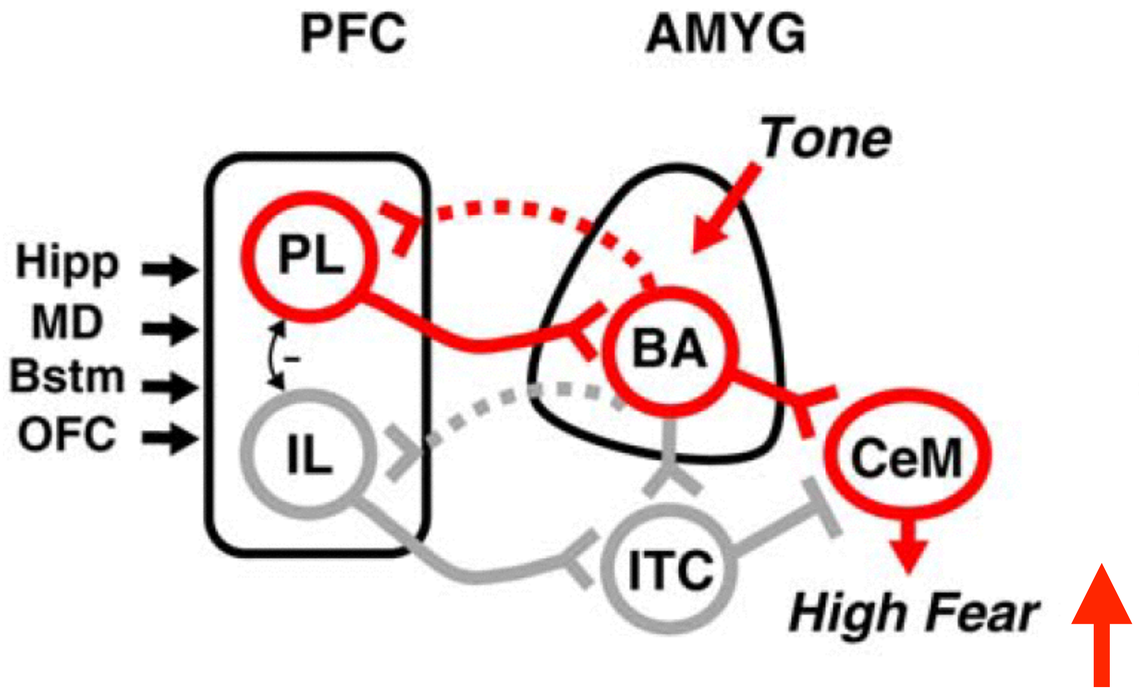
Shifts of the amygdala coupling with dorsal and ventral medial PFC are associated with fluctuations in arousal

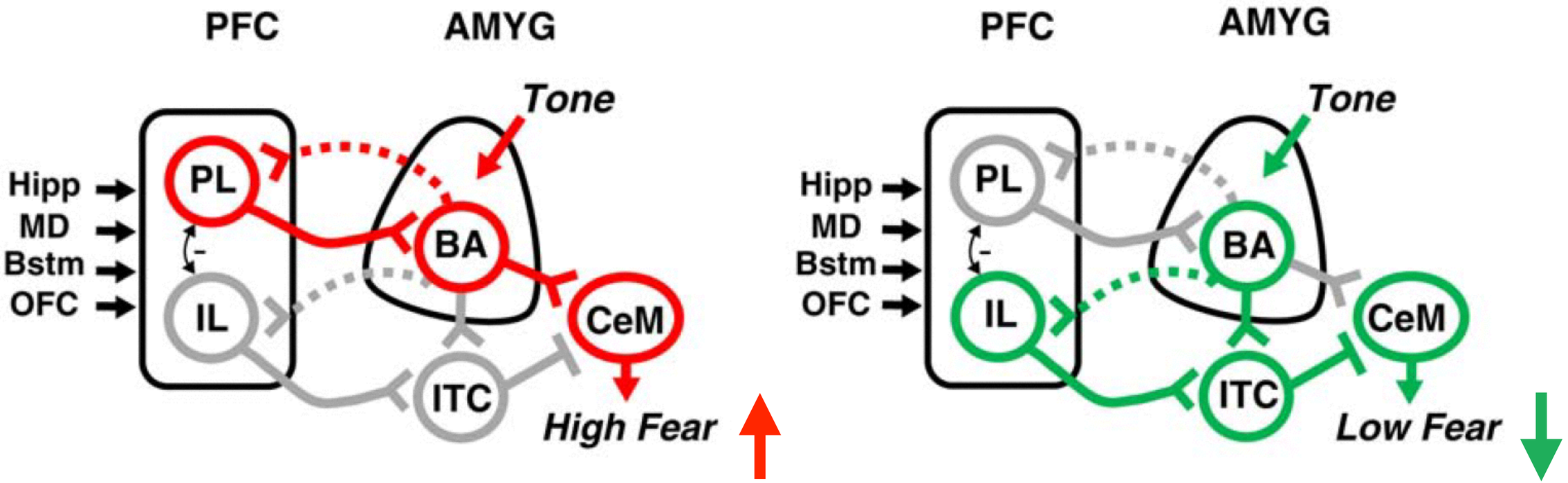
Blazej M. Baczkowski

In rodent models, amygdala-PFC circuit regulates fear expression



Sotres-Bayon & Quirk (2010)
Curr Opin Neurobiol

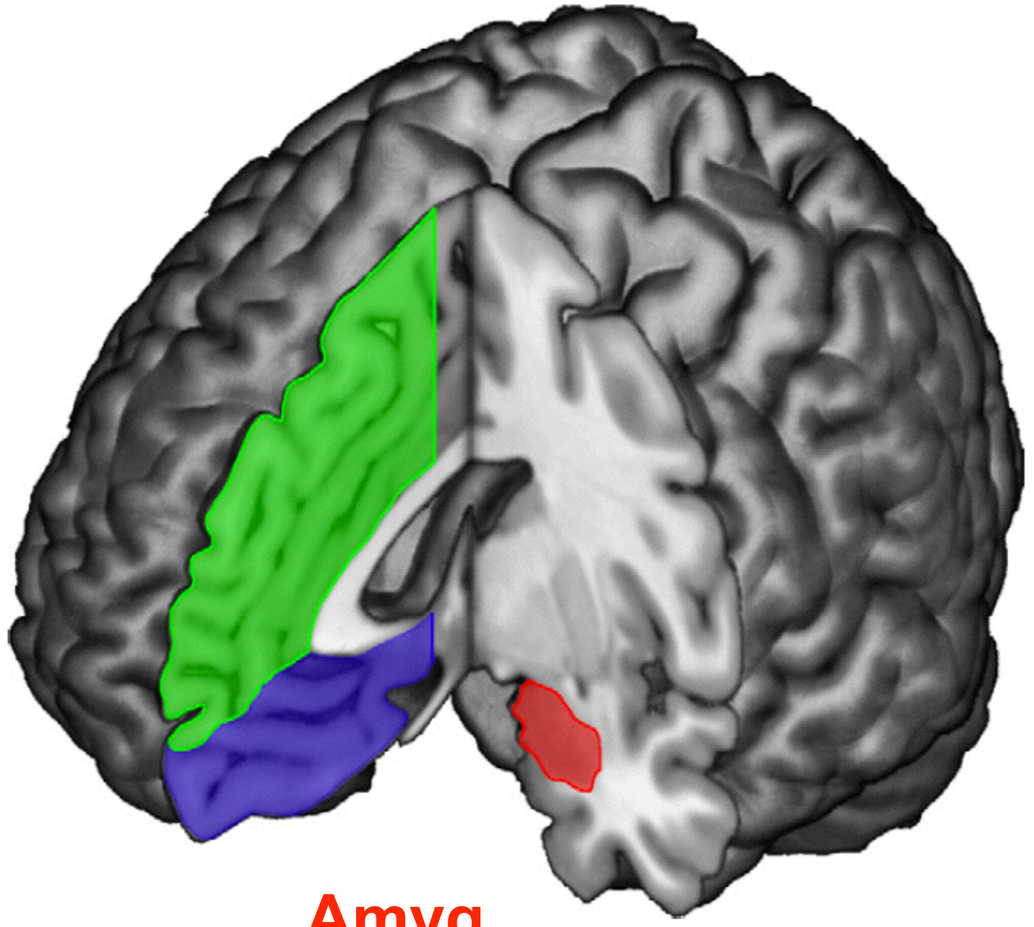
In rodent models, amygdala-PFC circuit regulates fear expression



Sotres-Bayon & Quirk (2010)
Curr Opin Neurobiol

Human neuroimaging revealed homologous dorso-ventral components of the amygdala-PFC circuit

Dorsal mPFC

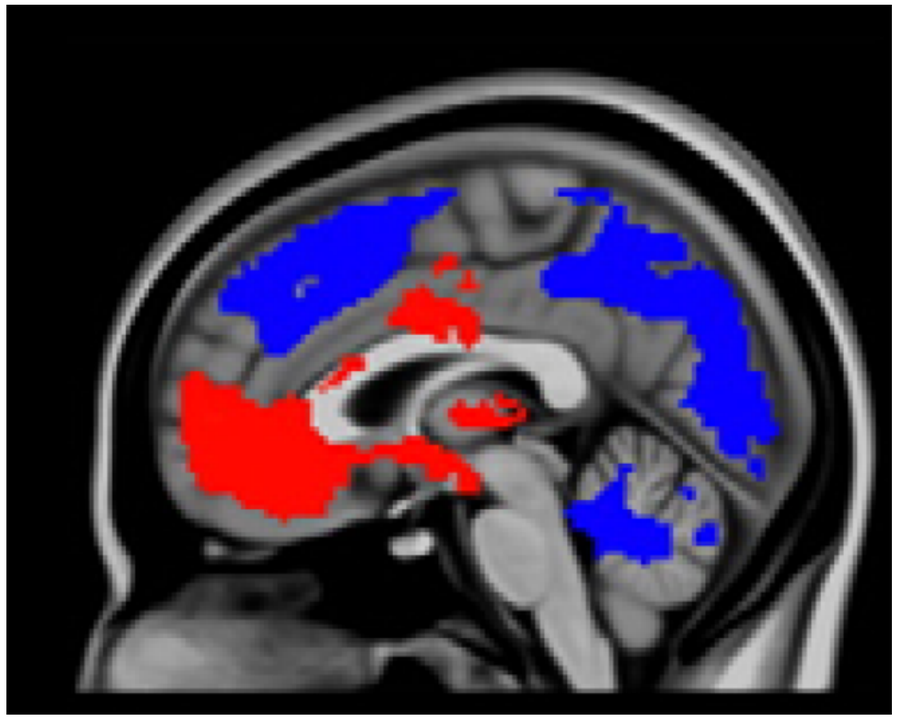


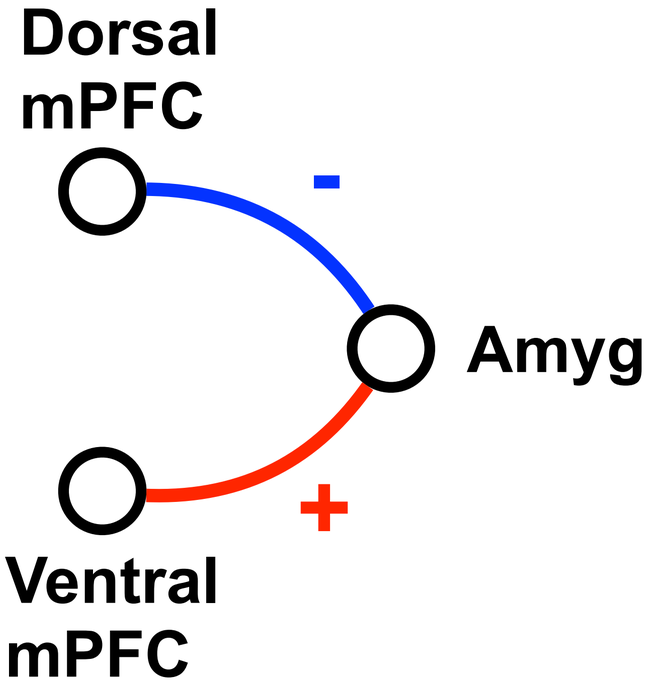
Ventral mPFC

Amyg

Kim et al. (2011)
Behav Brain Res

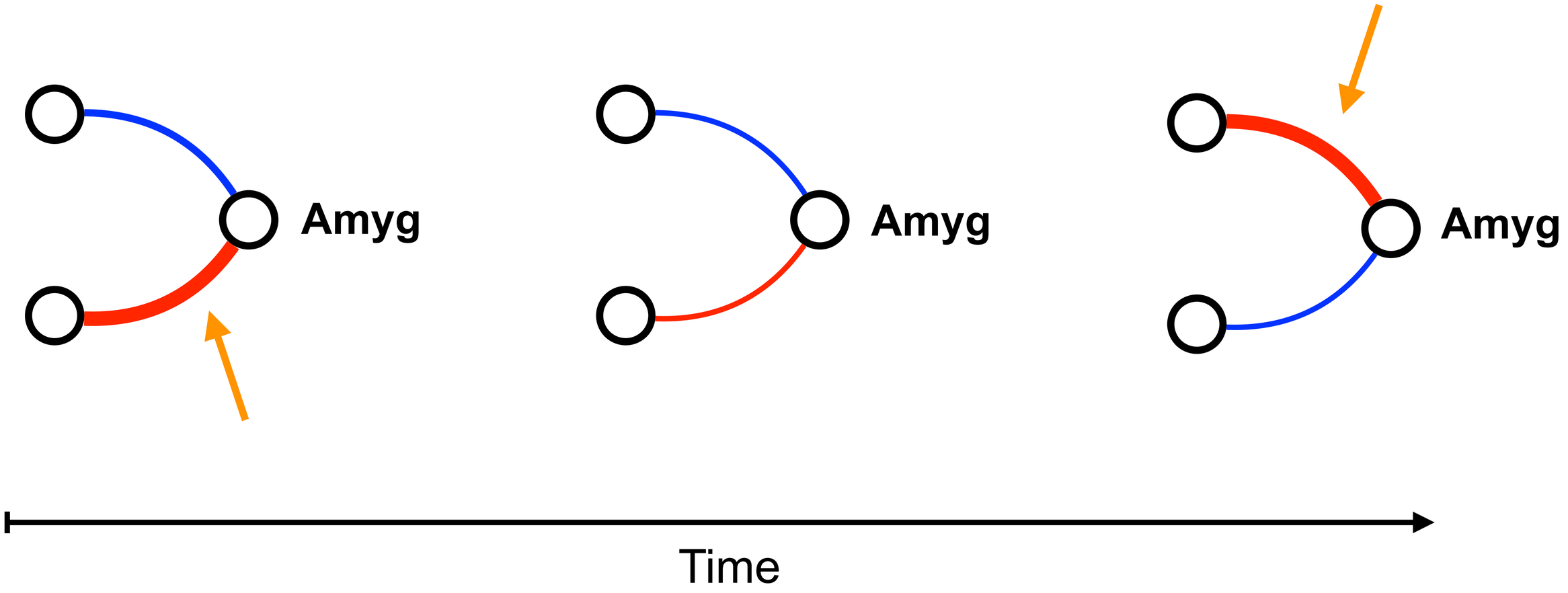
The amygdala exhibits default coupling with the ventro-medial PFC



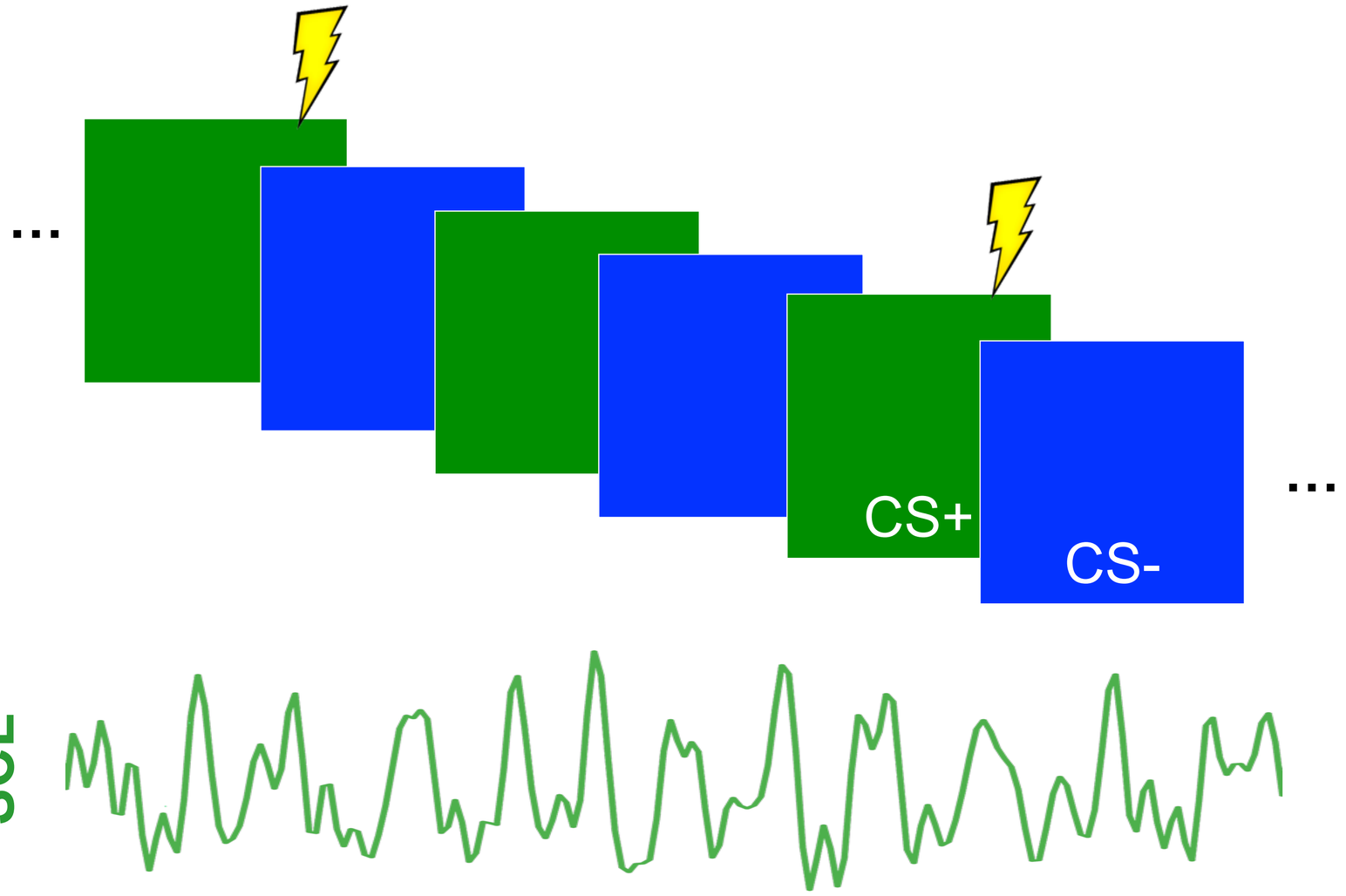


Roy et al. (2009)
NeuroImage

Are the shifts of the amygdala-mPFC coupling associated with fluctuations in arousal?



Classical fear conditioning task induces changes in arousal indexed by skin conductance level (SCL)



Design

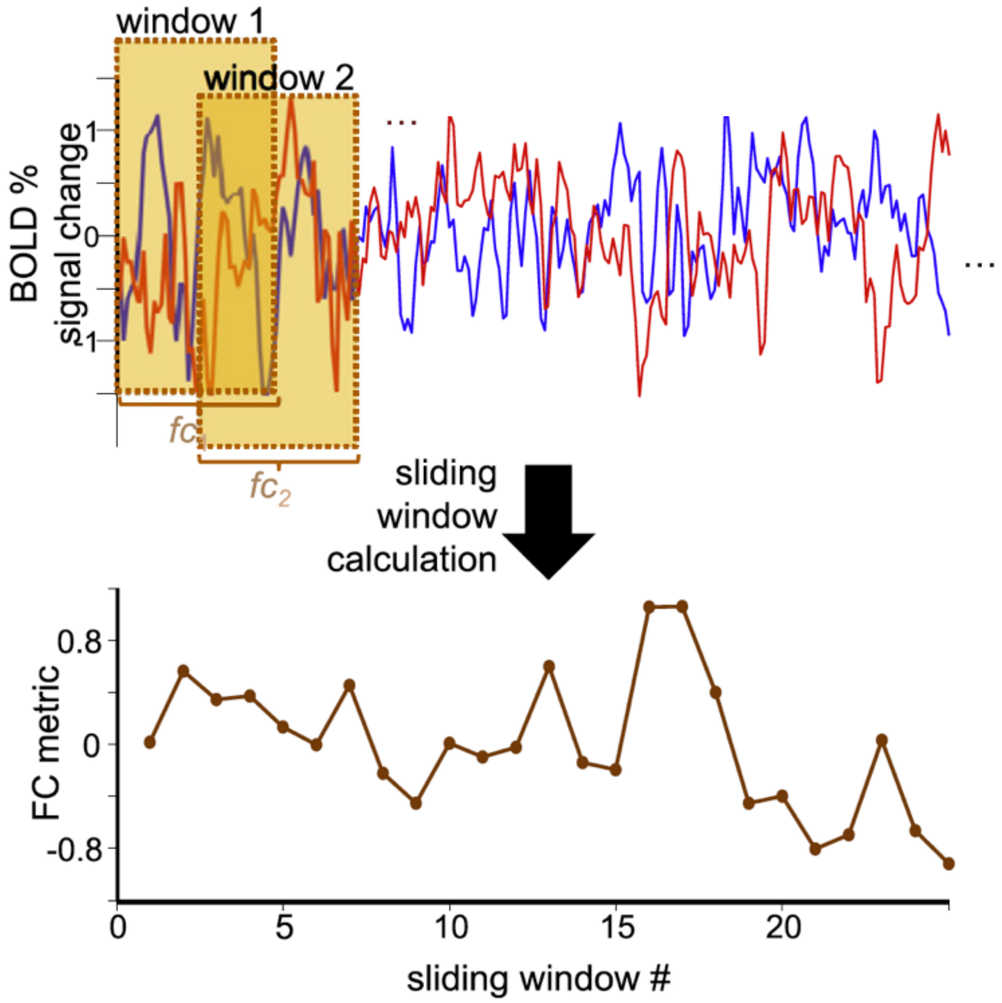
- 32 participants
- associative learning with partial reinforcement
- UCS (electric shock)

fMRI parameters

- 413 volumes
- TR=1.96 sec
- 39 axial slices
- sequential ascending
- 3.0 x 3.0 x 2.4 mm

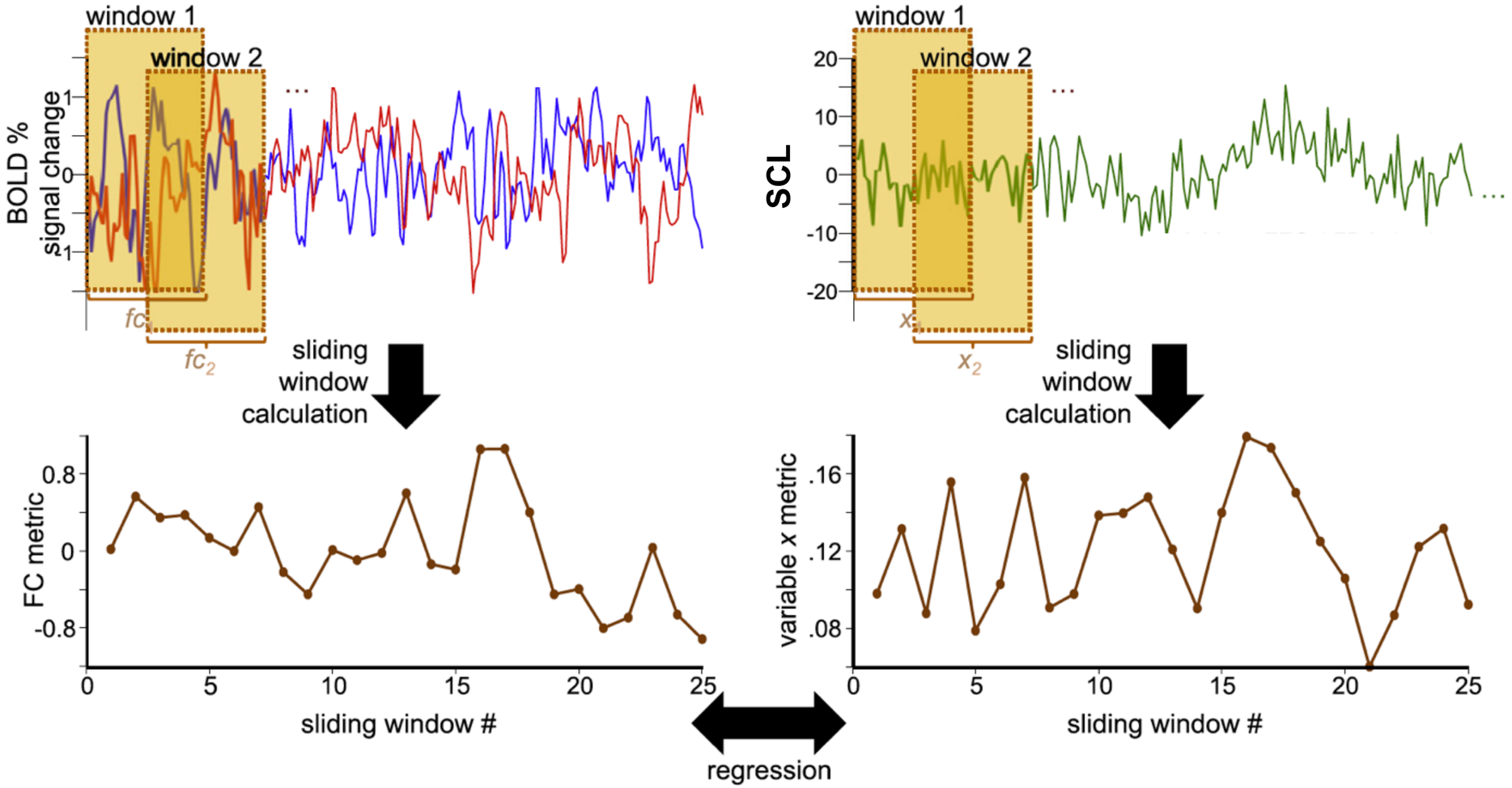
Bilkei-Gorzo, Erk et al (2013), J Neurosci

Ongoing fluctuations in functional connectivity are typically investigated with a sliding-window



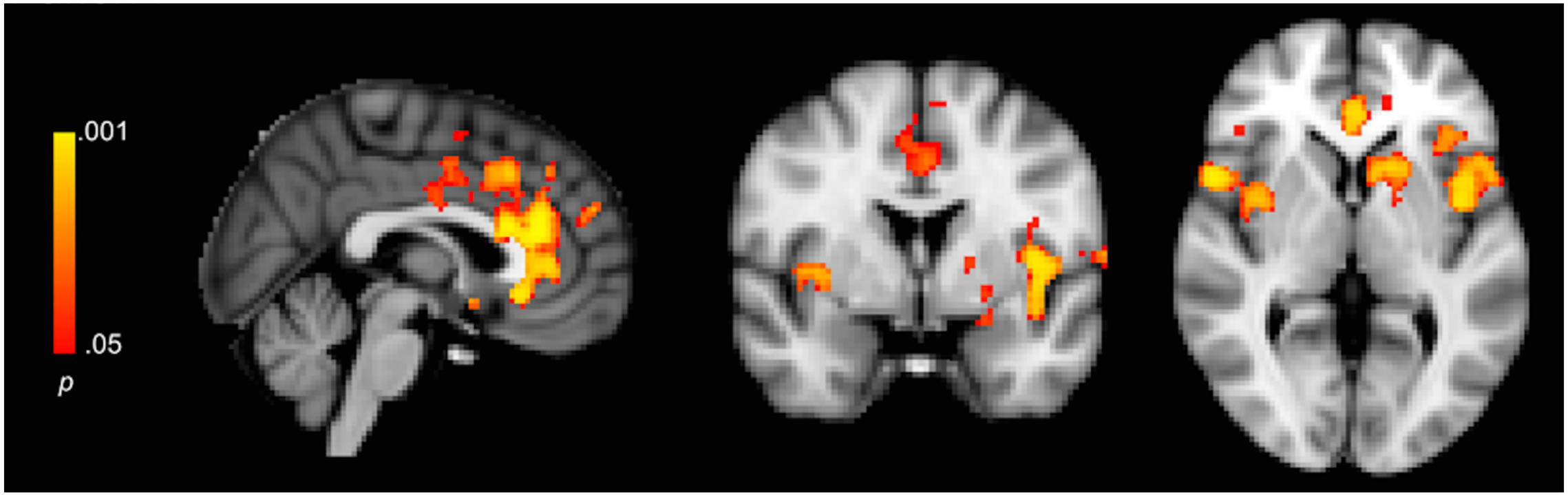
Hutchison et al. (2013) NeuroImage

Skin conductance level (SCL) enabled us to track fluctuations in amygdala sliding-window connectivity



Adapted from:
Hutchison et al. (2013) NeuroImage

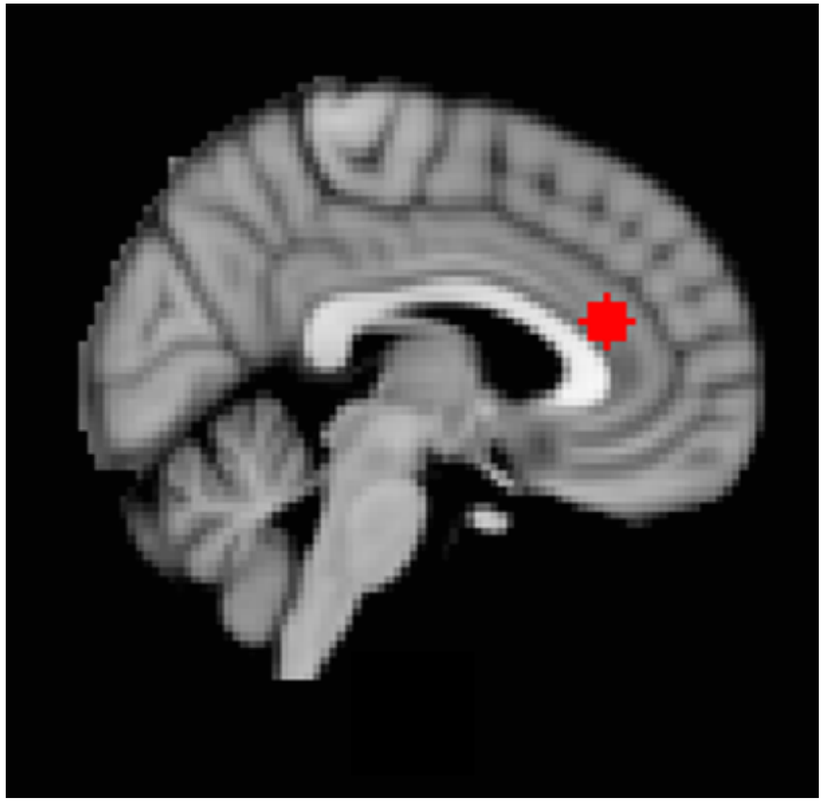
Sliding-window revealed fluctuations in the left amygdala connectivity associated with skin conductance level

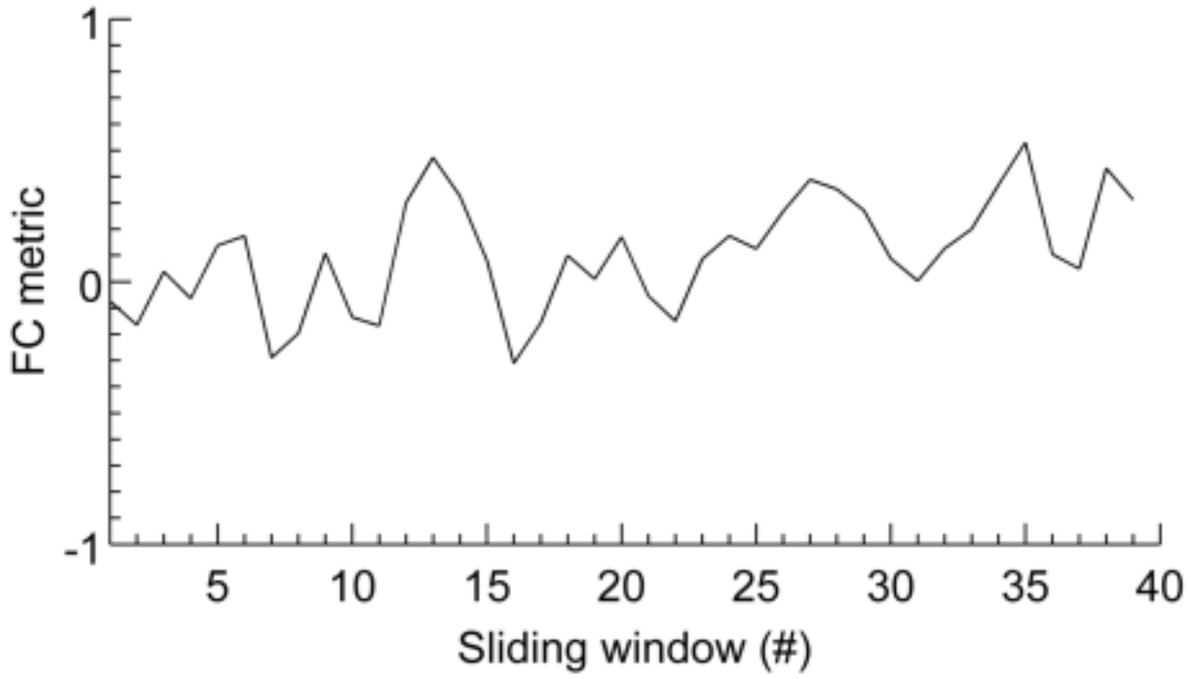


p<.05 FWE-corrected
(non-parametric t-test; 5000 perm.; TFCE)

Baczkowski et al. (2017)
NeuroImage

The anterior cingulate cortex (ACC) was used as an ROI to explore the features of the amygdala sliding-window connectivity

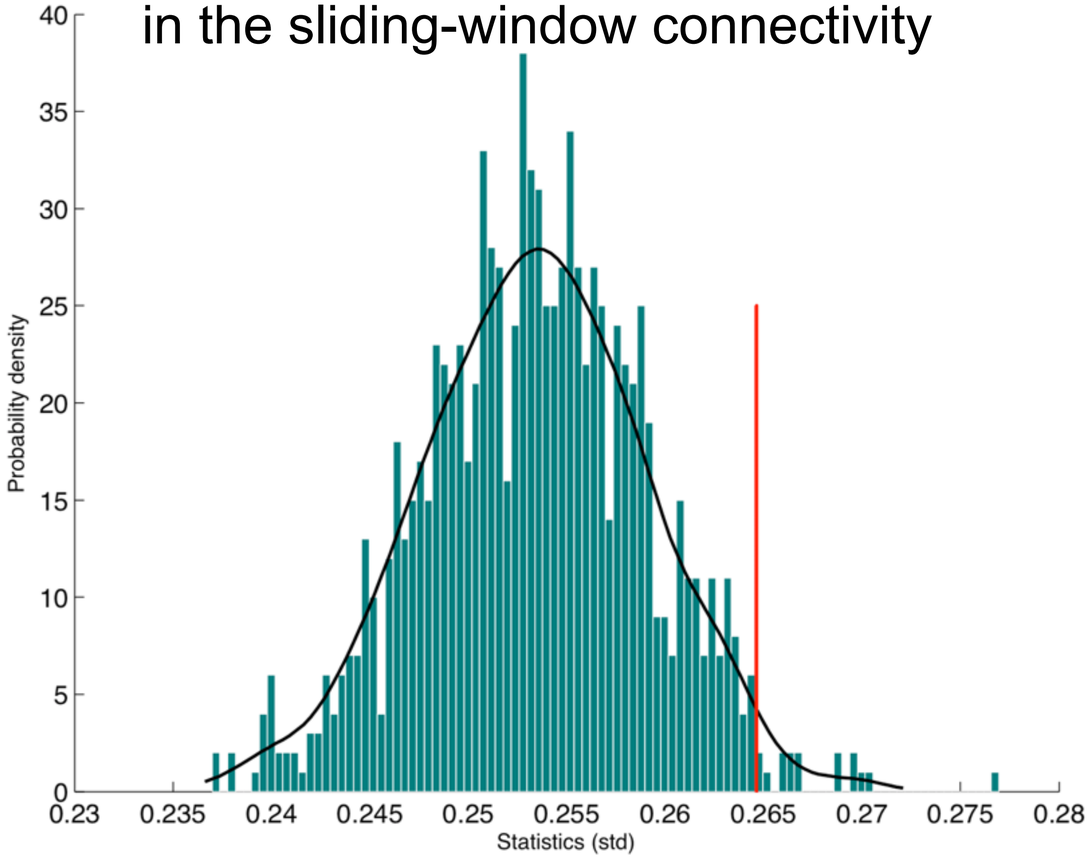




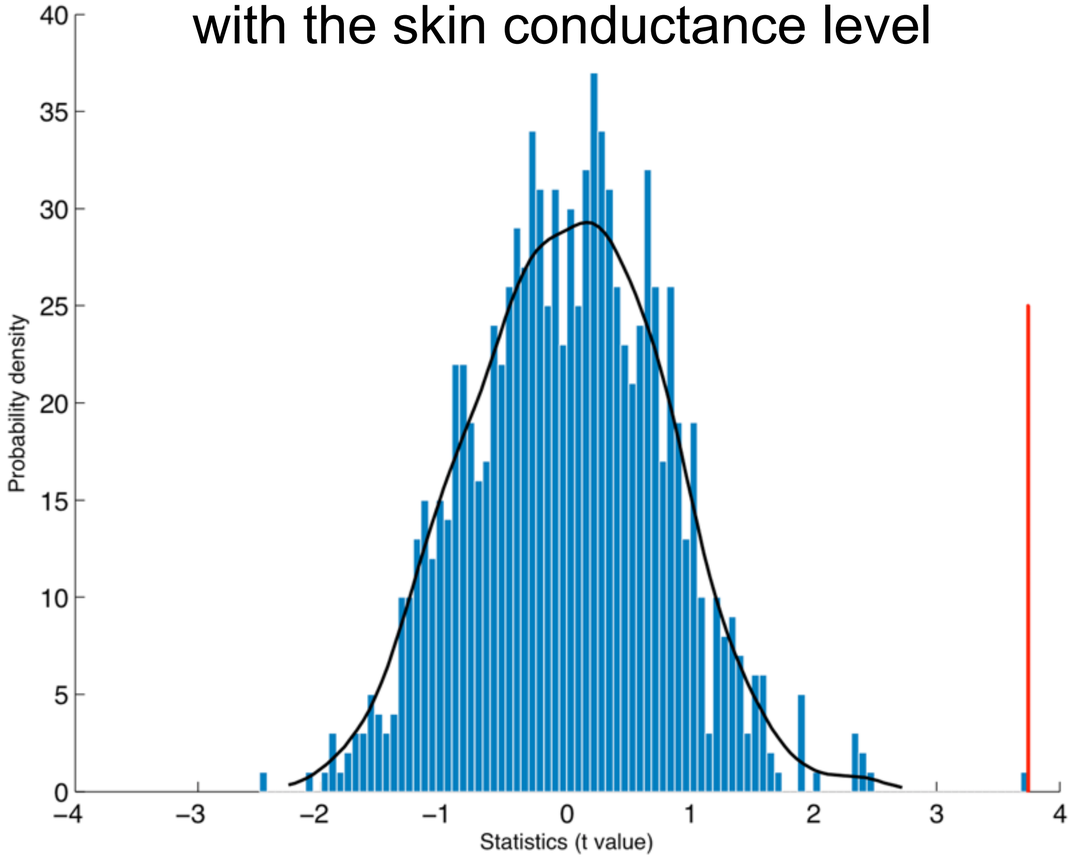
Baczkowski et al. (2017)
NeuroImage

Surrogate data confirmed the presence of the amygdala-ACC connectivity fluctuations

variability
in the sliding-window connectivity

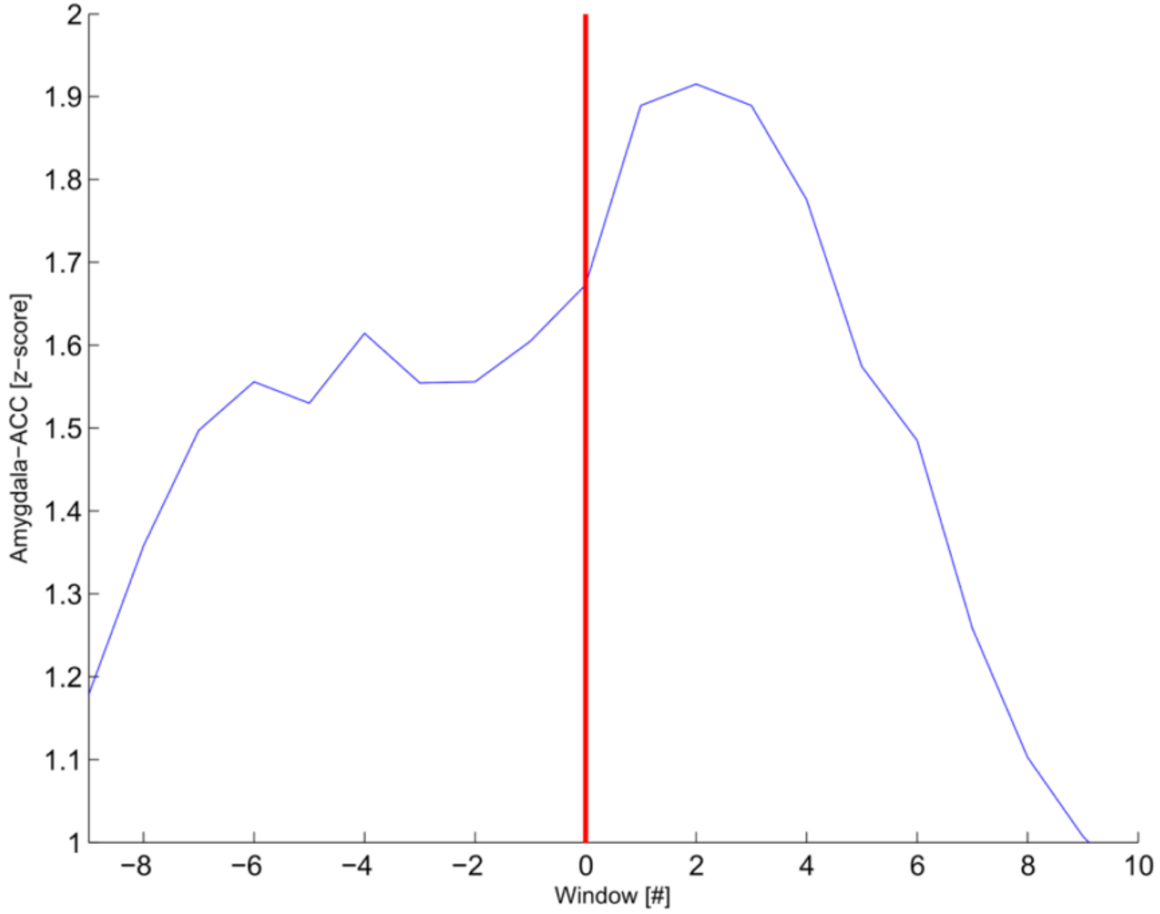


association
with the skin conductance level



Baczkowski et al. (2017)
NeuroImage

Increases in the amygdala-ACC connectivity coincided with the presentation of a shock

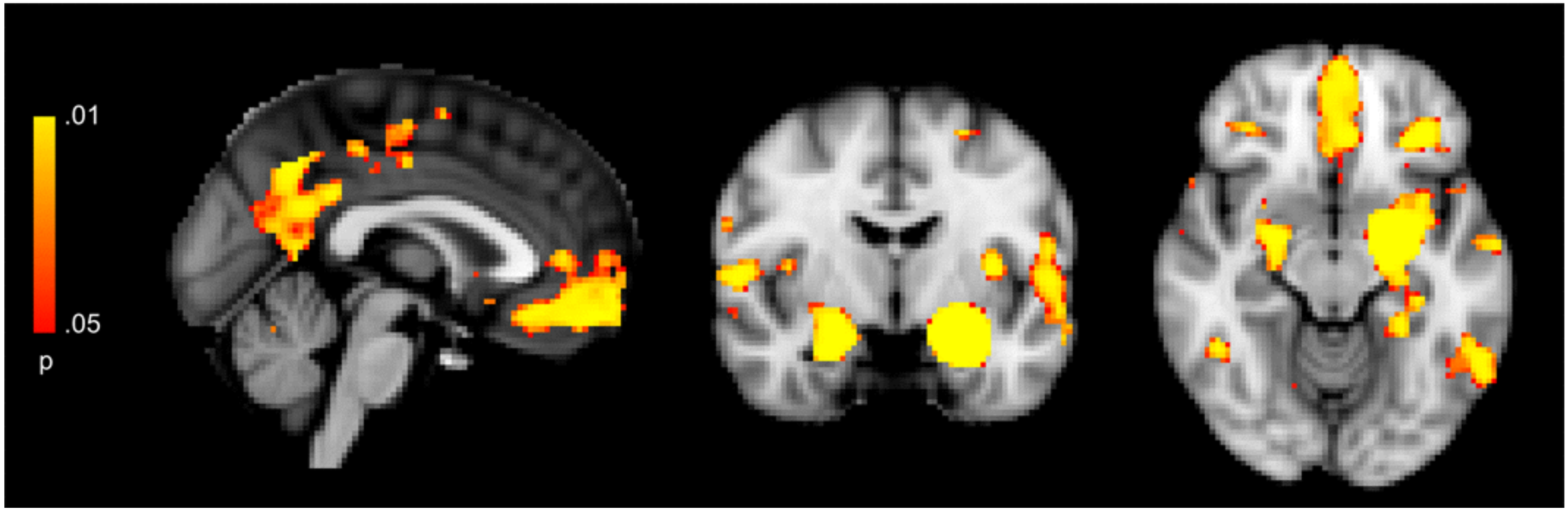


GLM analysis

- 5 sine functions (window length harmonics)
- epoch of 20 windows
- F(6,388)=3.32; *p*=.006
- 0.0125 Hz sine best fit (*p*<.0001)

Baczkowski et al. (2017) unpublished

Static (“averaged”) amygdala connectivity exhibited its default topography



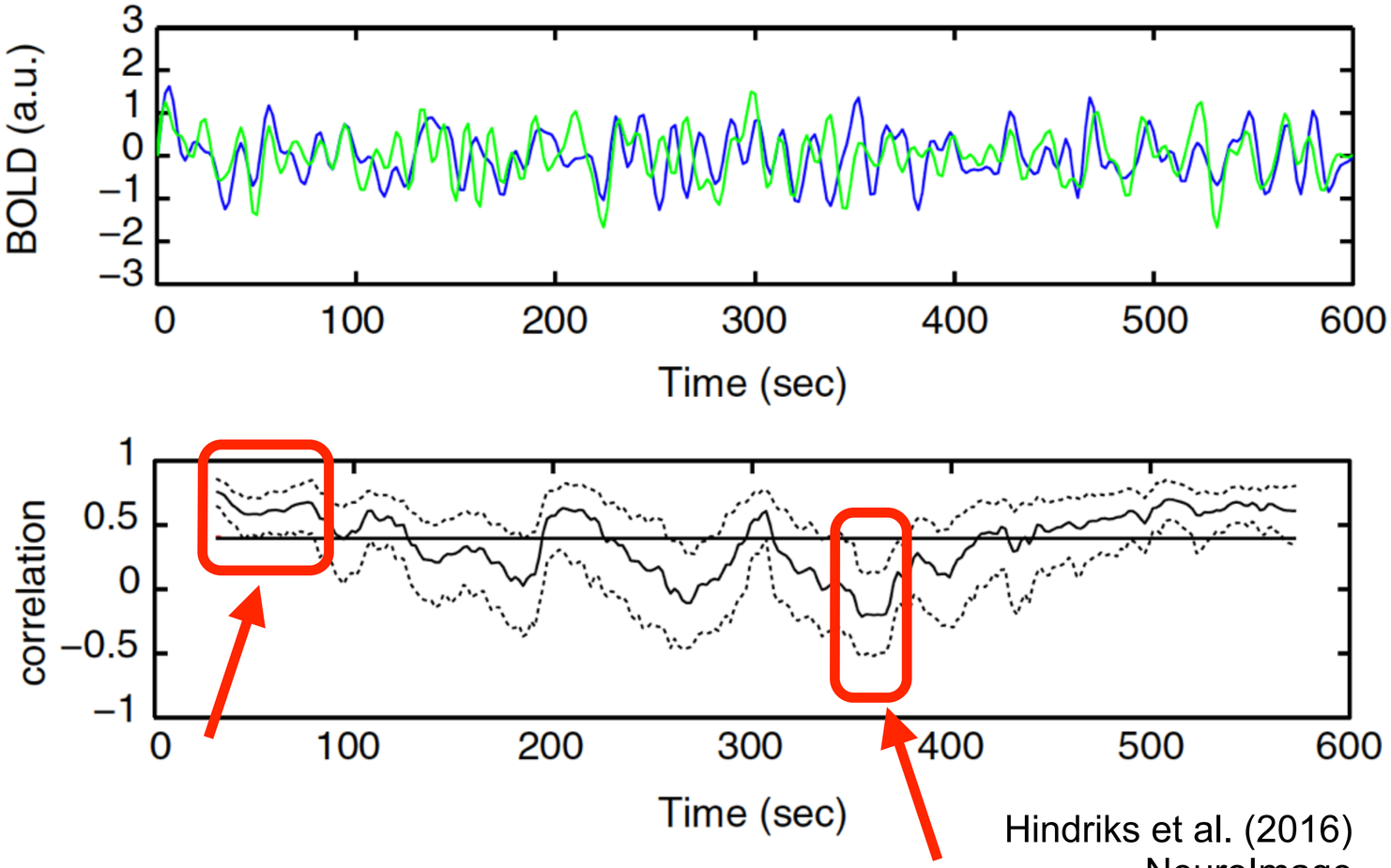
p<.05 FWE-corrected
(non-parametric t-test; 5000 perm.; TFCE)

Baczkowski et al. (2017)
NeuroImage

During periods of increased arousal,
the amygdala tends to shift its connectivity pattern
from ventral to dorsal parts of the medial PFC

What are the implications for intrinsic connectivity changes?

What are the implications for intrinsic connectivity changes?



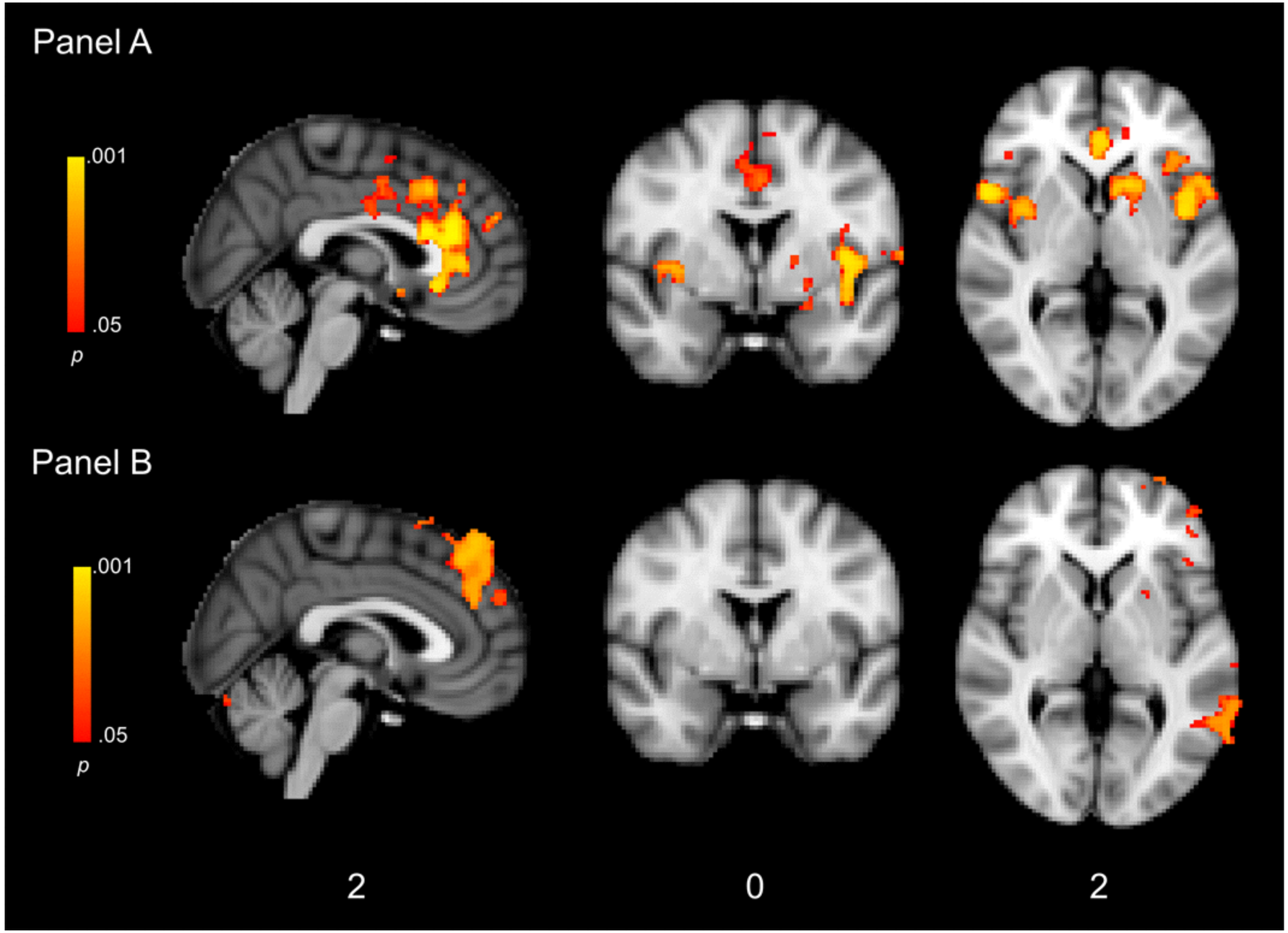
Hindriks et al. (2016)
NeuroImage

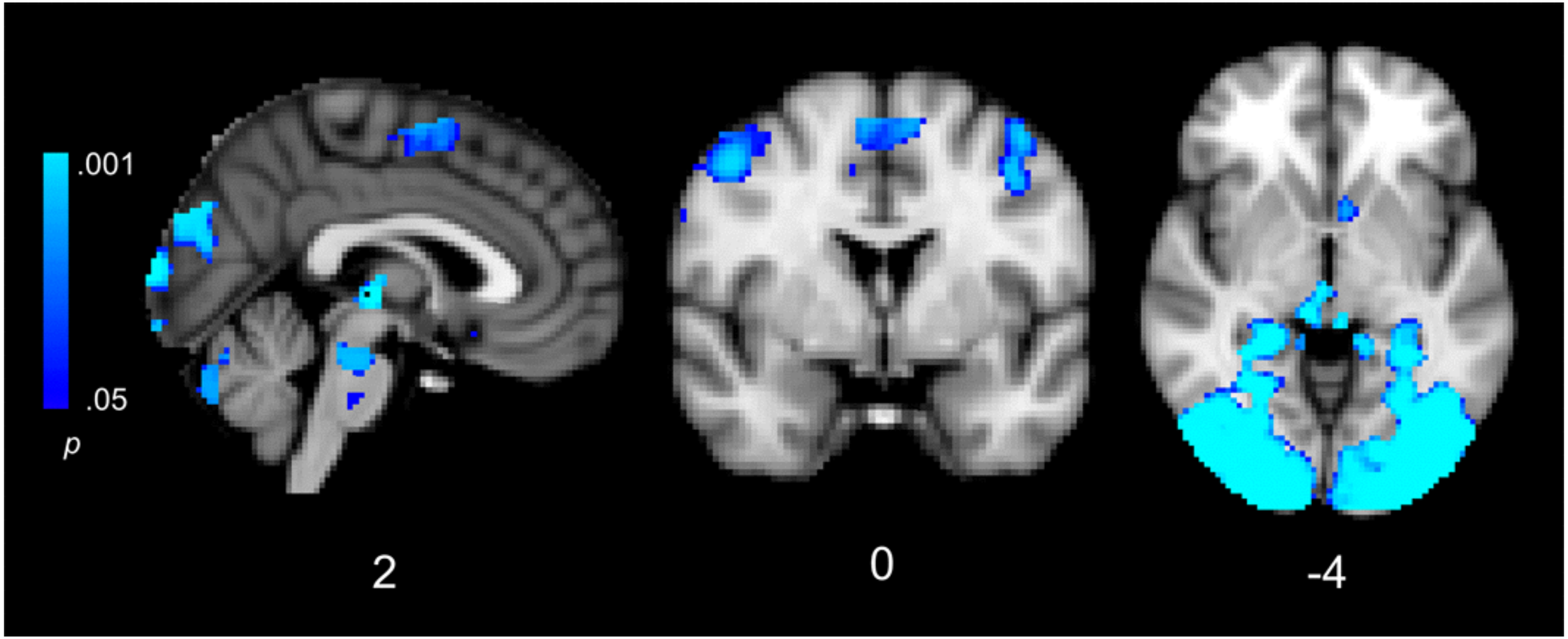
Potential major sources

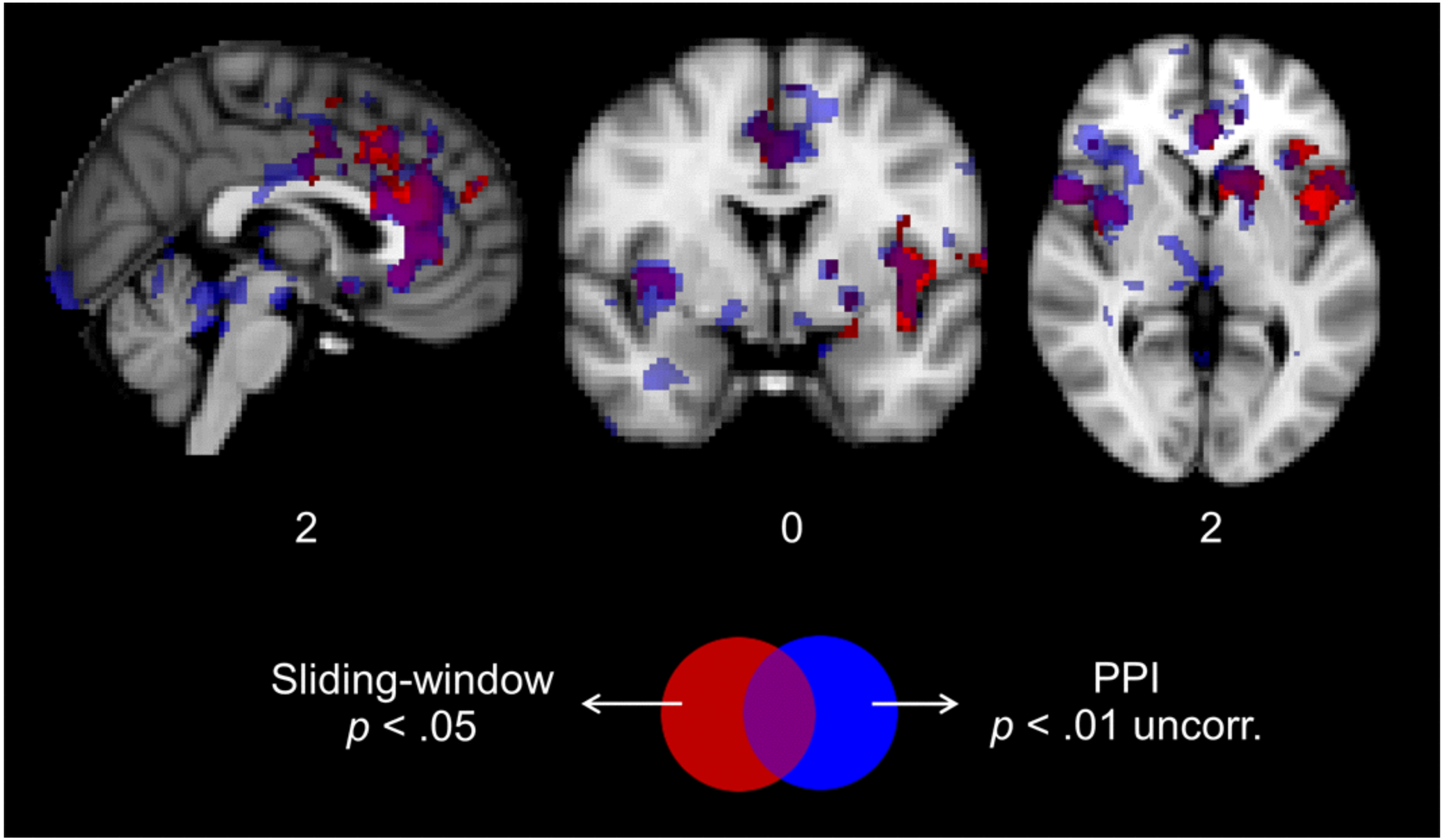
- head motion
  (Laumann et al., 2016)
- drowsiness/sleep
  (Tagliazucchi et al., 2012)
- arousal
  (Chang et al., 2013; 2016)
- synaptic change/ learning
  (e.g., Hermans et al., 2016)

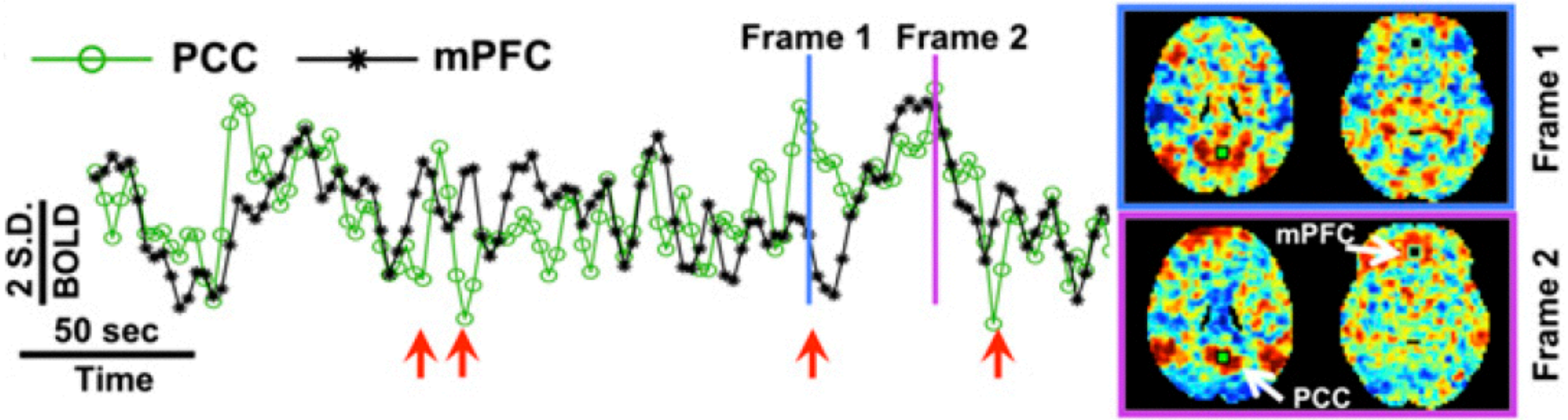
Acknowledgments

- Prof. Tom Johnstone
- PD Susanne Erk, PhD
- Prof. Henrik Walter
- Ilya Veer, PhD
- Prof. Hauke Heekeren


Panel A
.001
.05
p
Panel B
.001
.05
p
2
0
2


.001
.05
p
2
0
-4


2
0
2
Sliding-window
p < .05
PPI
p < .01 uncorr.



Liu & Duyn (2011)
PNAS