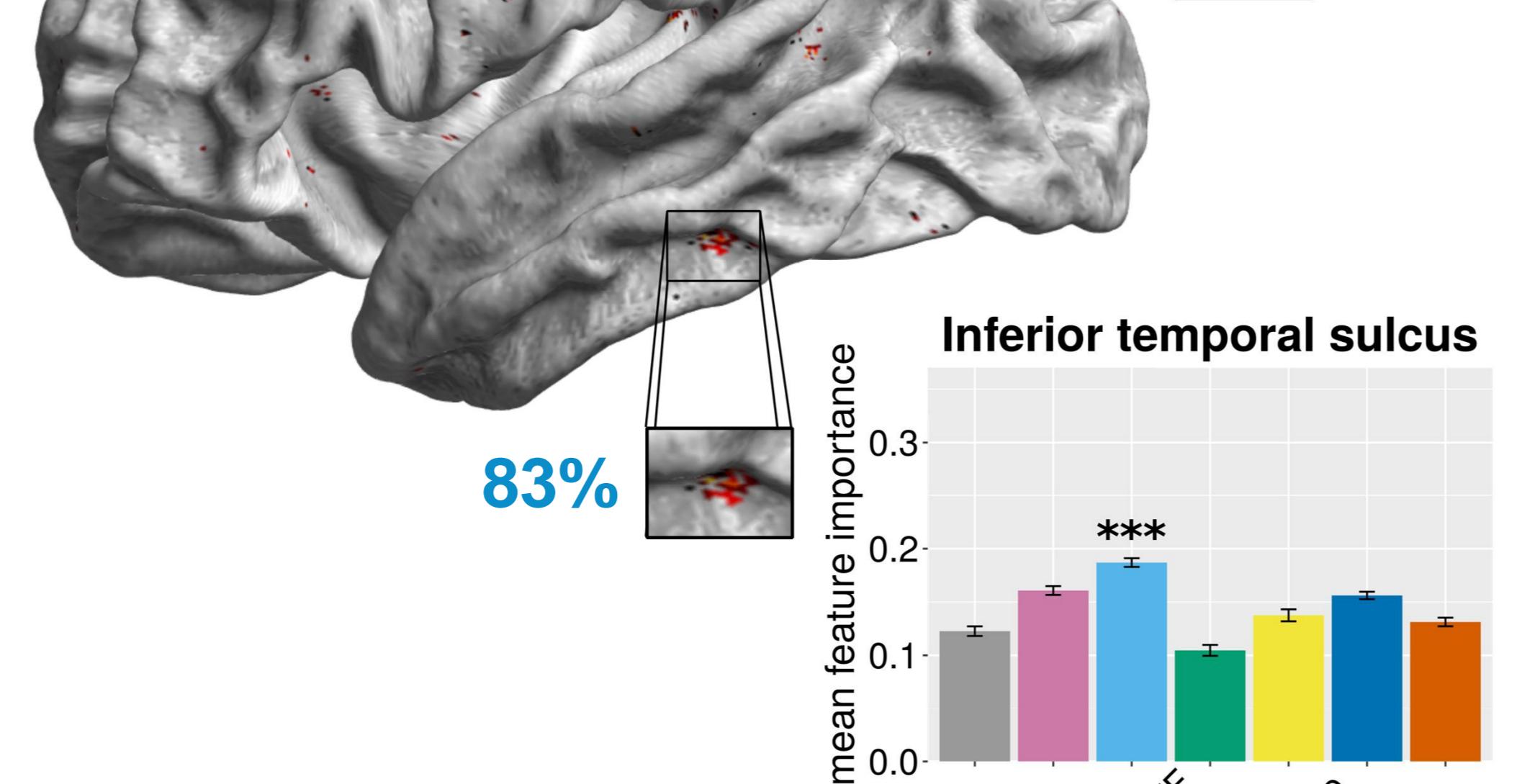
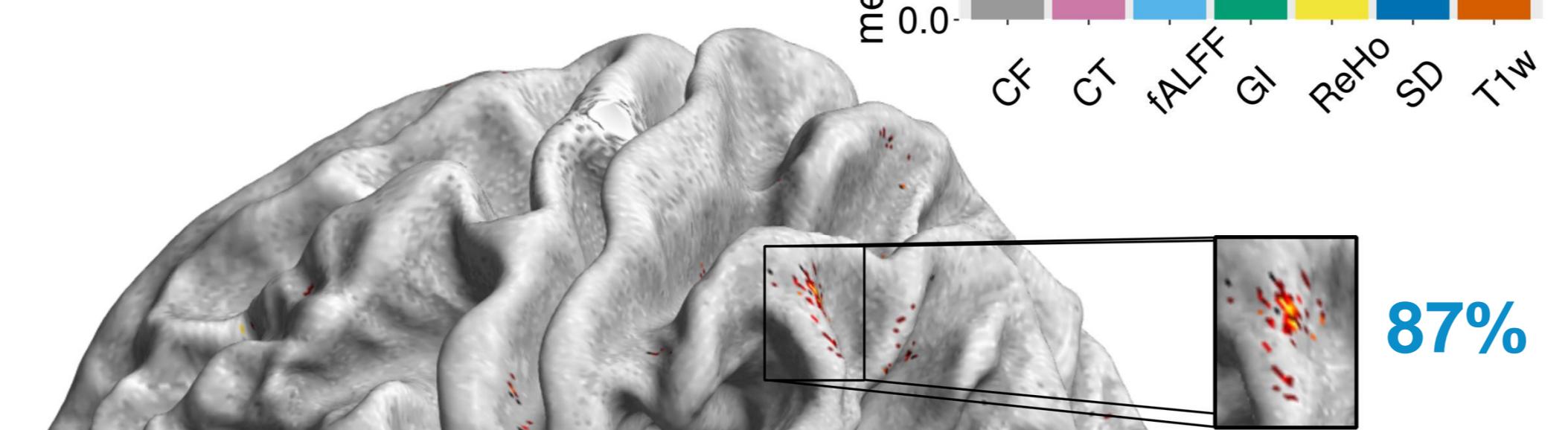
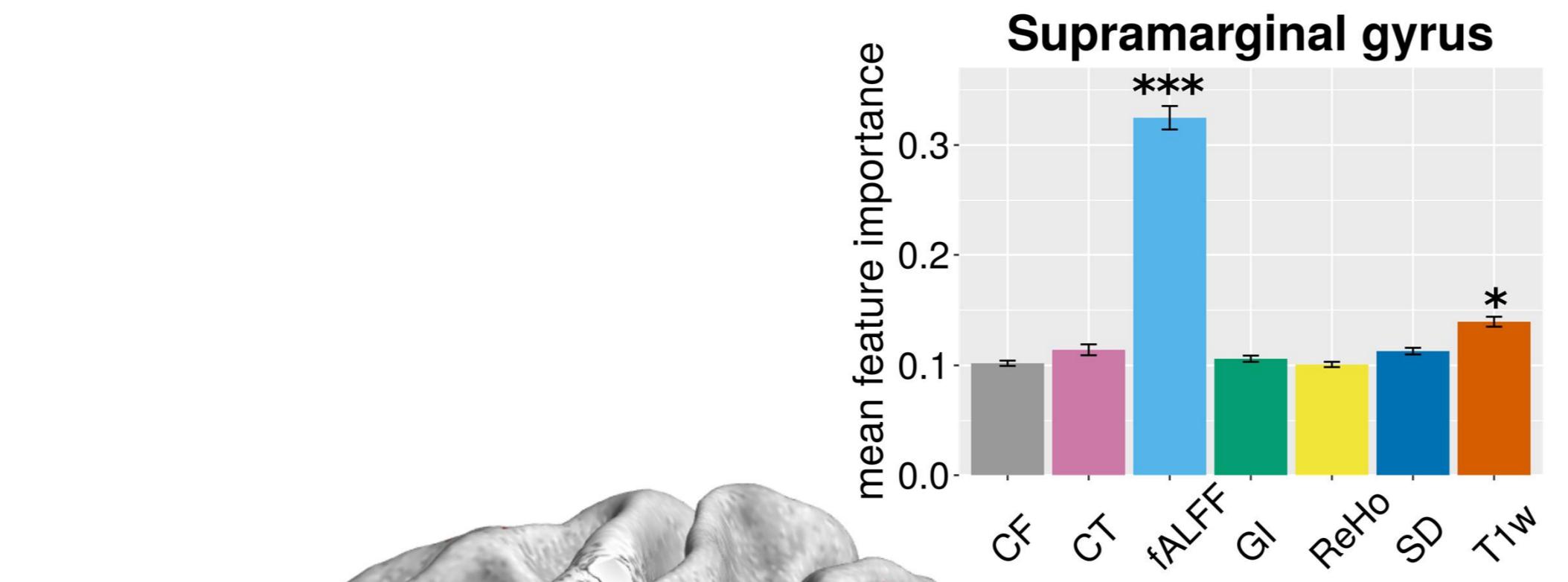
Zou et al., 2008

Regional functional homogeneity (ReHo)

Zang et al., 2004

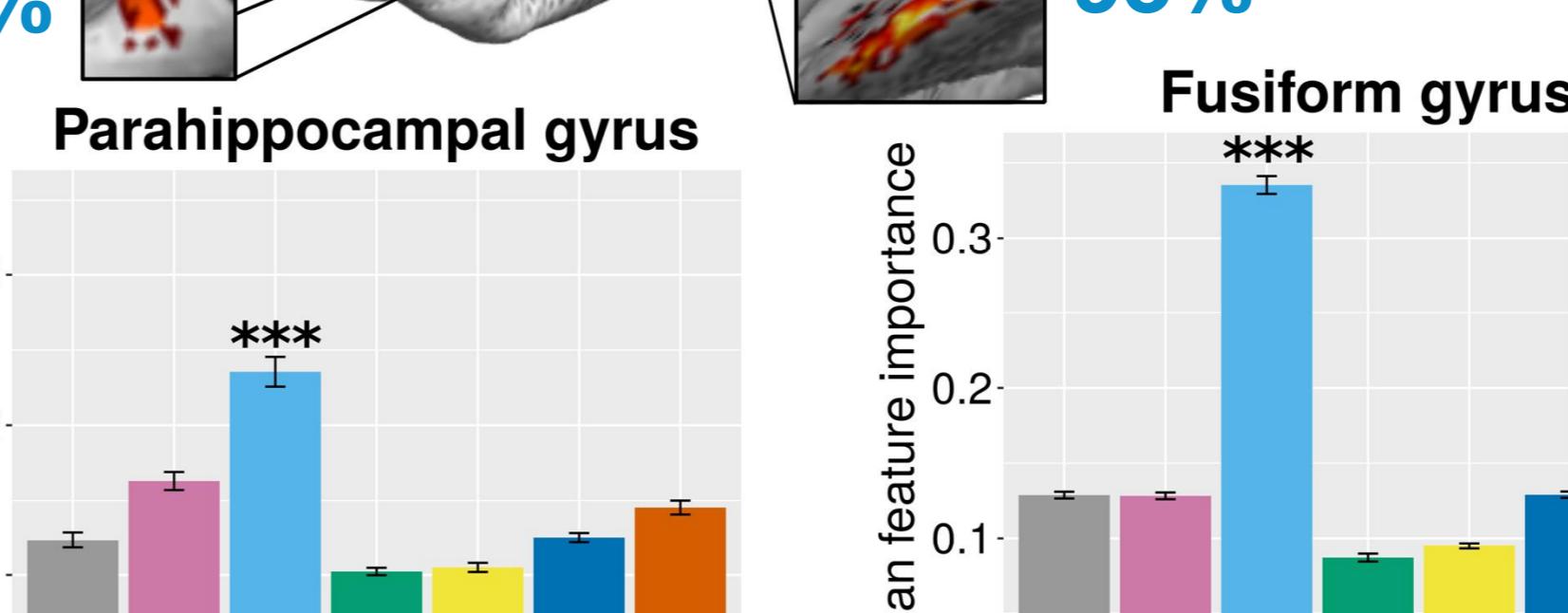
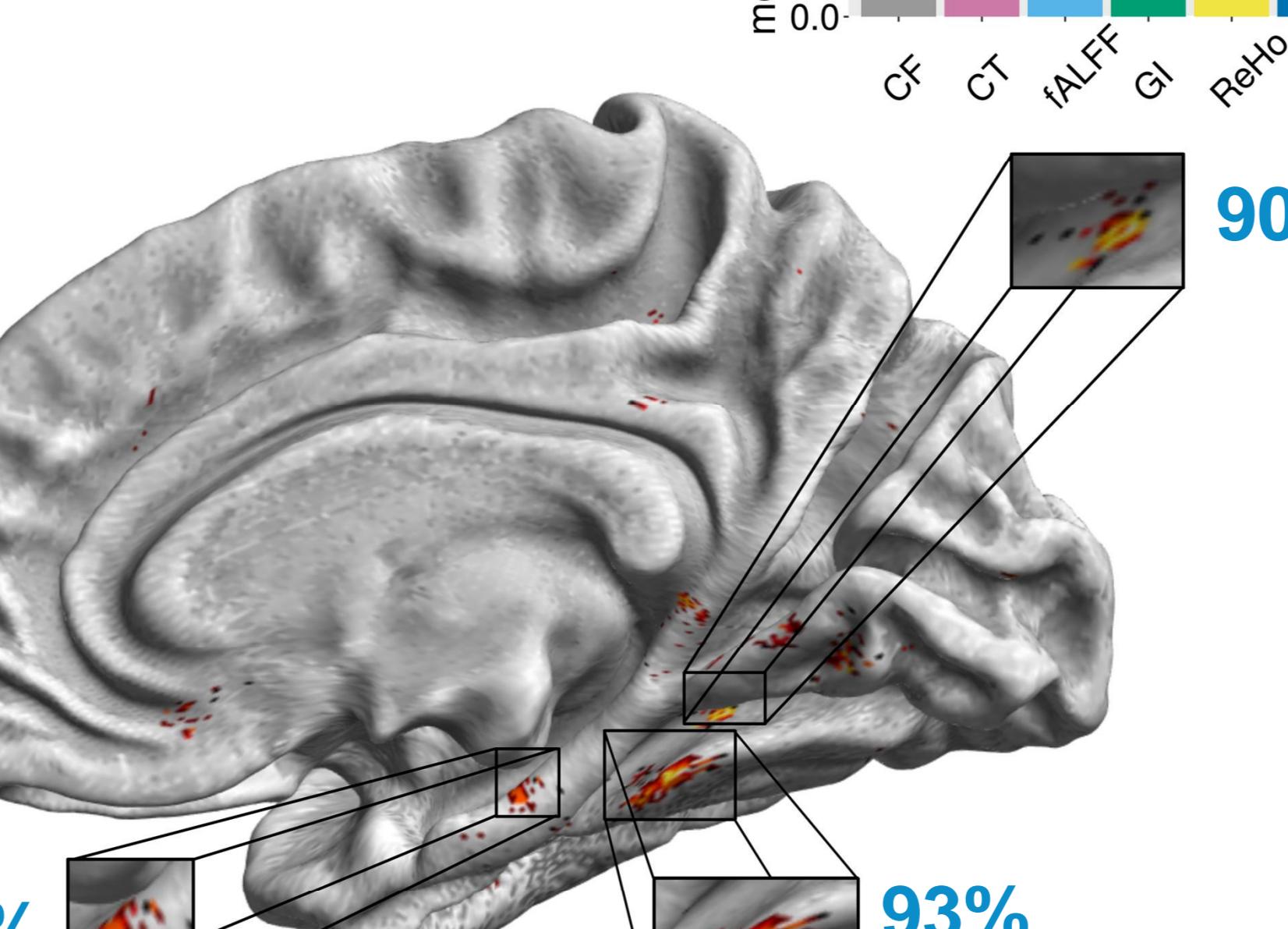
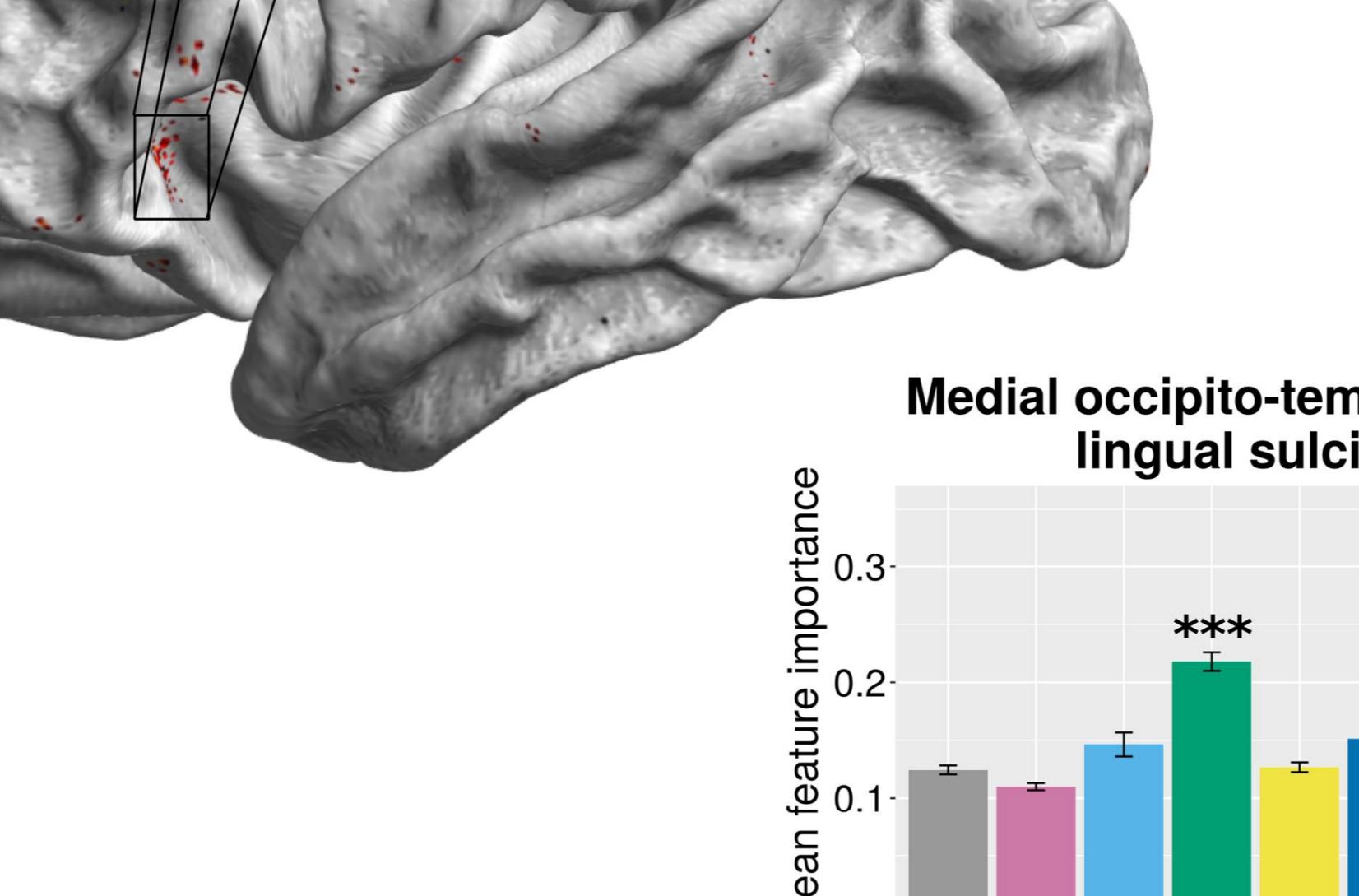
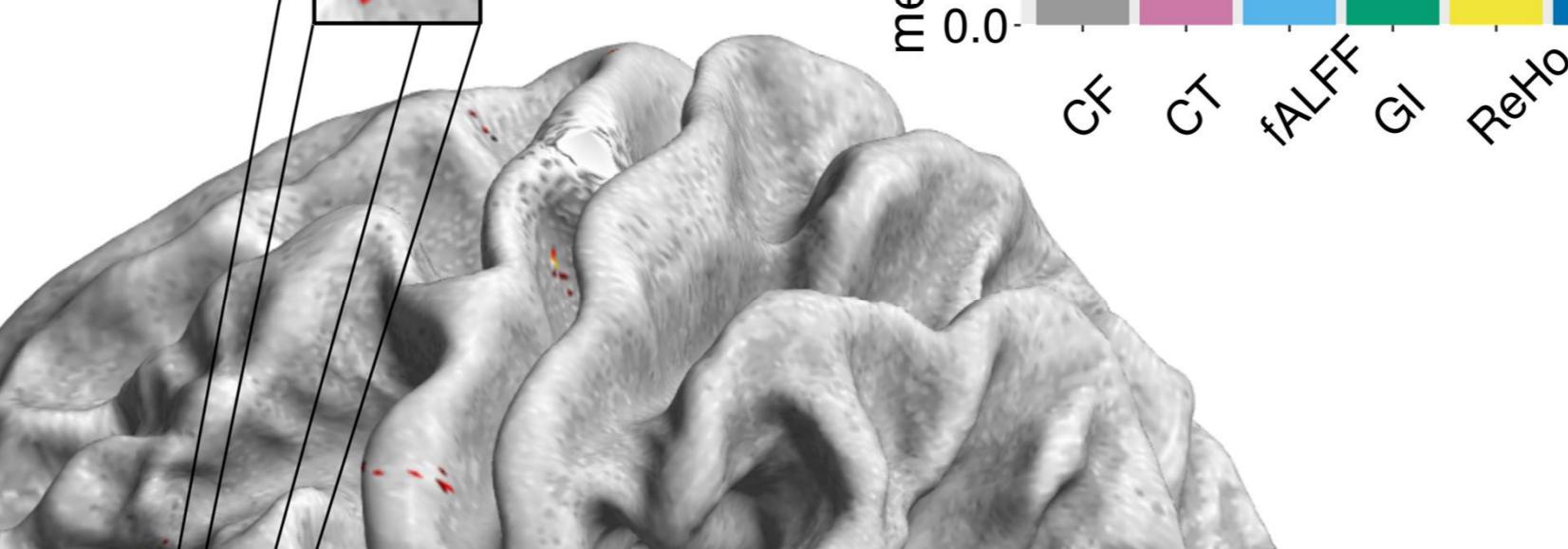
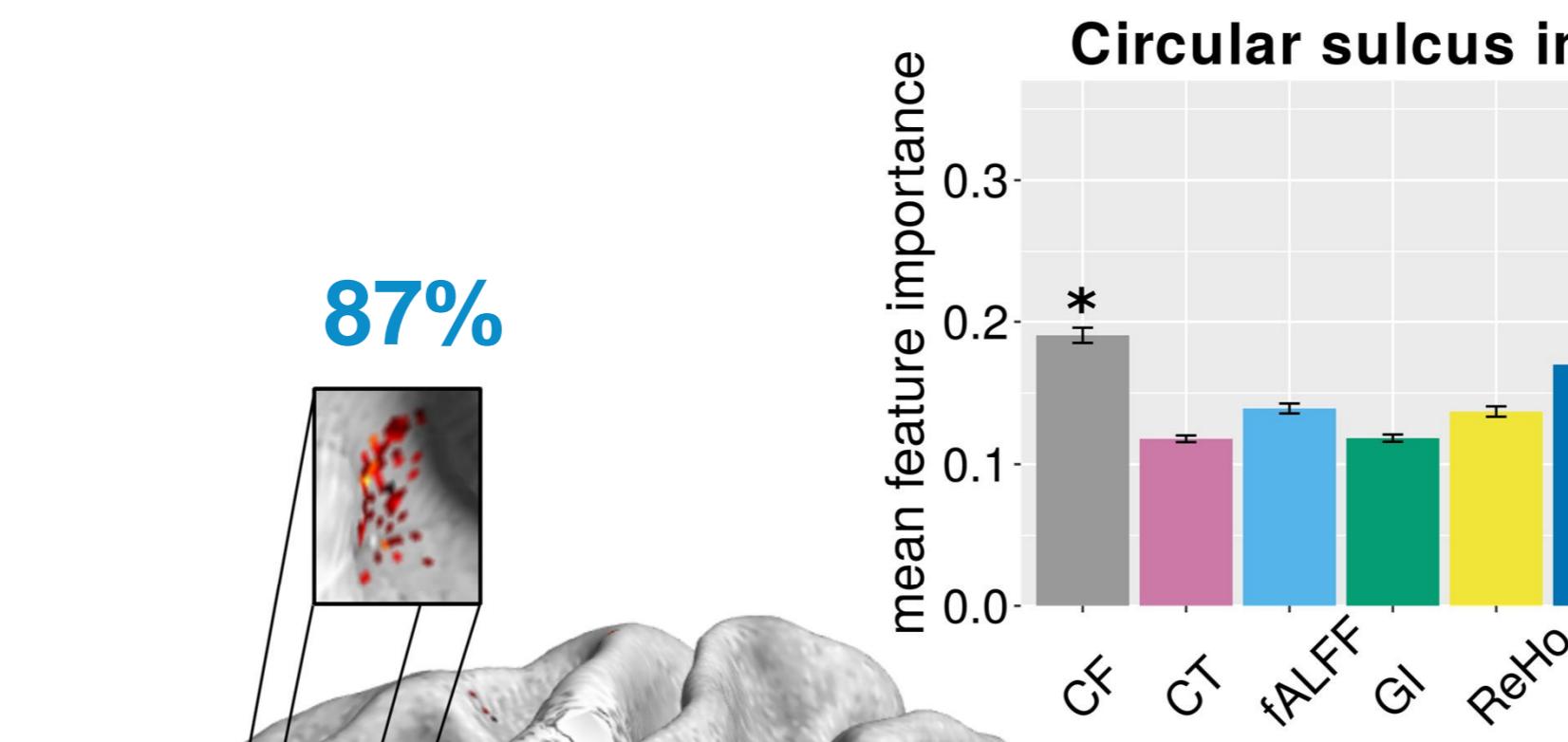
## Results

### Before literacy instruction (5 years)



\*\*\* = significantly different from all ( $p<0.001$ ); \* = significantly different from all ( $p<0.05$ )

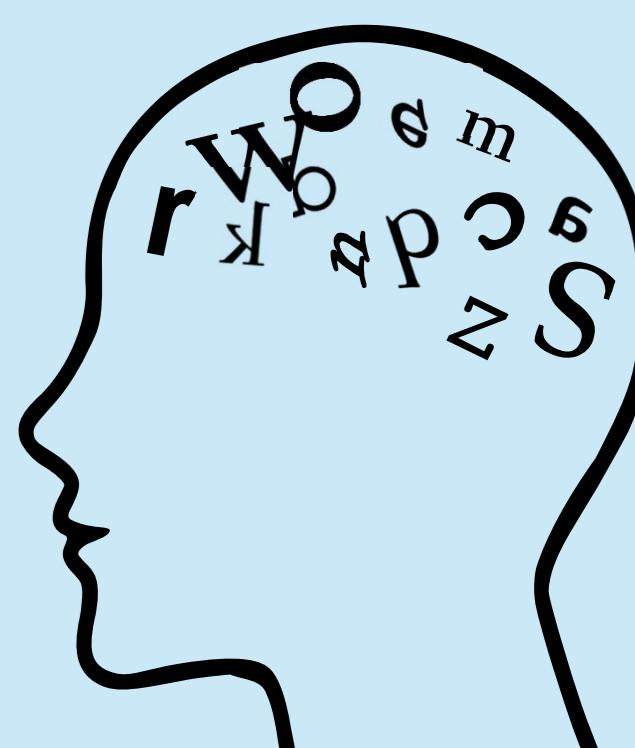
### After literacy instruction (8 years)



## Discussion & Conclusion

### Before literacy instruction

- Left **ventrolateral-temporal cortex**
  - close to the 'visual word form area'
  - Skeide et al., 2016
- Left **supramarginal gyrus**
  - grey matter increase with literacy
  - Carreiras et al., 2009



### After literacy instruction

- Left **insula**
  - deficient temporal processing of speech and non-speech sounds
  - Steinbrink et al., 2009
- Right **ventral temporal cortex**
  - reduced grey matter volume in dyslexic adolescents
  - Kronbichler et al., 2008

Classification performance is **differentially driven by various cortical features**.

Discriminative of dyslexia outcome prior to reading: **Regions later forming the reading network**

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