Investigating the Dependence of Spontaneous Fluctuations in Visual Cortex on Callosal Connectivity

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Declaration of Relevant Financial Interests or Relationships

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I have no relevant financial interest or relationship to disclose with regard to the subject matter of this presentation.

Inter-hemispheric functional connectivity during Rest
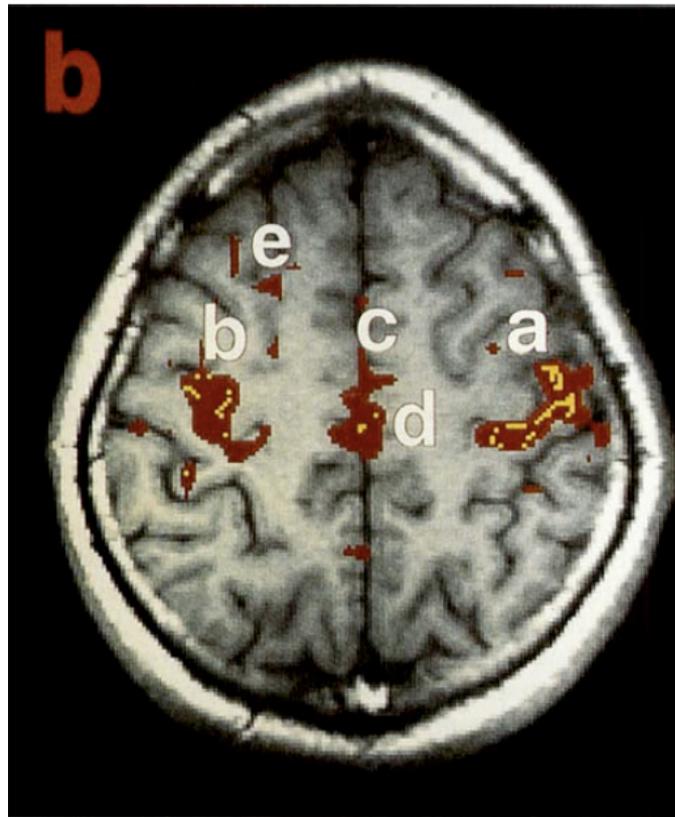
- *Biswal et al., MRM 1995*

ISMRM2011:
- *Jo et al., #430*
- *Tyszka et al., #431*
- *Zhou et al., #3686*
- *Li et al., #4123*

Does callosal connection underlie inter -hemispheric functional connectivity?

| **Seed points in V1** | **BEFORE callosotomy** | **AFTER callosotomy** |
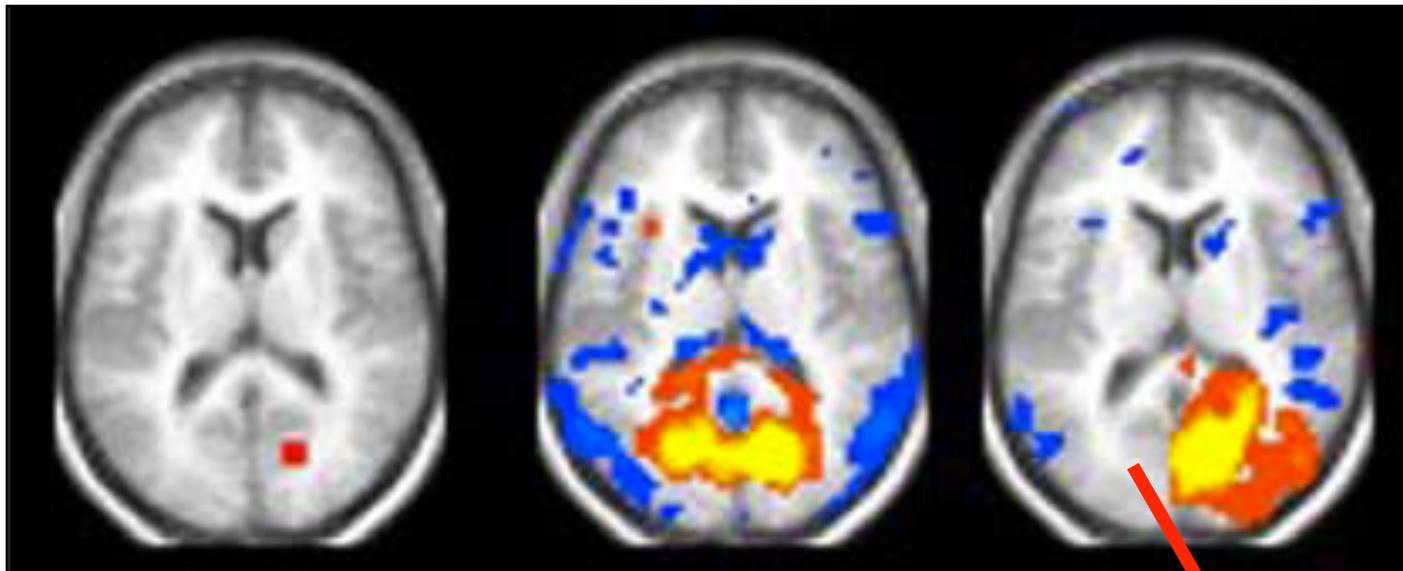
- Johnston et al., J. Neurosci. 2008

Loss of inter-hemispheric functional connectivity

- *Mohajerani et al., J. Neurosci. 2010*
- *Quigley et al., AJNR 2003*

Callosal connections in V1

Vertical Meridian (VM)

Callosal fibers

Callosal

Horizontal Meridian (HM)

Acallosal

- *Clarke and Miklossy, J. Comp. Neuro. 1990*
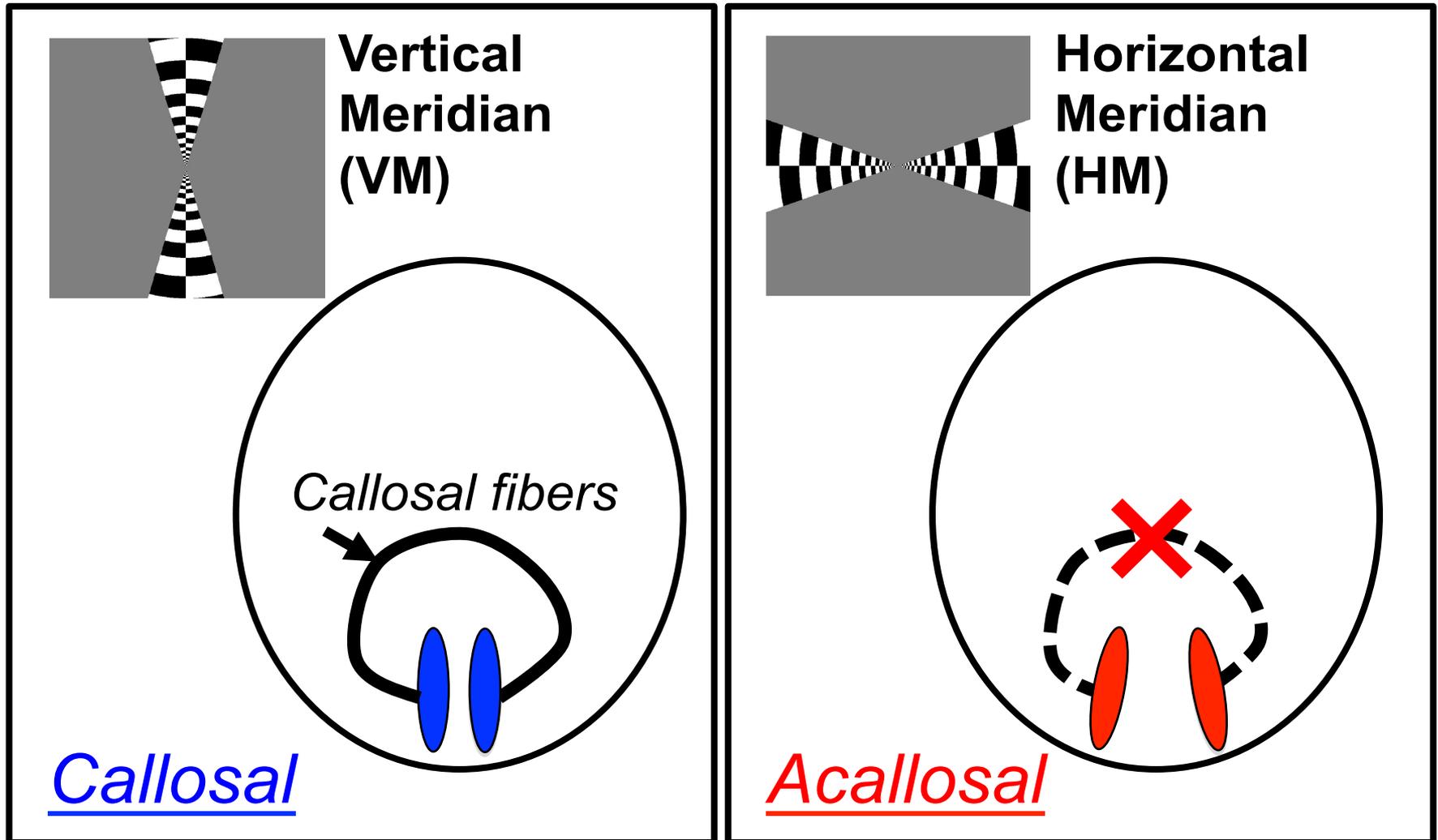
Aim

- Our aim was to **investigate the dependence of the strength of spontaneous fluctuations in V1 on callosal connectivity**

- *Hypothesis:* ***The strength of inter-hemispheric correlations is higher in callosal regions (VM) than in acallosal regions (HM)***
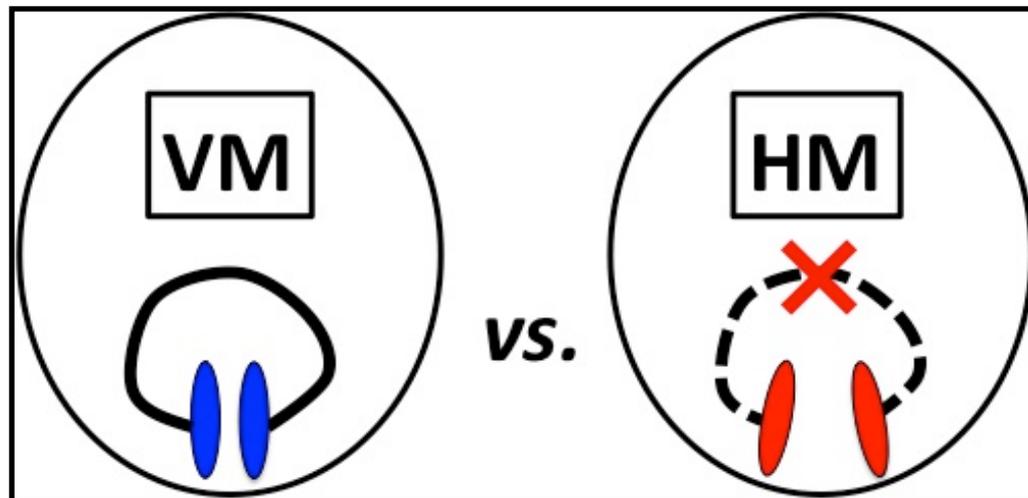
Methods

- Functional localization
  - **Traveling-wave method[1,2]**

BOLD fMRI at 3T
*GRE-EPI, SENSE R2, TR/TE = 2000/30 ms, **2.3 × 2.3 × 3 mm³**, matrix 96 × 96, 20 slices, 231 repetitions*

- Functional connectivity
  - **Eyes-closed resting-state[3]**
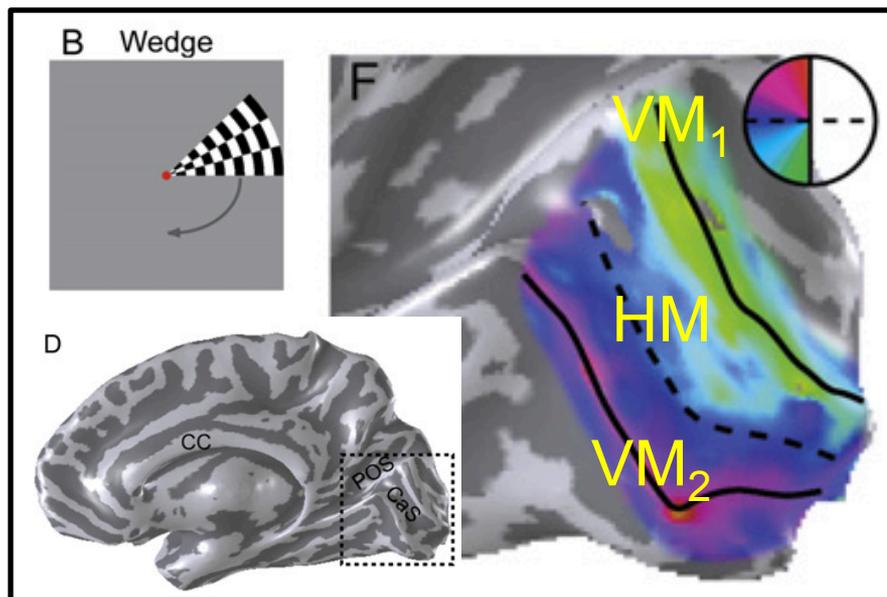
BOLD fMRI at 7T
*GRE-EPI, GRAPPA R2, TR/TE = 2000/24 ms, **2.3 × 2.3 × 2.3 mm³**, matrix 96 × 72, 50 slices, 300 repetitions*

- Three healthy volunteers
- T1 images: co-registration and surface reconstruction

[1] *Engel et al., Cere. Cortex 1997*
[2] *Wandell et al., Neuron 2007*
[3] *Biswal et al., MRM 1995*

Data analysis

- **fMRI data pre-processing**
  - Distortion correction
  - Slice-timing correction
  - Head motion correction
  - Temporal polynomial detrending

- **Resting-state fMRI**
  - Temporal filtering (0.01-0.1 Hz)
  - Global mean signal regression
  - Nuisance signal regression

- **Surface data analysis**

- Cortical surface reconstruction
(FreeSurfer)

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- Retinotopic mapping
- Region-of-interest placement
(AFNI & SUMA)

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- Connectivity mapping
- ROI-based correlation

ROI localization
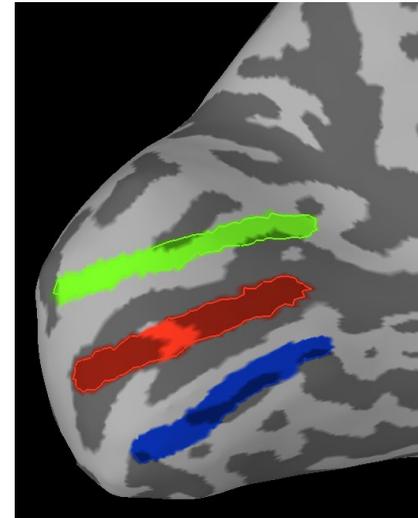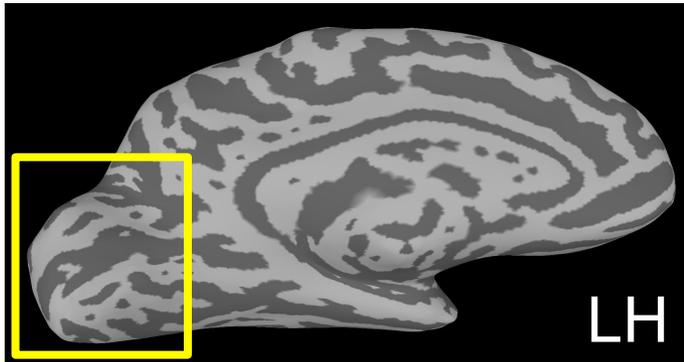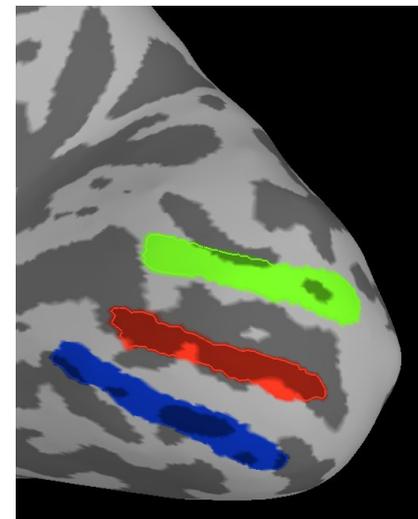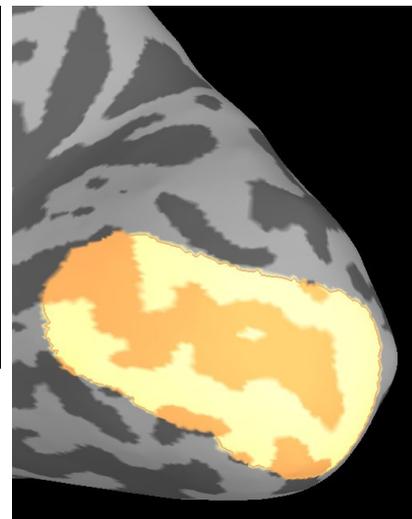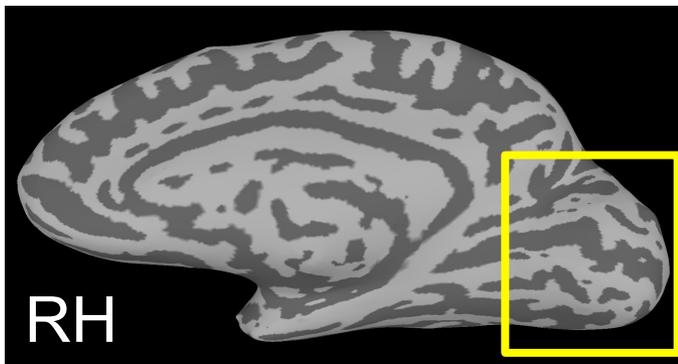
Connectivity mapping (seed in RH)
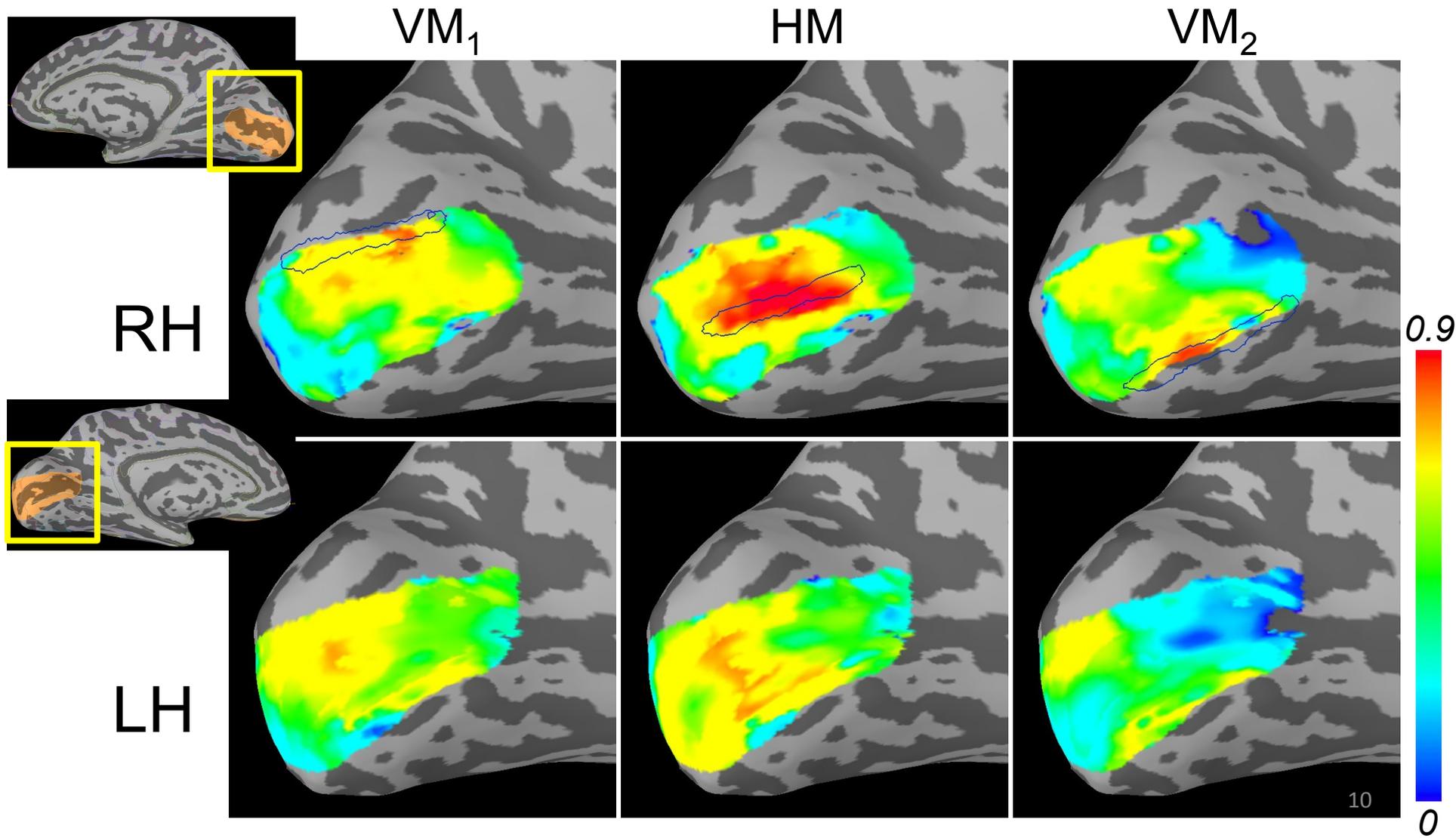
Connectivity mapping (seed in LH)
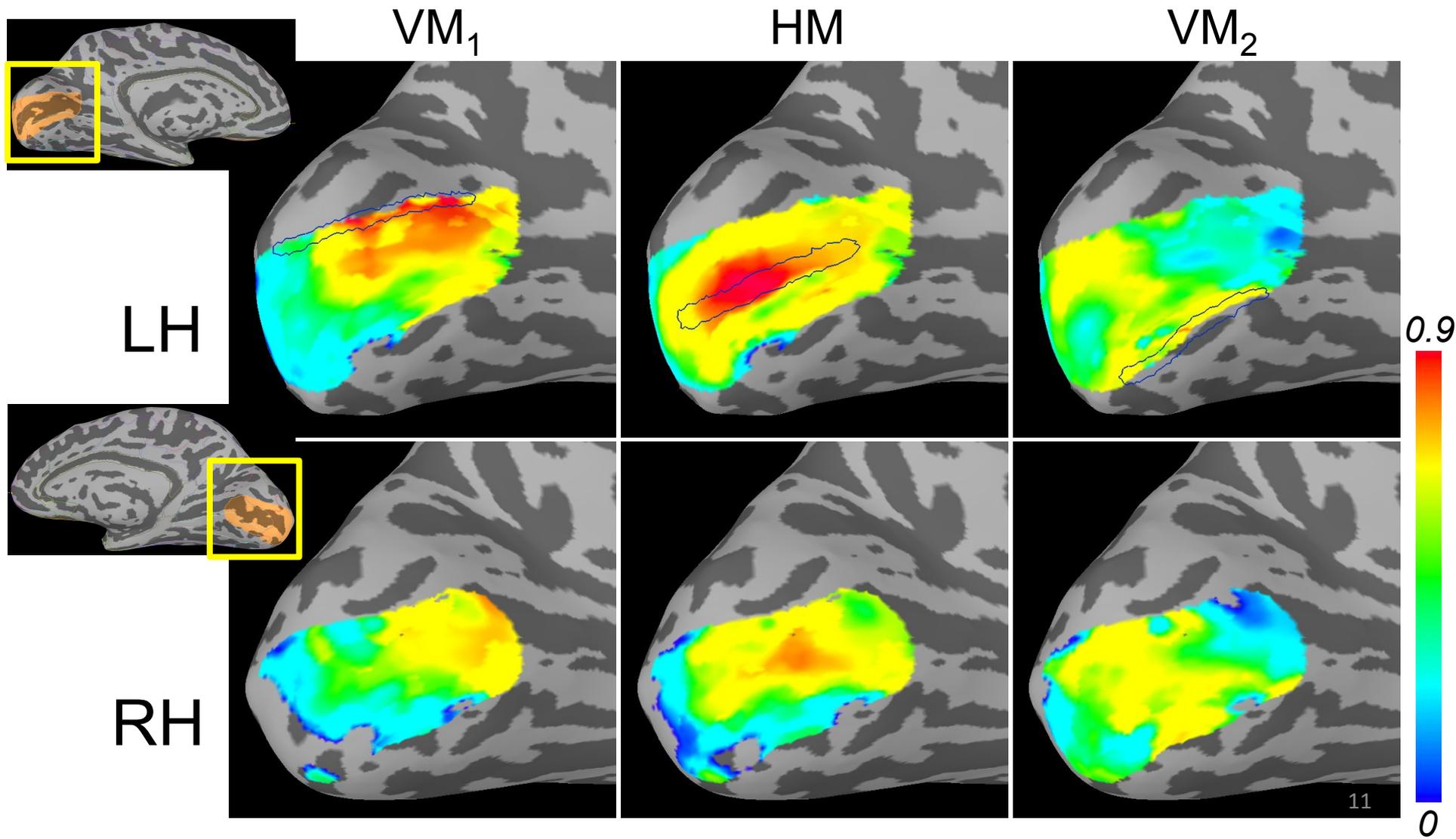
Pearson's correlation matrix

Stronger inter-hemispheric correlations in retinotopically homologous areas
(Polimeni et al., ISMRM2010)
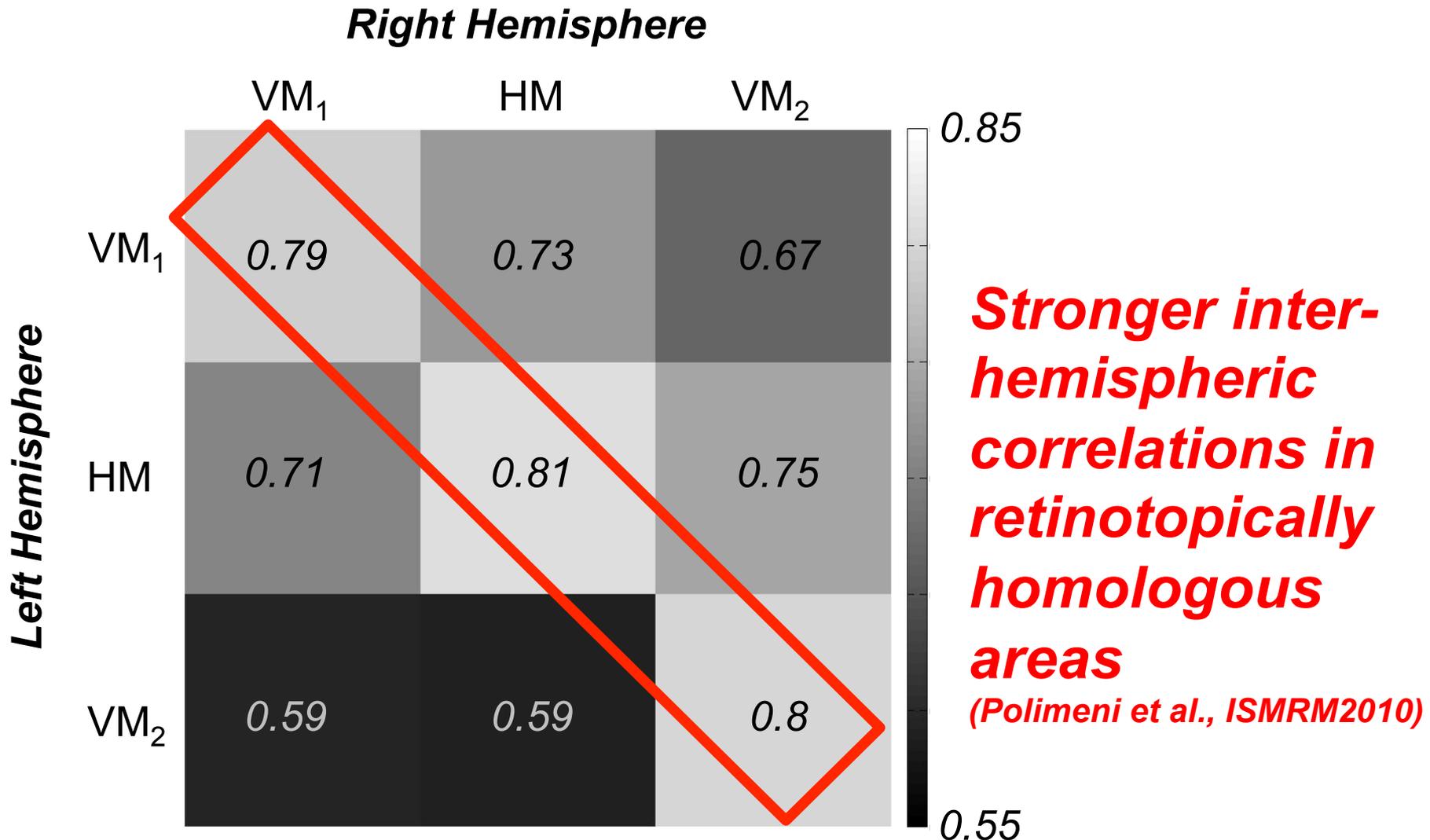
Comparison of VM *vs*. HM

LH   RH

VM
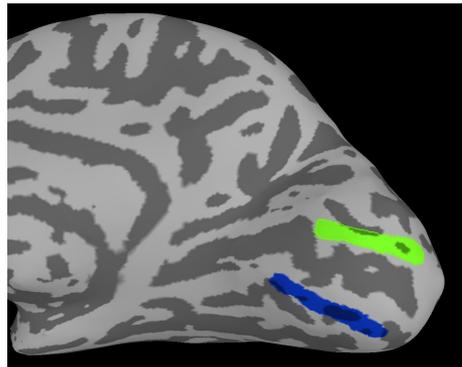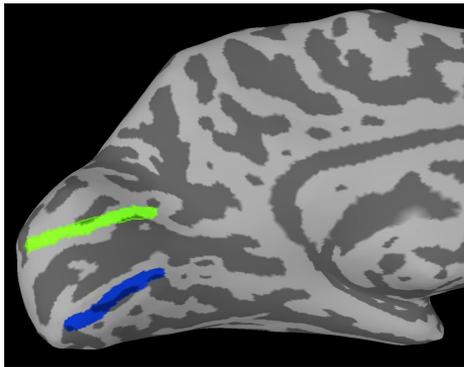
HM
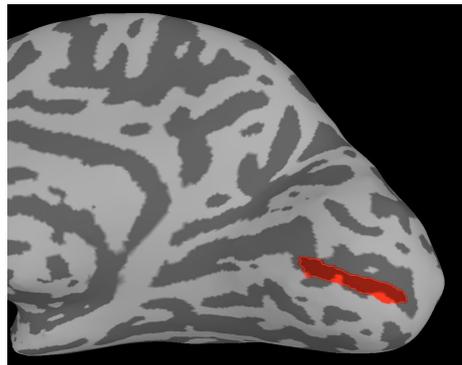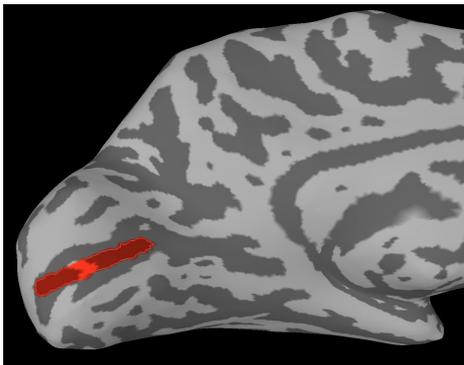
Comparison of VM *vs*. HM
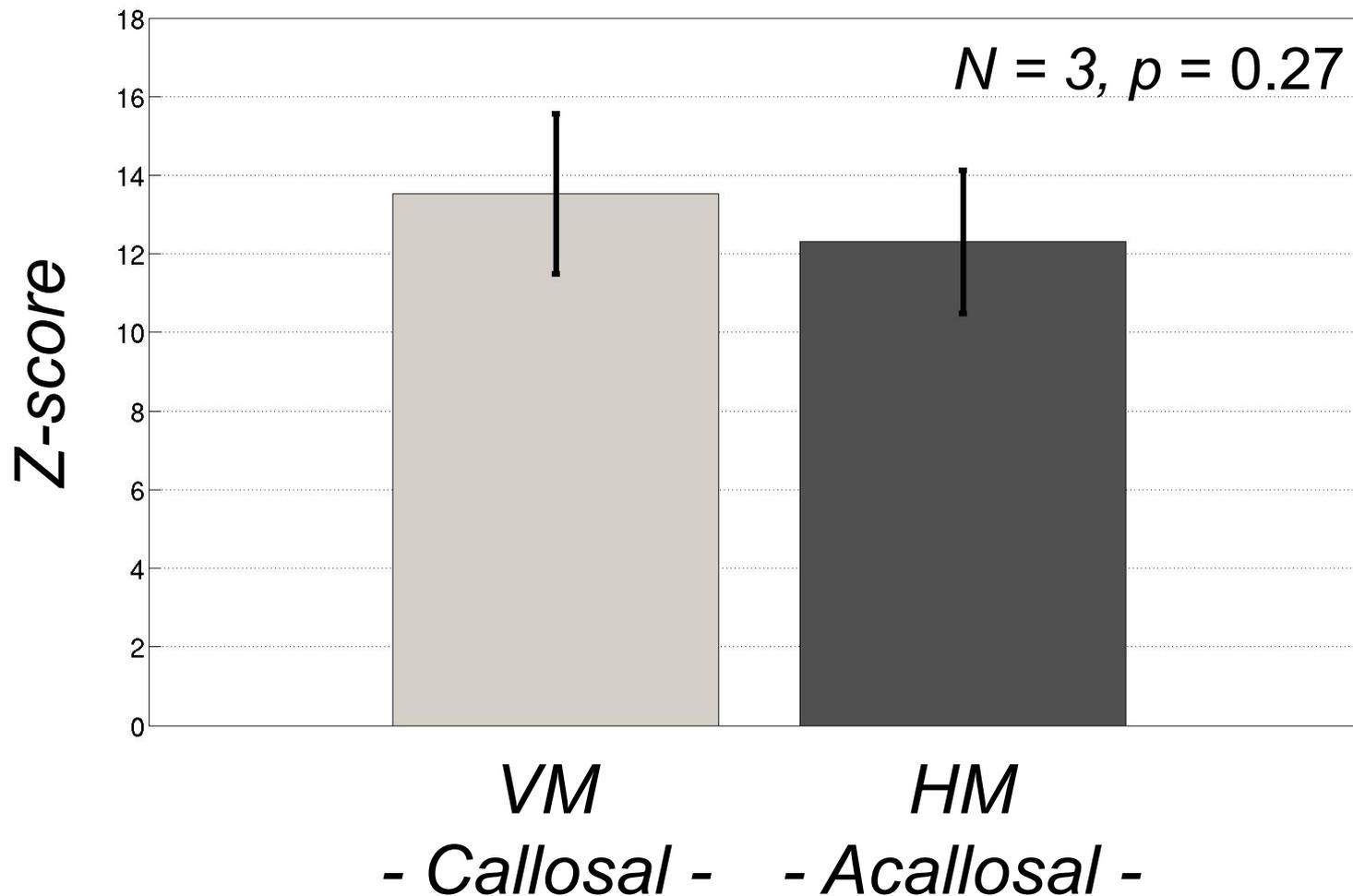
Discussion

- No significant difference in inter-hemispheric functional connectivity was found between callosal and acallosal regions in primary visual cortex

  - ***Mono-synaptic connections may not be the most critical factor driving these inter-hemispheric correlations***

- Our current results suggest that ***a dominant involvement of a multi-synaptic pathway may need to be considered***

- Additional subjects are being scanned to solidify our findings

Thank you for your attention!

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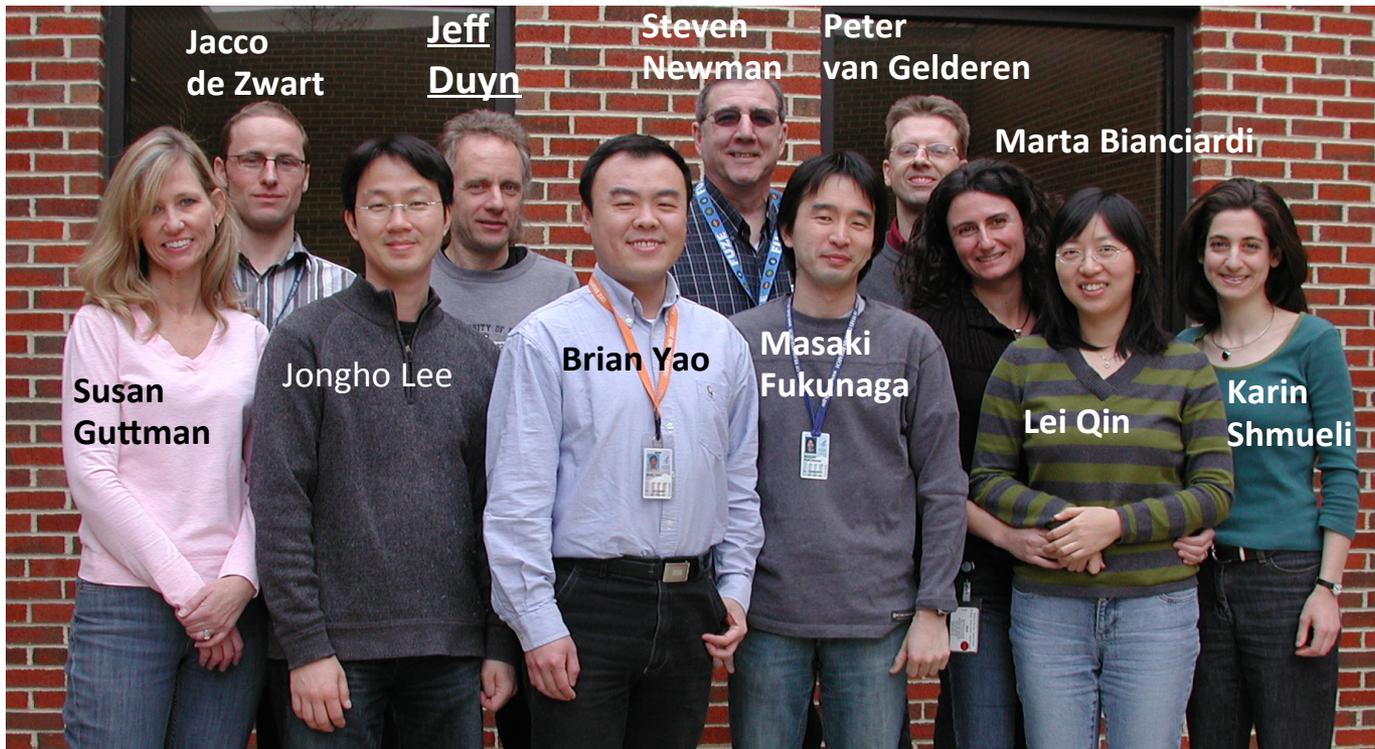
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