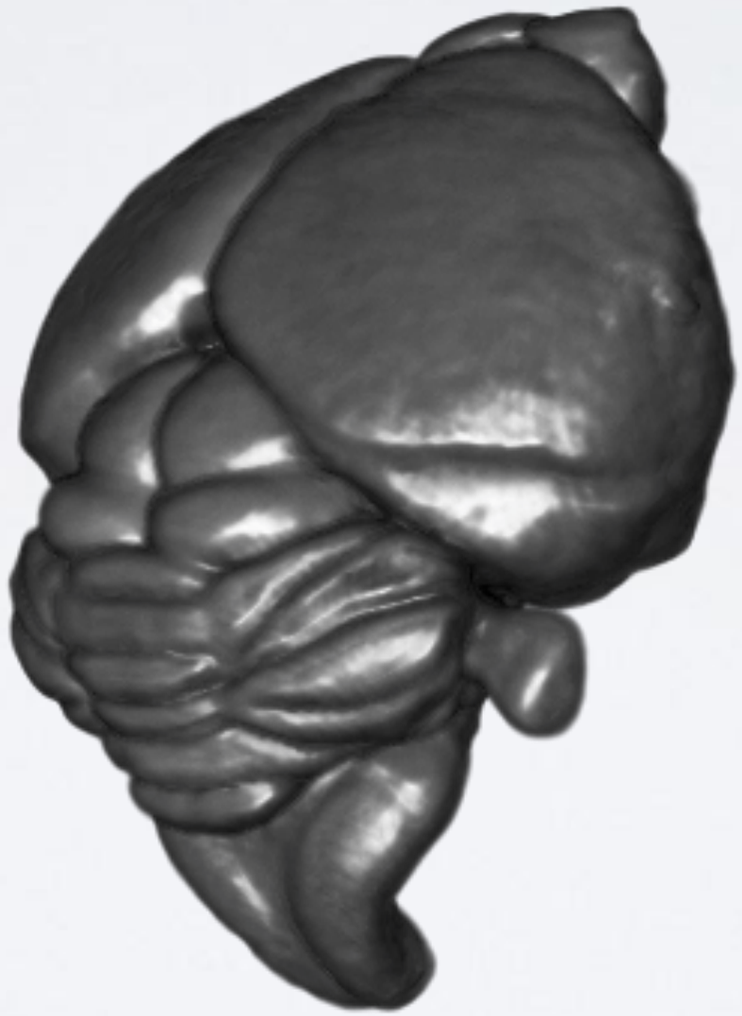
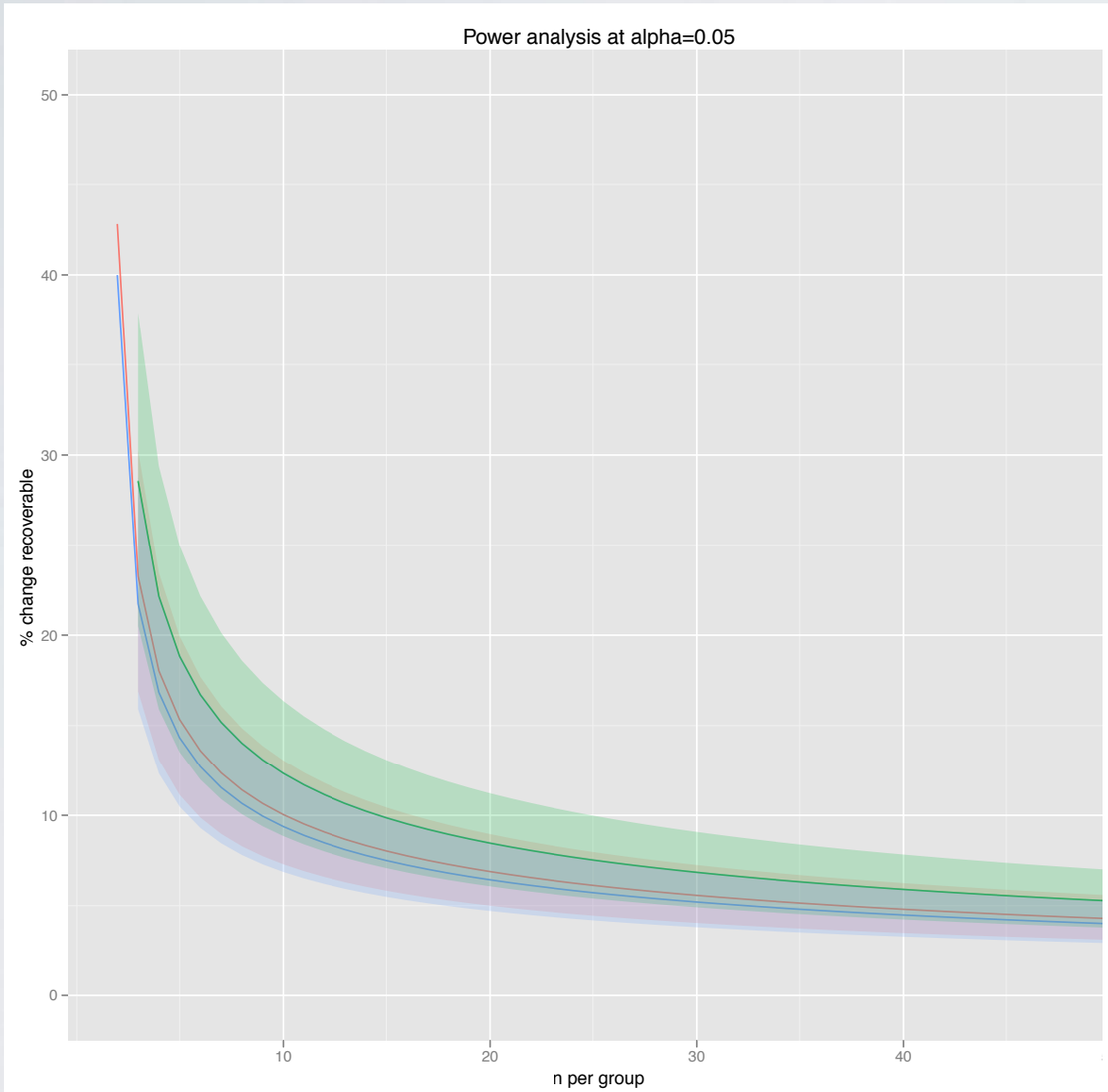
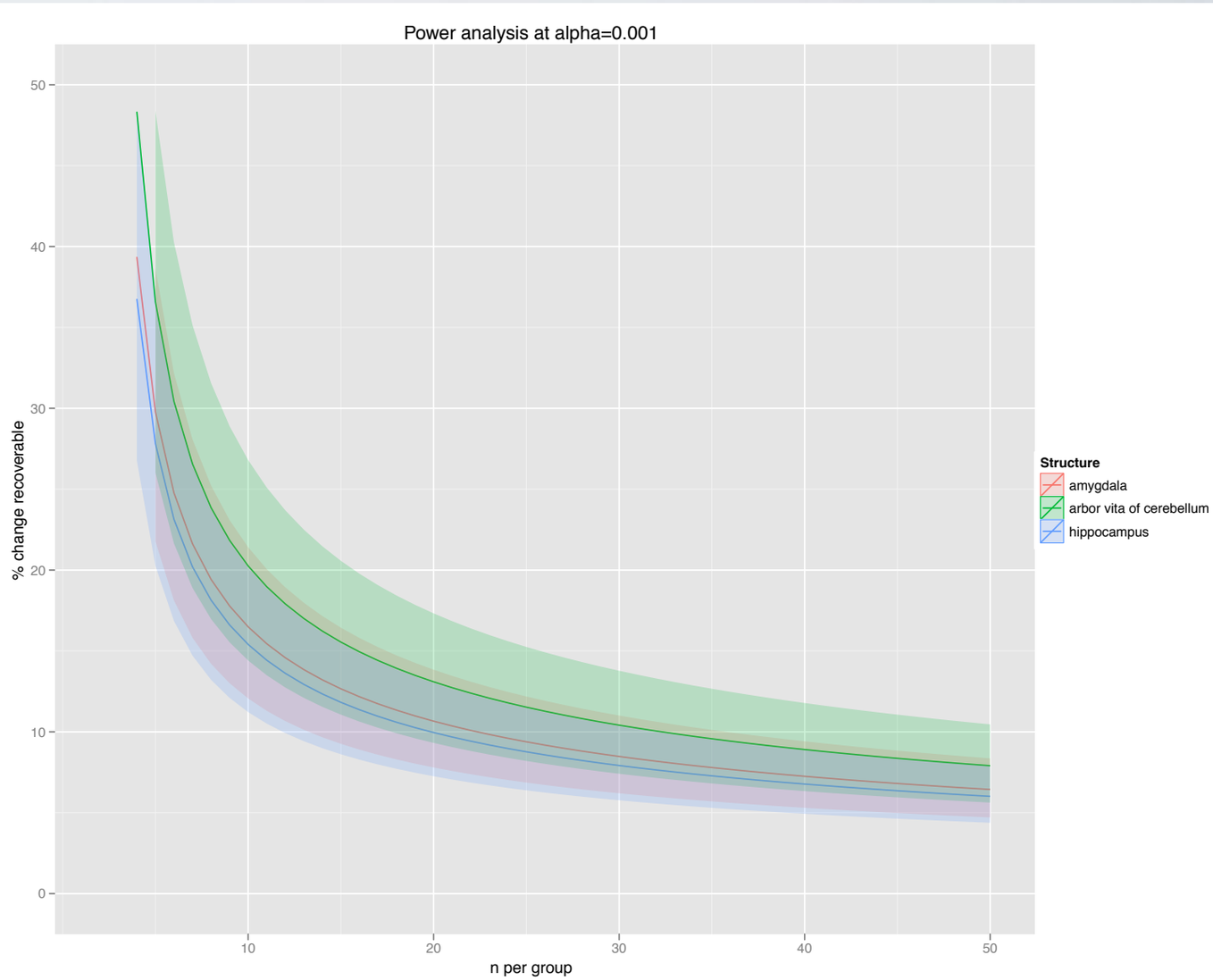
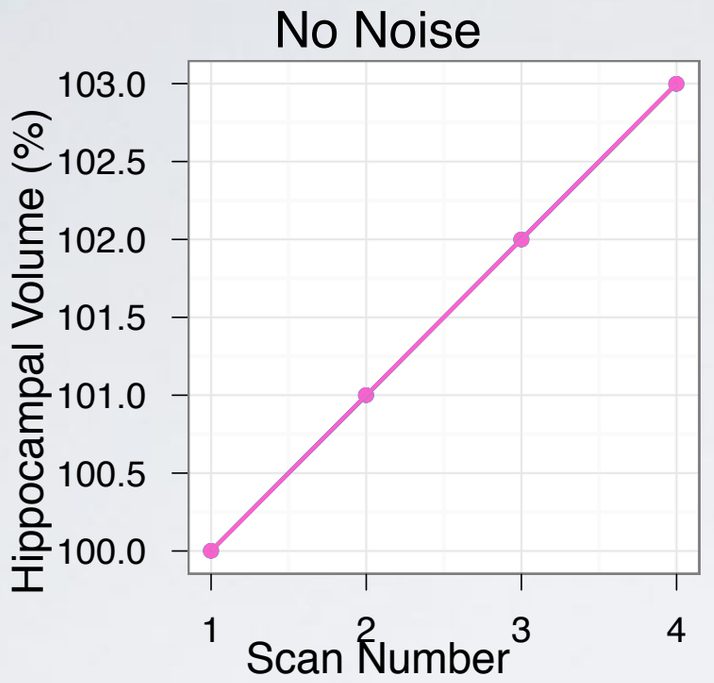
CONFIDENCE AND STUDY DESIGN

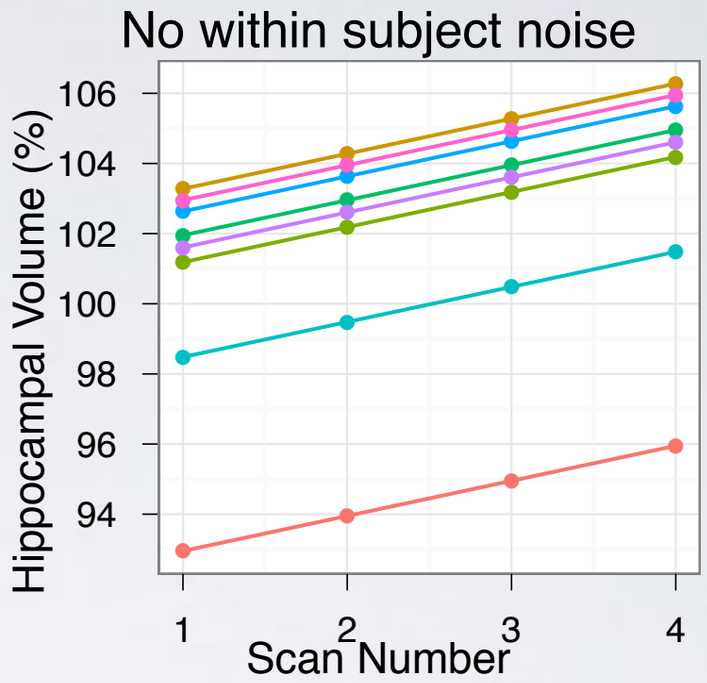


POWER


Power analysis at alpha=0.05
% change recoverable
n per group
0
10
20
30
40
50


Power analysis at alpha=0.001
% change recoverable
n per group
0
10
20
30
40
50
Structure
amygdala
arbor vita of cerebellum
hippocampus





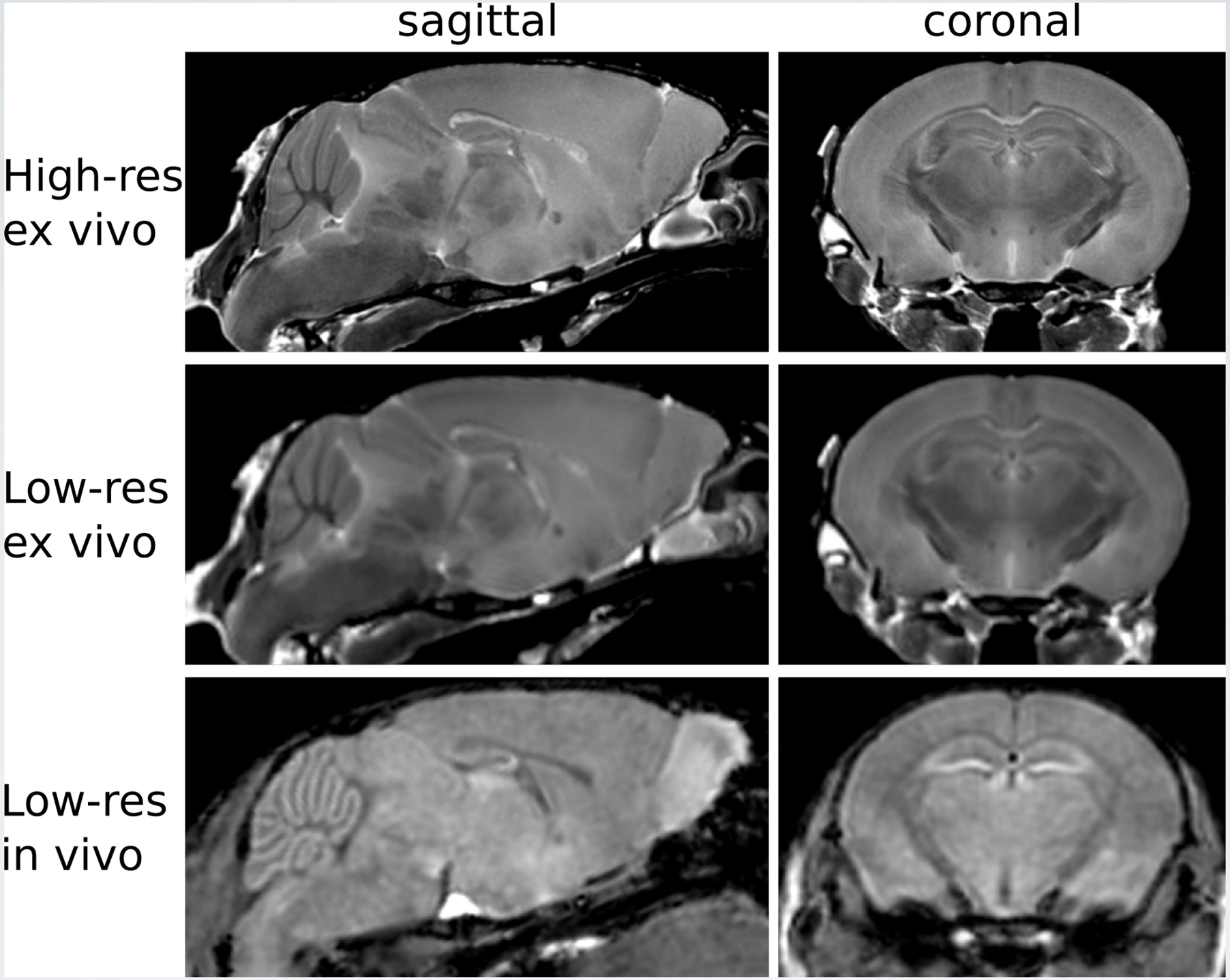
Lerch JP, Gazdzinski L, Germann J, Sled JG, Henkelman RM, Nieman BJ. Wanted dead or alive? The tradeoff between in-vivo versus ex-vivo MR brain imaging in the mouse. Front Neuroinform. 2012 Mar 23;6:6.

Item	**Description**
$Volume\_Baseline$	The tissue volume at baseline of the study.
$\sigma_{population}$	The inter-subject standard deviation.
$\sigma_{subject}$	The within-subject standard deviation.
μ_β	The volume difference between baseline and final measure.
n	The number of subjects per group.
$N_{timepoints}$	The number of scans per subject for longitudinal data.

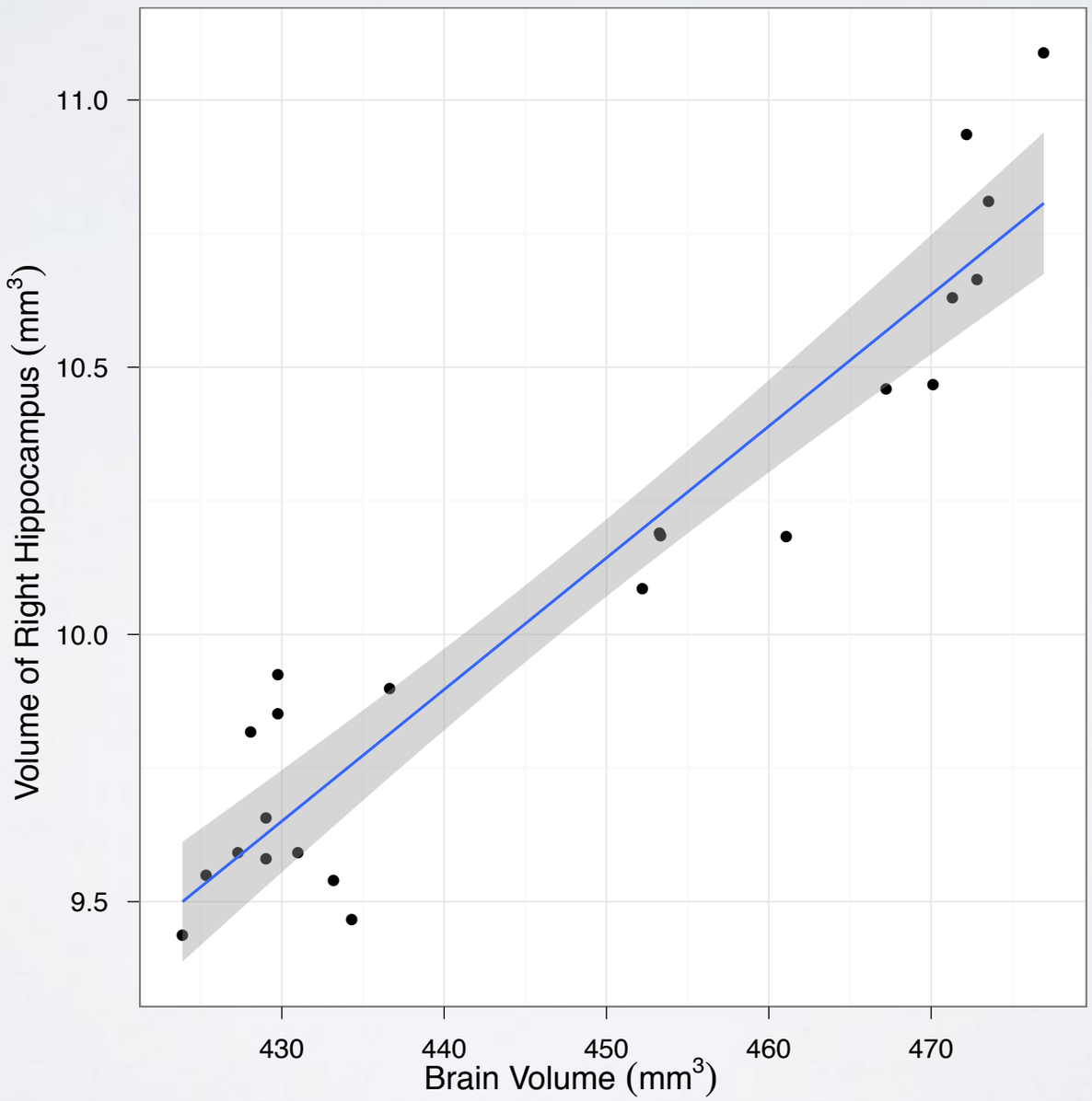
Table 1: The key parameters in simulating change over a short period of time.

$$Volume\_Baseline \sim \text{normal}(\mu_{population}, \sigma_{population})$$

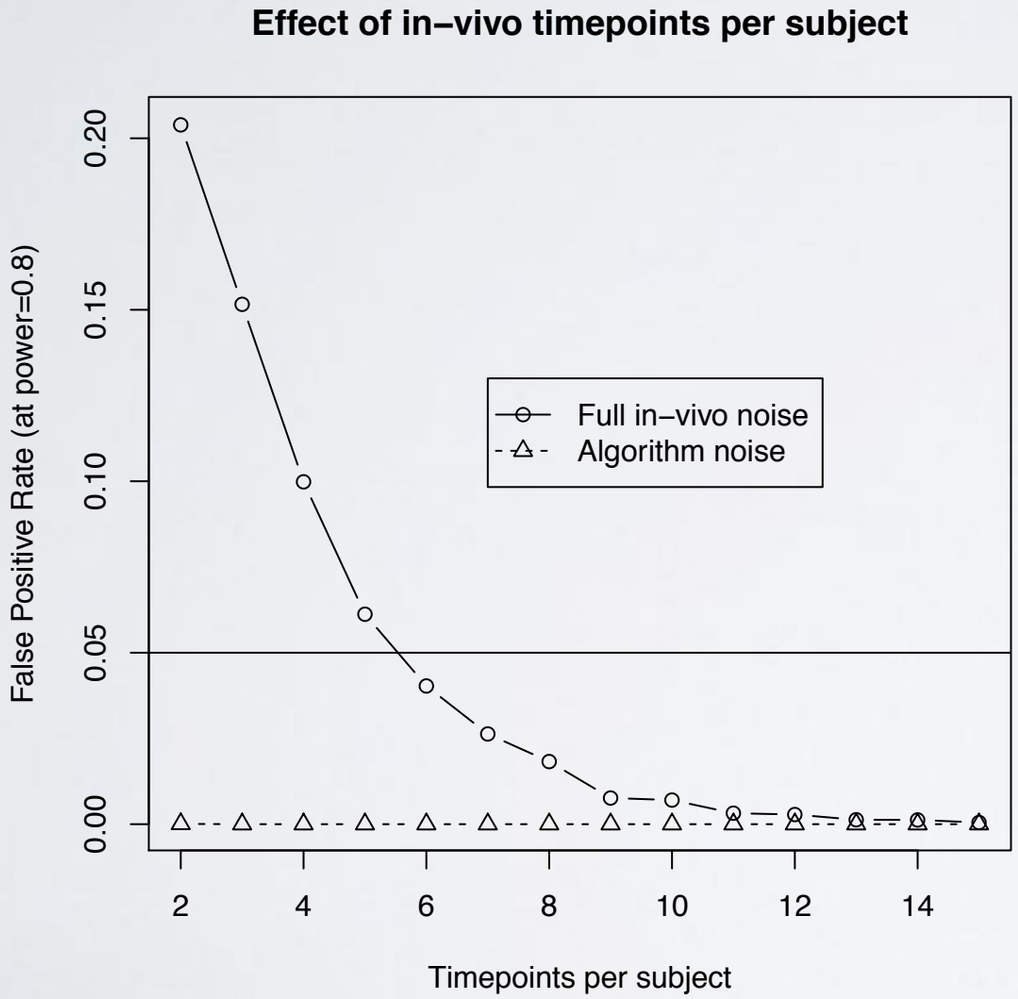
$$Volume\_Timepoint_i \sim Volume\_Baseline + \text{normal}\left(\mu_\beta \left(\frac{timepoint_i - 1}{N_{timepoints} - 1}\right), \sigma_{subject}\right)$$

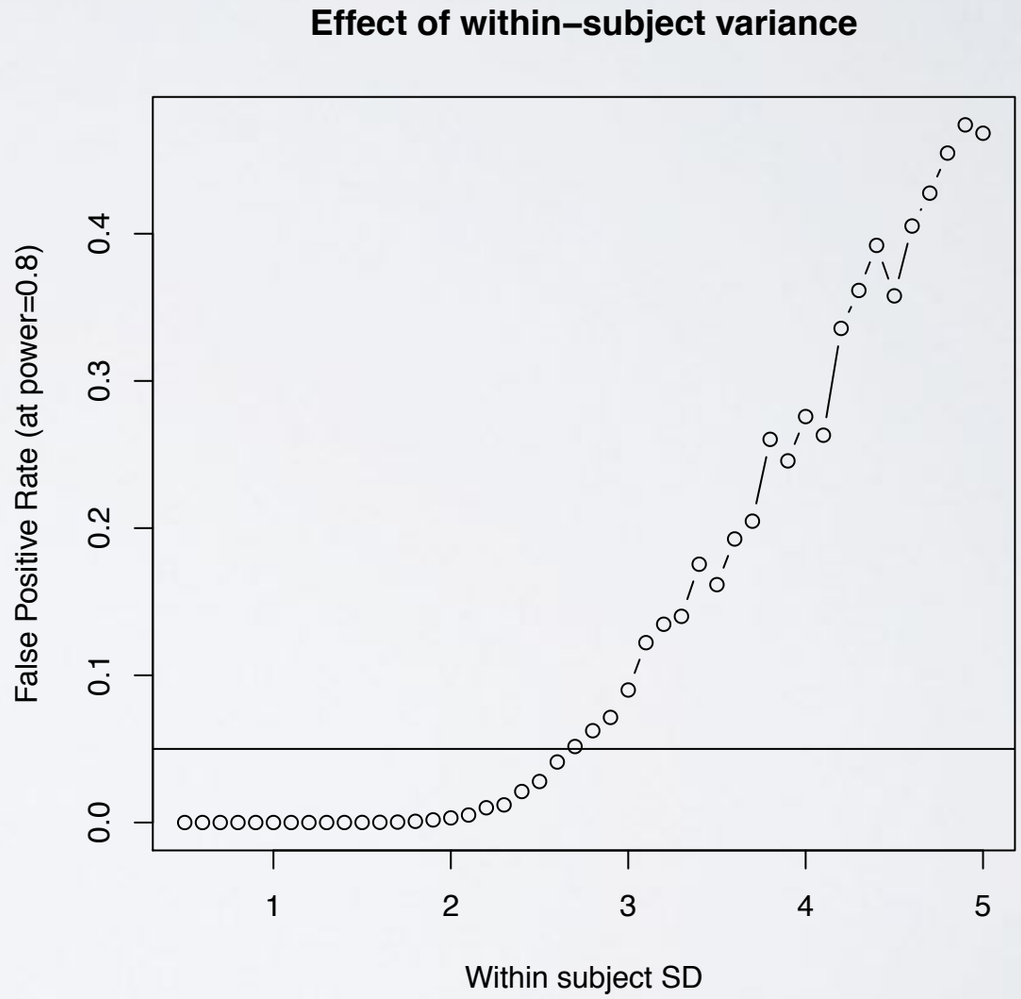

sagittal
coronal
High-res ex vivo
Low-res ex vivo
Low-res in vivo

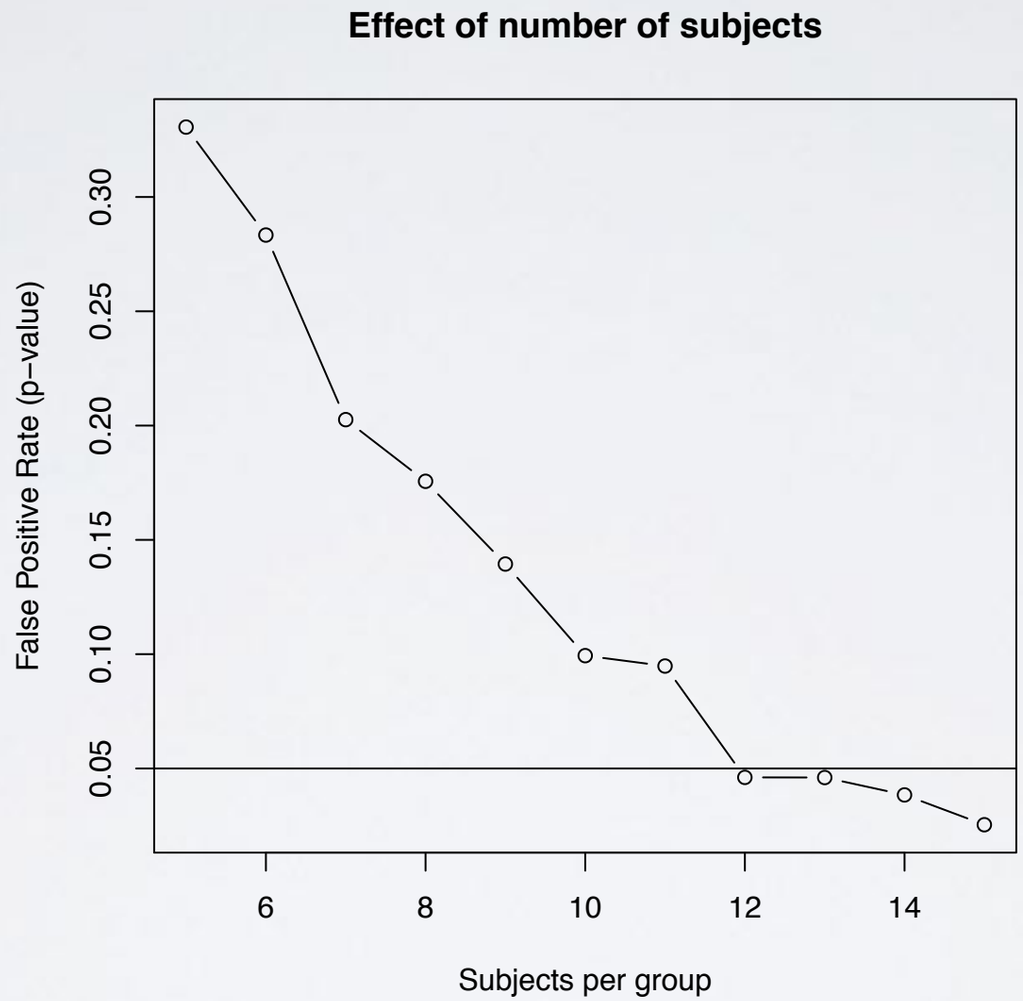
Dataset	absolute volume		relative to brain volume	
	$\sigma_{population}$	$\sigma_{subject}$	$\sigma_{population}$	$\sigma_{subject}$
Ex-vivo high resolution	5.0 %	1.1 %	1.7%	0.99%
Ex-vivo low resolution	4.8 %	1.3 %	3.0%	1.0%
In-vivo	4.8 %	3.1 %	2.2%	1.7%



Recovering 3% volume change

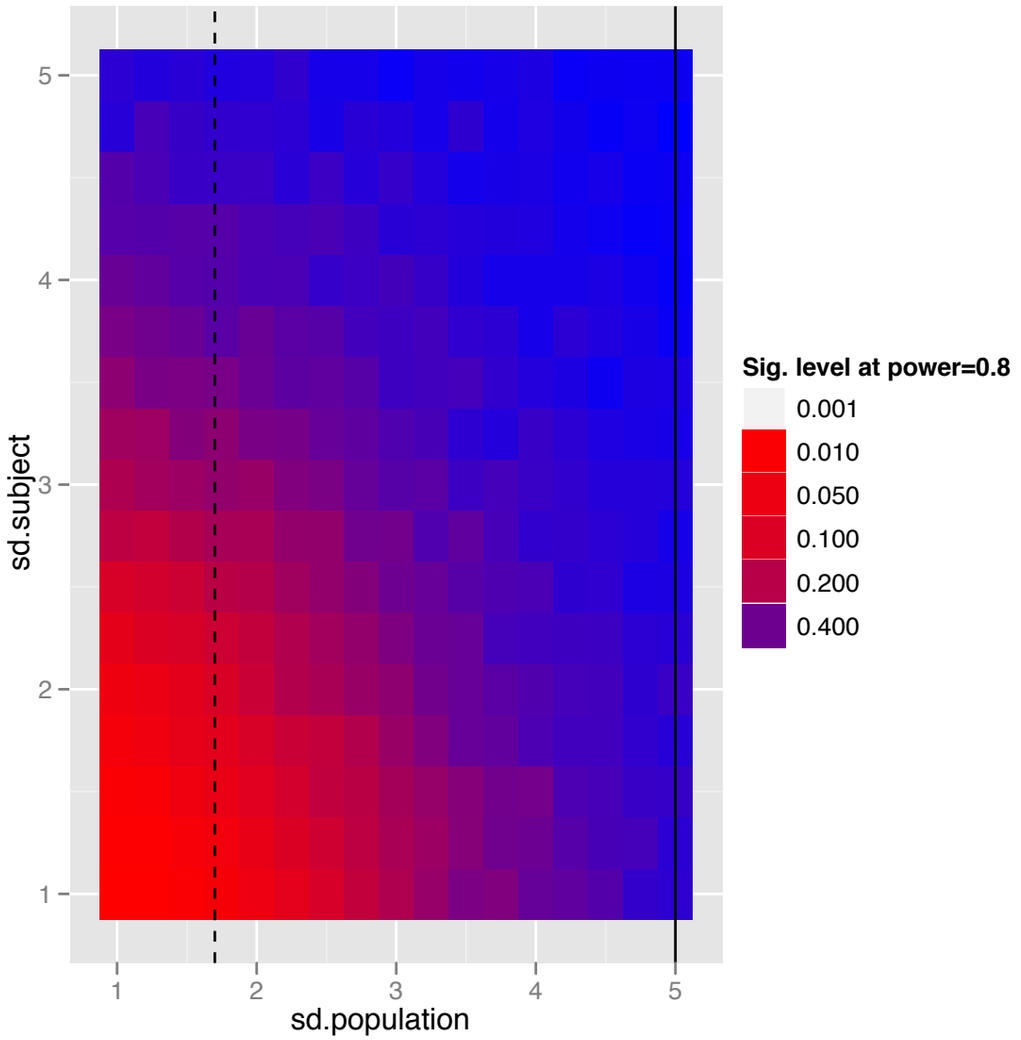




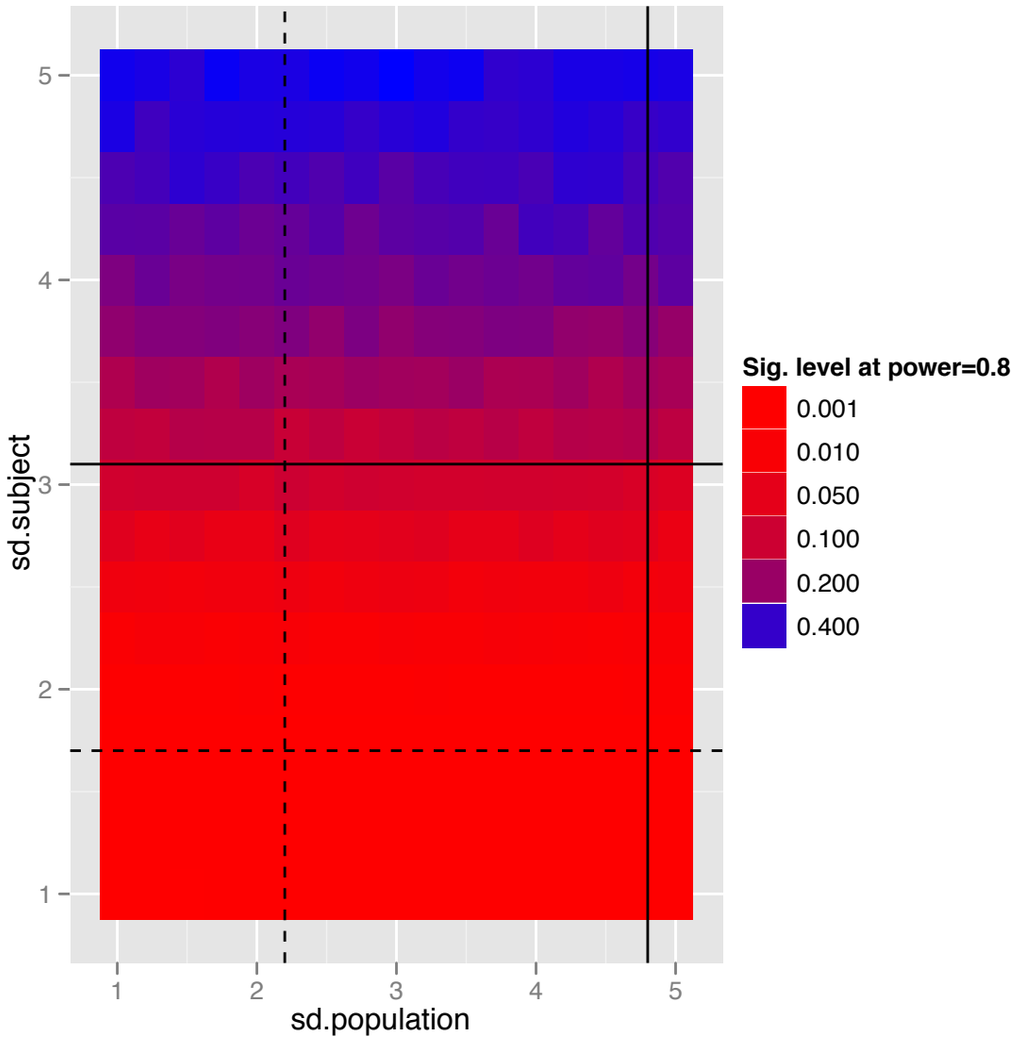


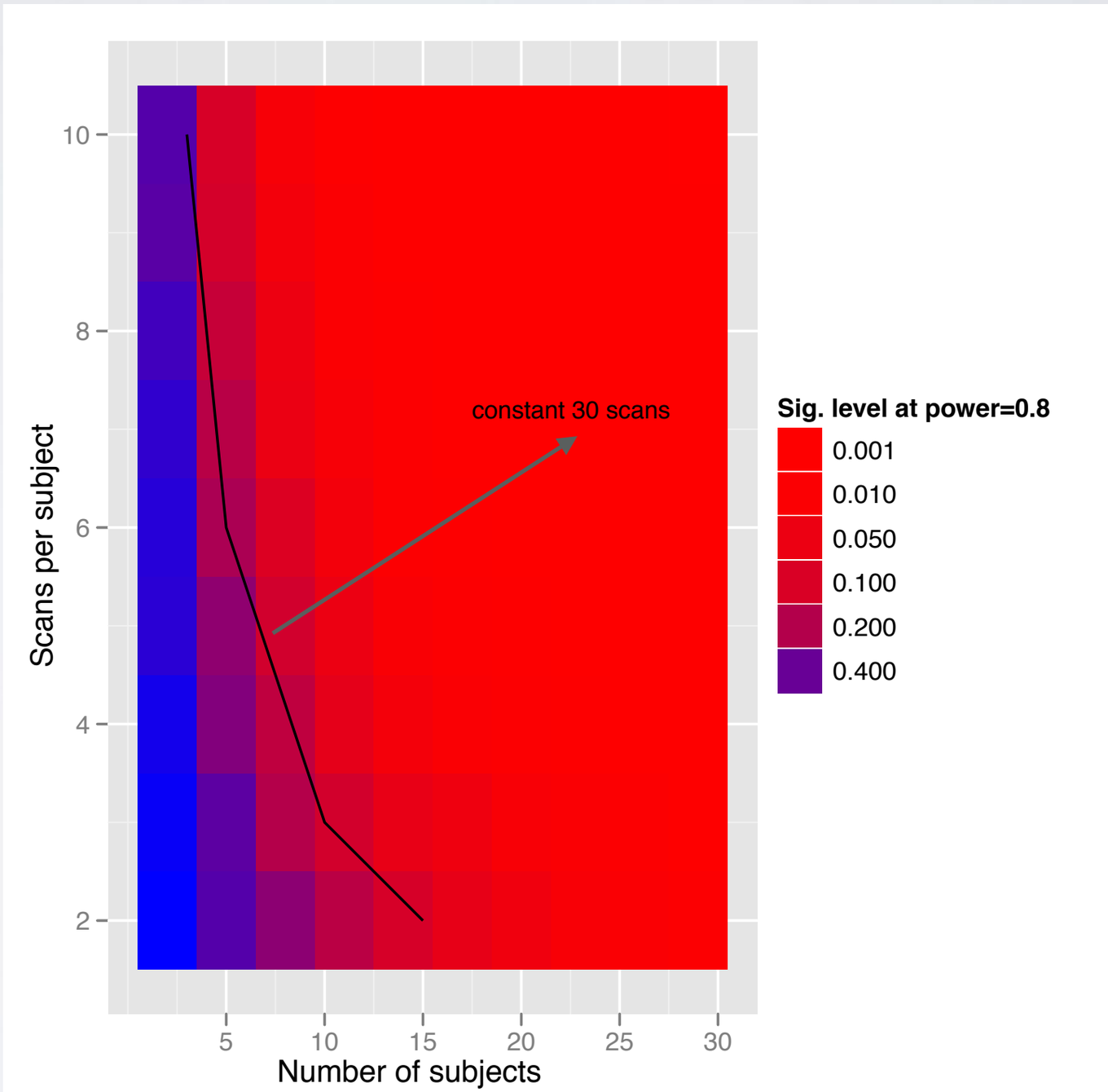
4 scans per subject

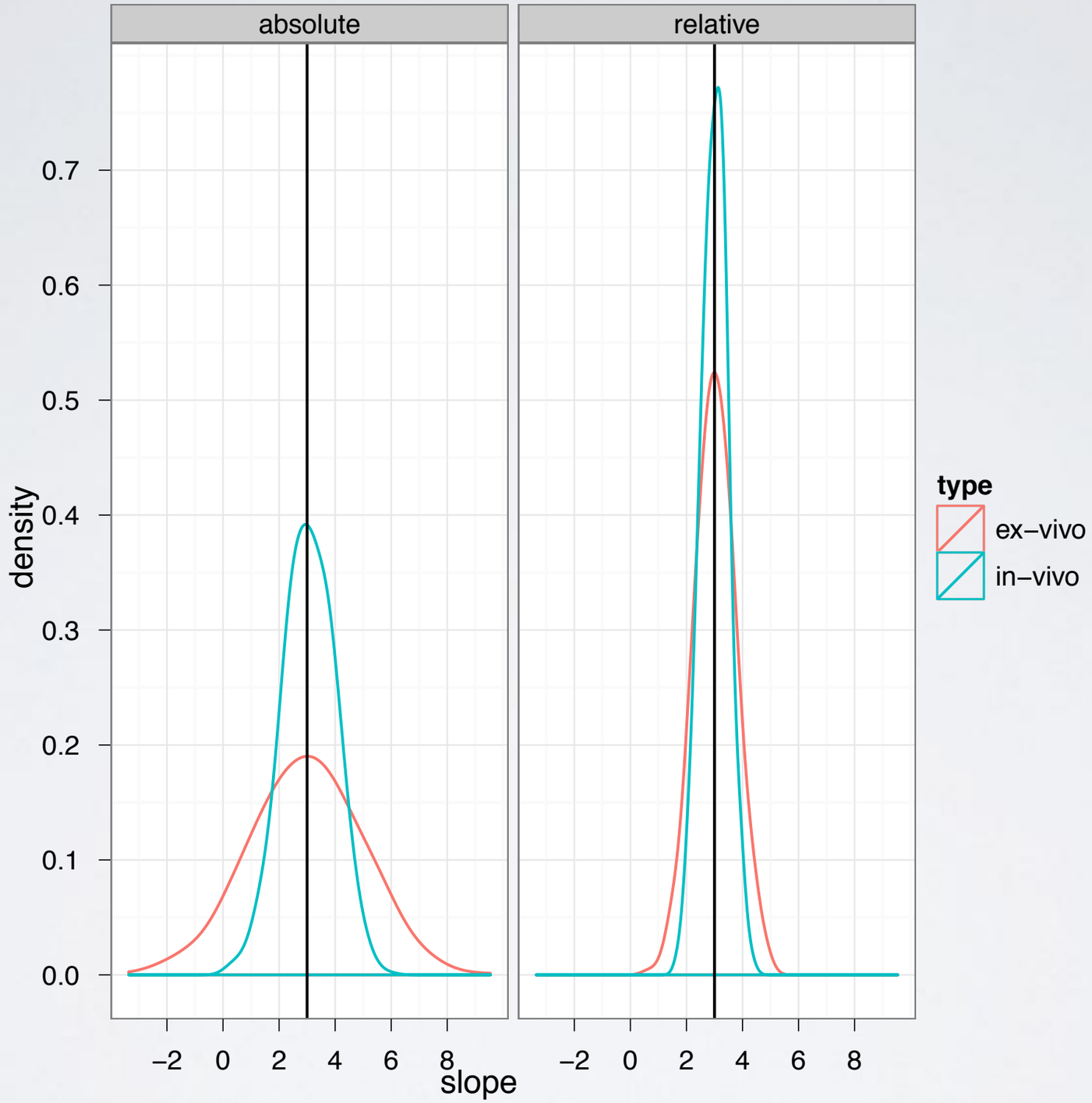
Fixed brain experiment



In-vivo experiment



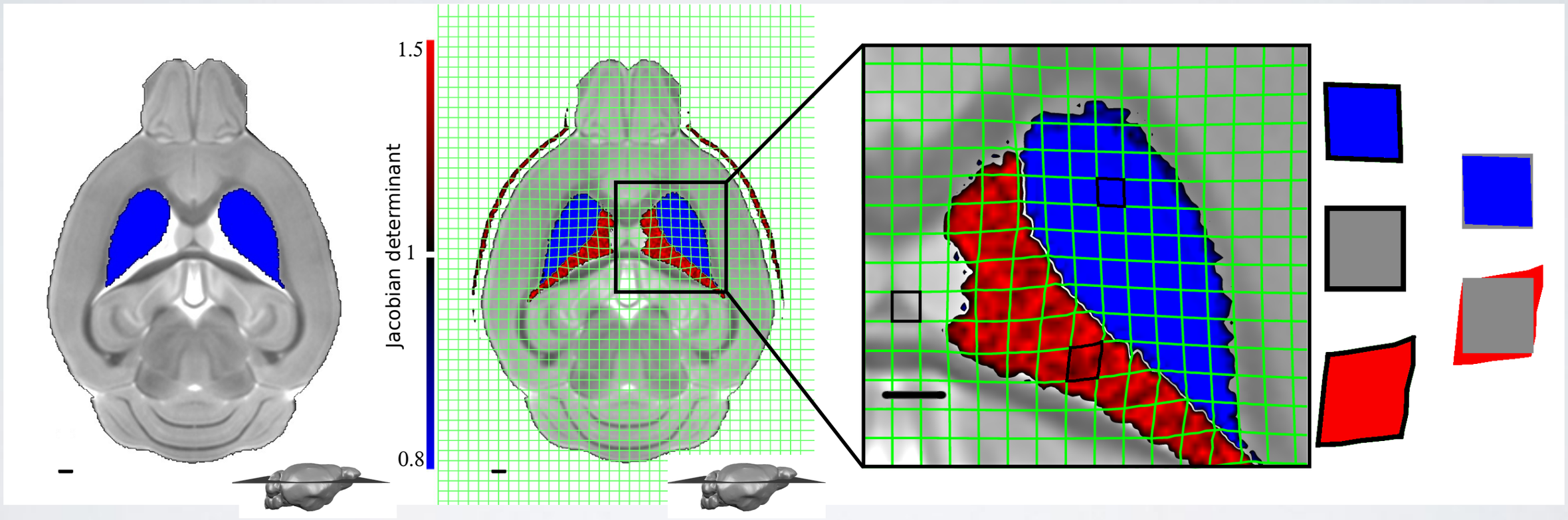

10
8
6
4
2
Scans per subject
5
10
15
20
25
30
Number of subjects
constant 30 scans
Sig. level at power=0.8
0.001
0.010
0.050
0.100
0.200
0.400

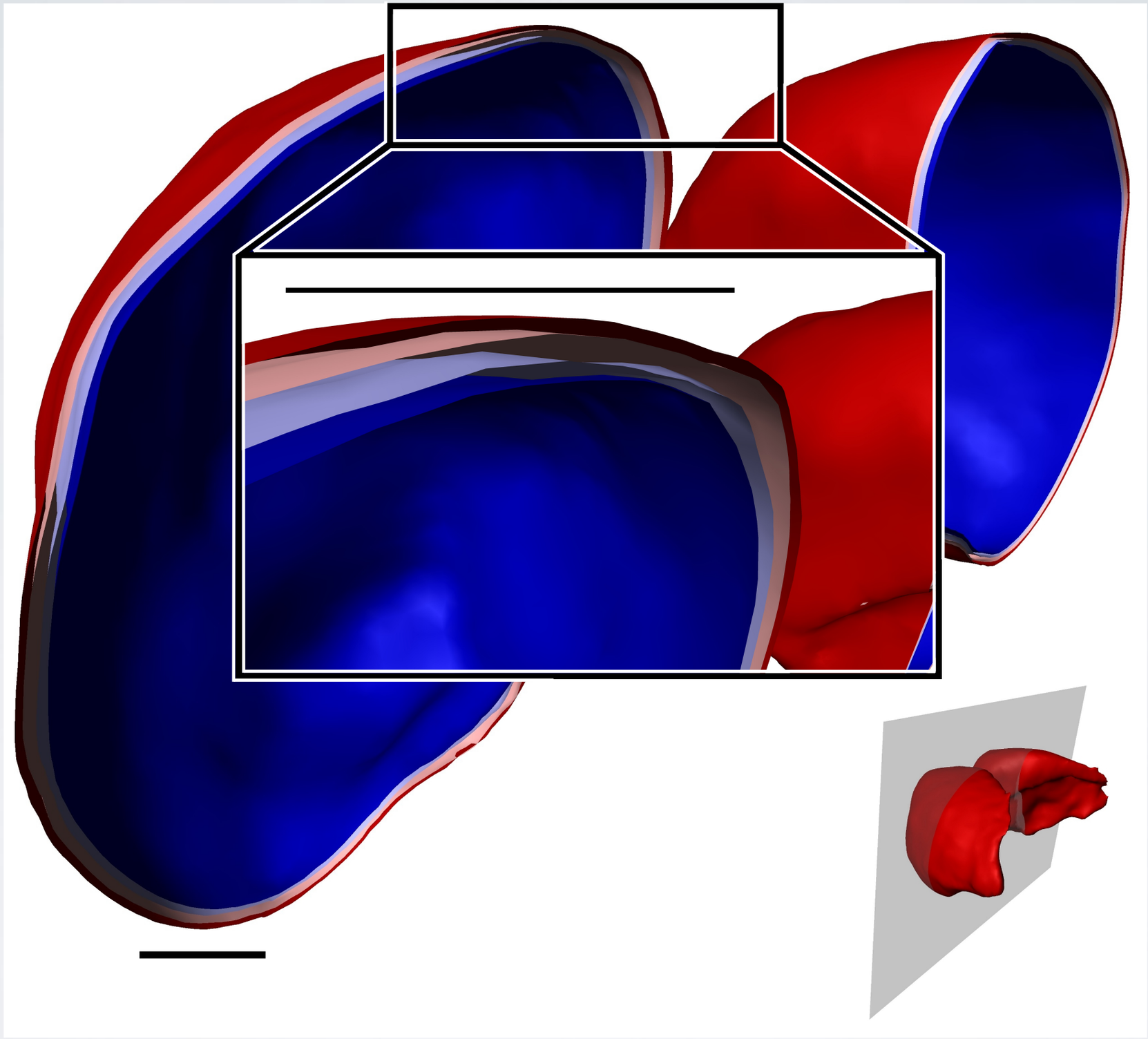

absolute
relative
density
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
−2
0
2
4
6
8
slope
type
ex−vivo
in−vivo

HOW ACCURATELY CAN WE DETECT ANATOMICAL DIFFERENCES?

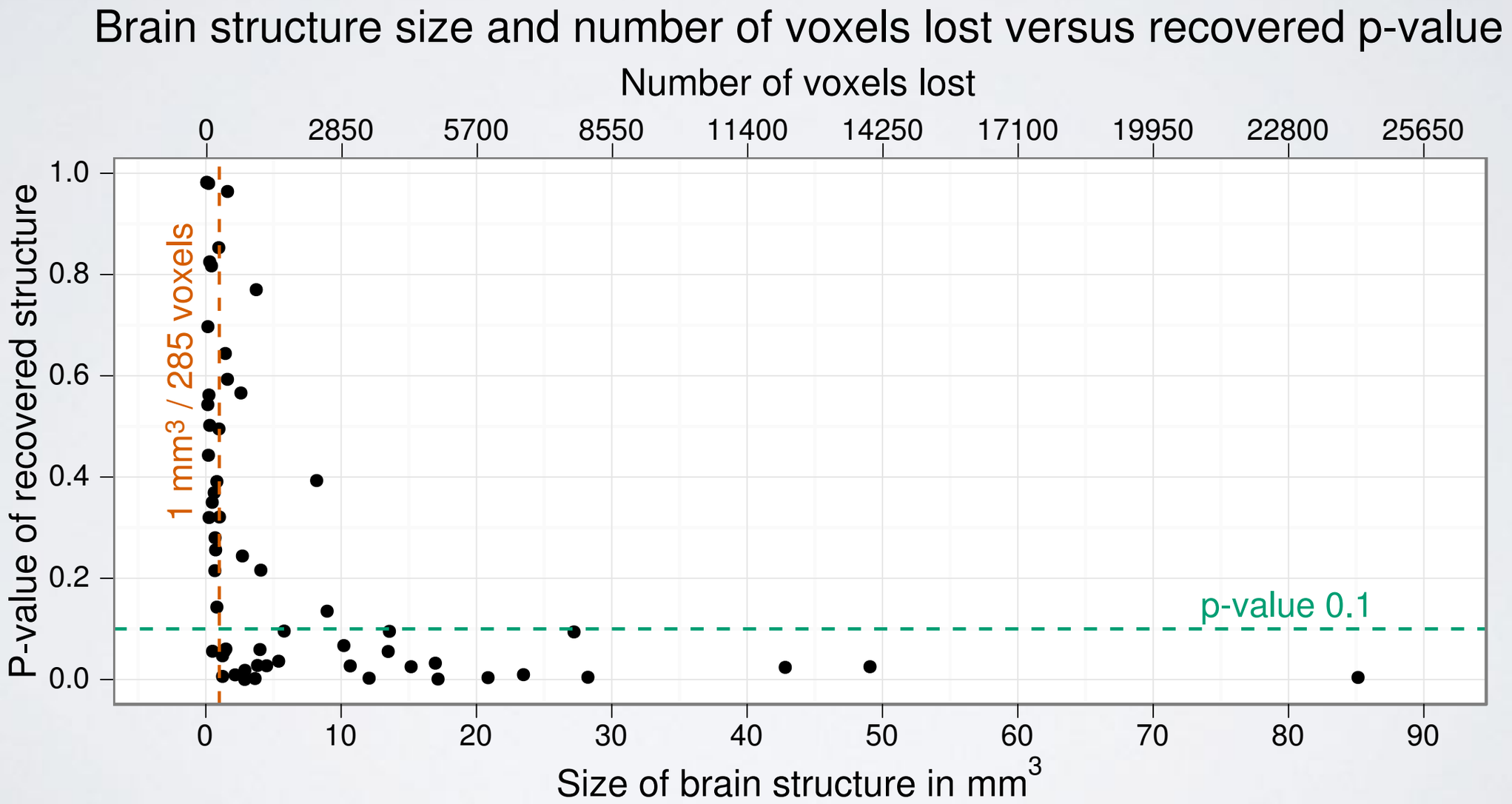
van Eede MC, Scholz J, Chakravarty MM, Henkelman RM, Lerch JP. Mapping registration sensitivity in MR mouse brain images. Neuroimage. 2013 Nov 15;82:226–36.

SIMULATIONS

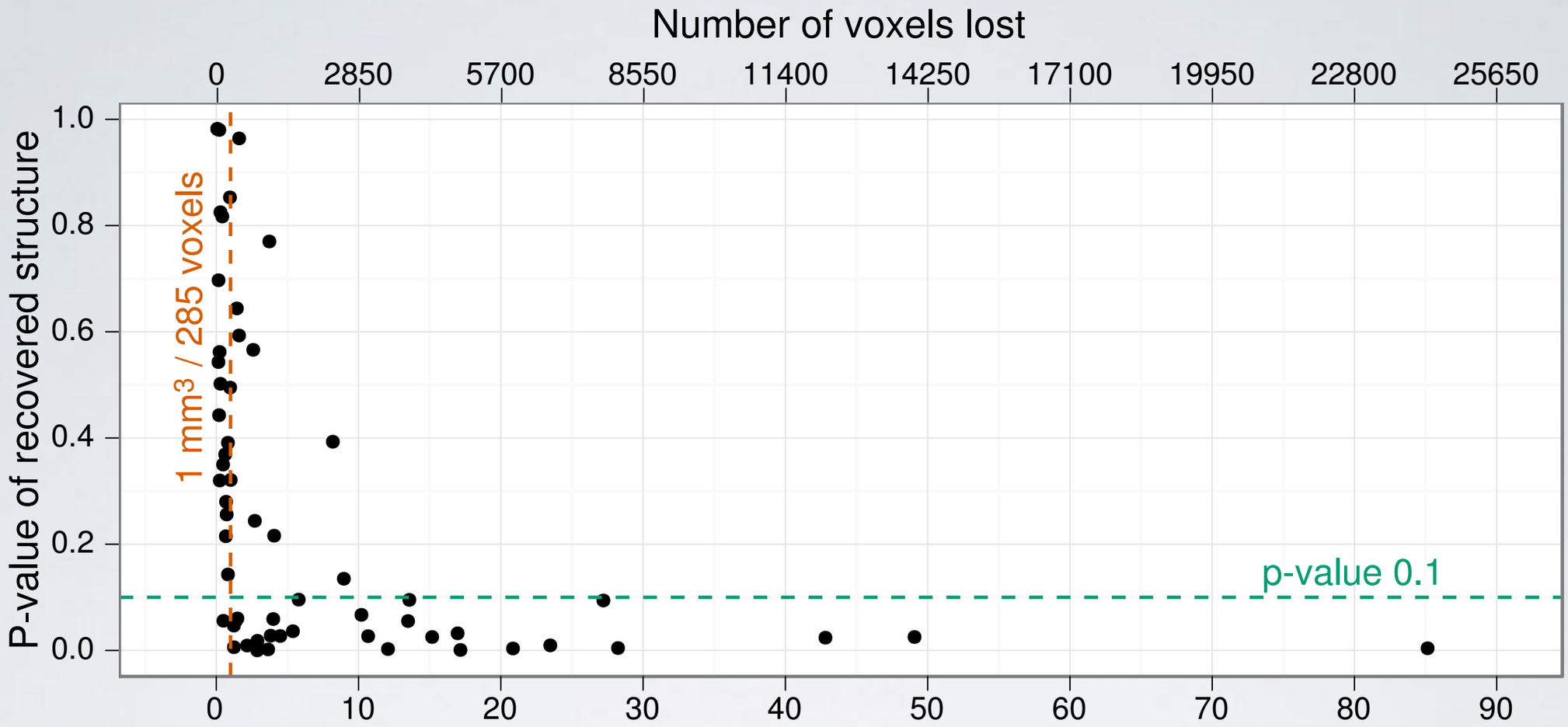


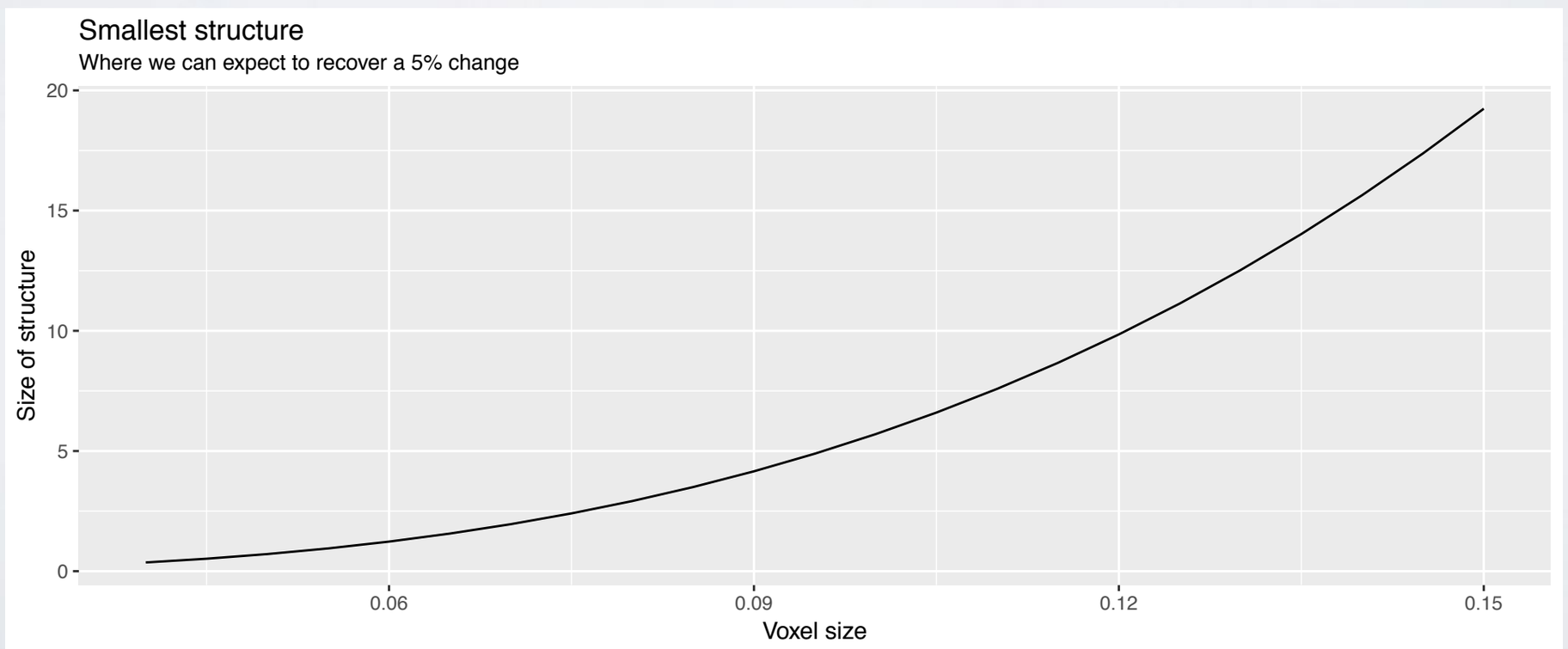


5% VOLUME LOSS

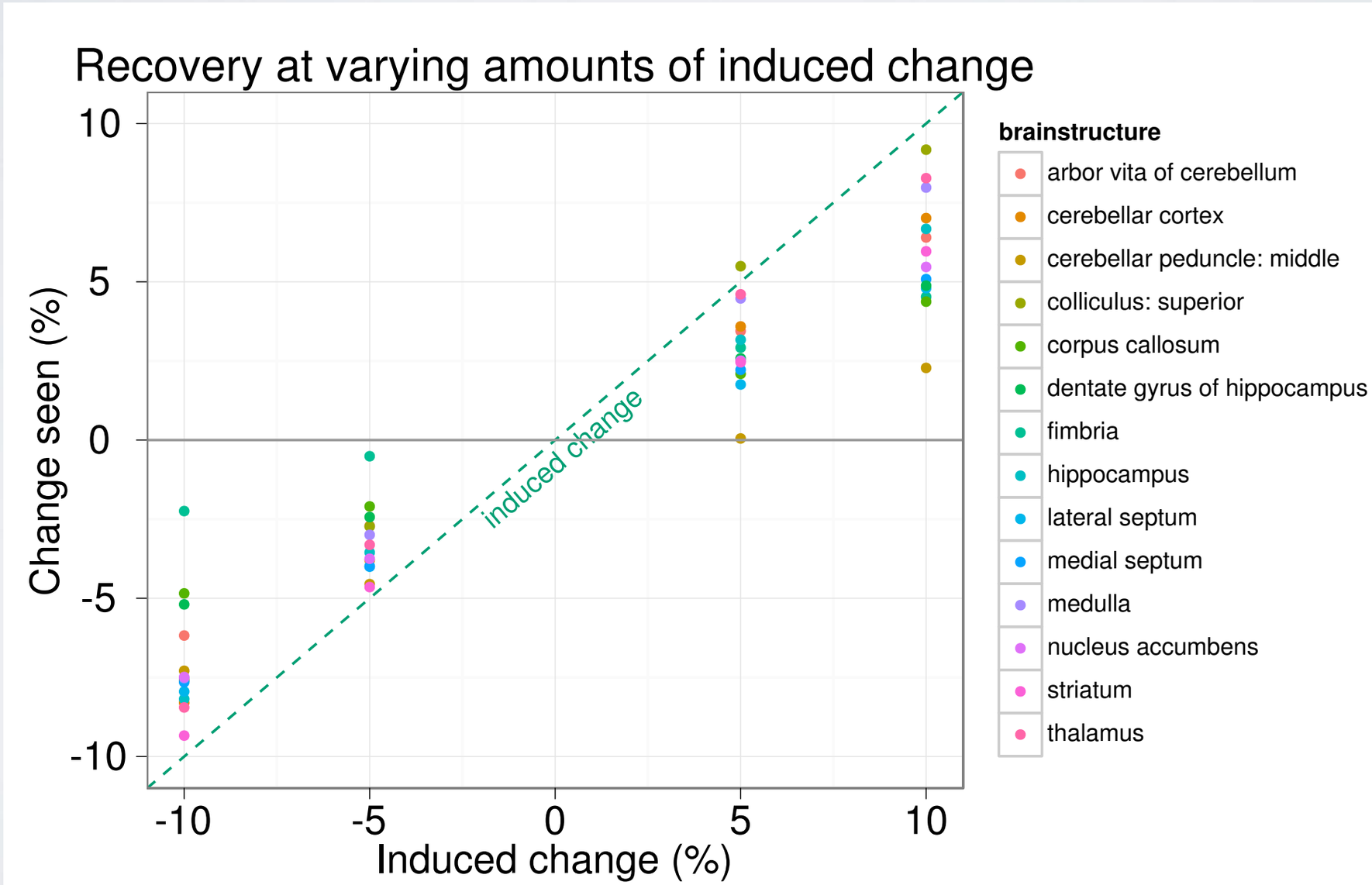


Brain structure size and number of voxels lost versus recovered p-value

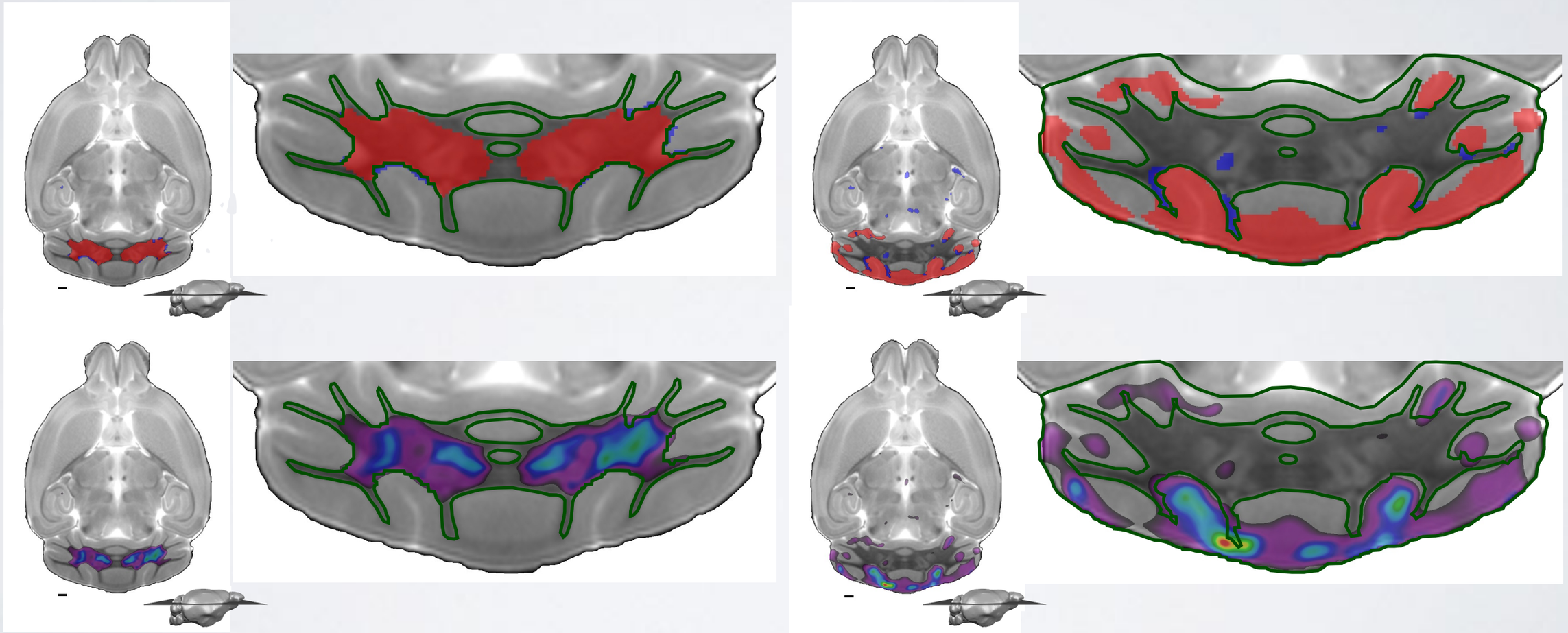




UNDERESTIMATE



BLOB-OLOGY



TRUE VS FALSE POSITIVES