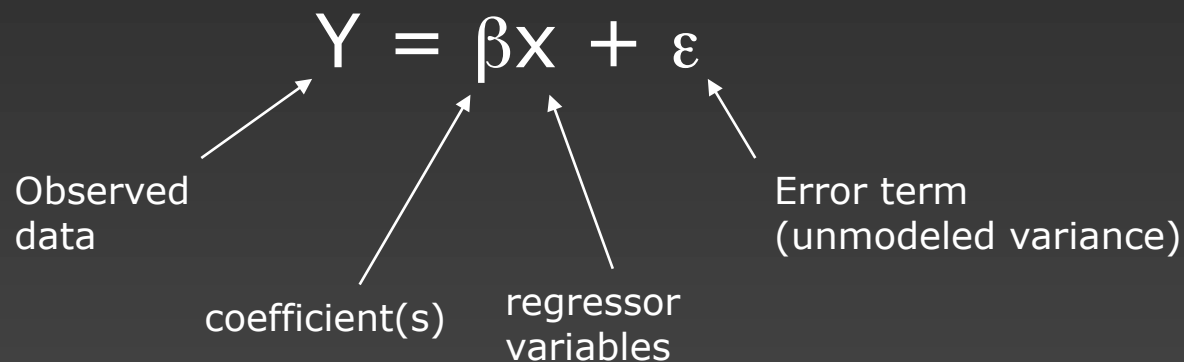# MRI Makes Itself Useful

Adjusting functional activations using anatomical information

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General Linear Model

$$Y = \beta x + \varepsilon$$

Observed
data

coefficient(s)

regressor
variables

Error term
(unmodeled variance)

statistical parametric map

$$t = \text{effect} / \text{variance} \sim x/\varepsilon$$

Does NOT ask, "Where is the effect large?", but rather
"Where is the effect statistically reliable?"

Functional Activations

1. Difference in a specific metabolic process which influences measured signal.
2. Difference in tissue composition within a supposedly homogenous structure.
3. Misregistration of a structure to the target template.
4. Partial volume effect (PVE), a special case of spatial blurring.

VBM Activations

1. Differences in the tissue component of a structure (e.g. more WM in the thalamus).
2. Misregistration: underlying differences in structure shape not removed by the coregistration process.

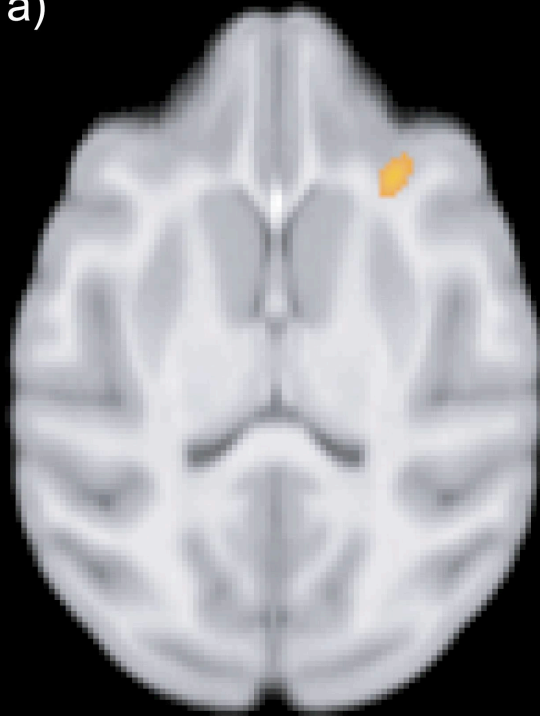# Gray Matter Probability Maps

PET: Quantitative

MRI: Not

GMP: Semi-quantitative

A comparable scale from 0.0-1.0
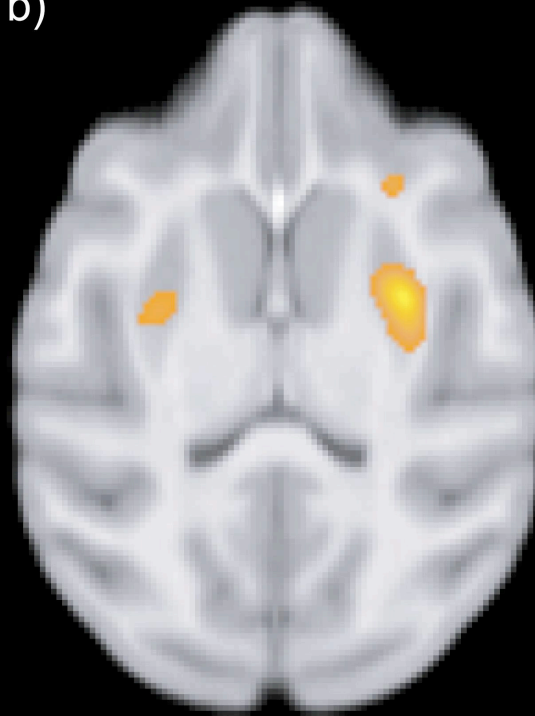for all subjects.
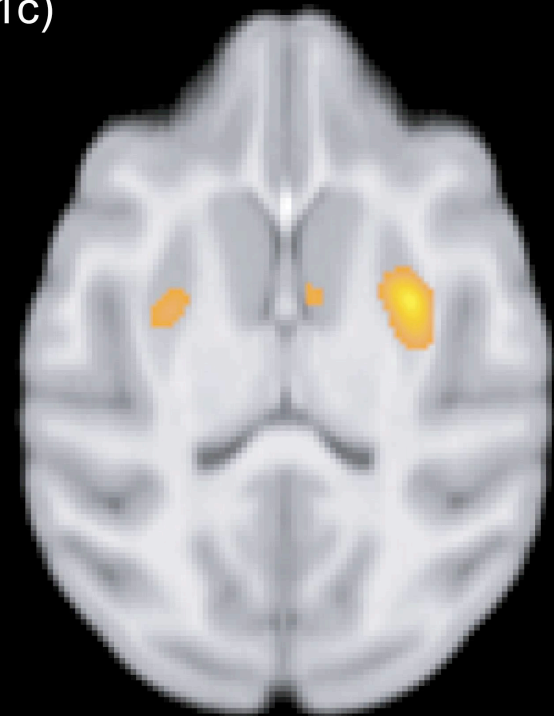
PET FDG rhesus

1a) GMP Difference Clusters

1b) Functional Activation Clusters

1c) Functional Activation Clusters After Covarying for GMP

Human fMRI

GMP t-test   Standard GLM Analysis   GLM with voxelwise GMP covariates

Fig. 2a — Fig. 2b — Fig. 2c — Fig. 2d — Fig. 2e — Fig. 2f — Fig. 2g — Fig. 2h — Fig. 2i

Functional activation increases
In both size and magnitude.

Functional activation decreases
(falls below statistical threshold).