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# Foundational concepts of Neuroscience

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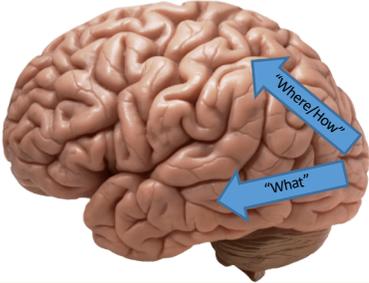
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# The Brain



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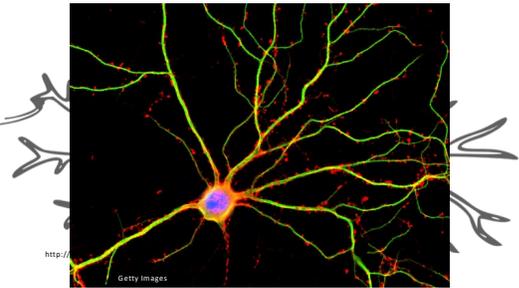
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# The Neuron



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### How'd we figure it out? Methods

- Animal
  - Pros: Experimental manipulation, less restrictive, easy to control
  - Cons: Structural brain differences, not humans
- Human
  - Pros: Most relevant species, have language
  - Cons: Restricted in methods, susceptible populations, lack of control, they're humans
- Converging evidence

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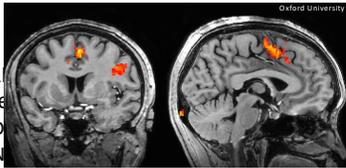
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### Spotlight: fMRI



- MRI
- fMRI
  - Dependent on blood oxygenation level dependent (BOLD) signal
  - Detects changes in oxygenated hemoglobin
  - Non-invasive
- Visualize changes in oxygen levels in regions
- Voxels – changes from baseline
  - Spatial Resolution – (1-5 mm<sup>3</sup>)
    - -smaller: less signal, longer scan time

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### Spotlight: fMRI

- Methods
  - Procedures
    - Stimulus presentations
    - Tasks
  - Group comparisons
  - Double dissociation
    - Trial comparisons

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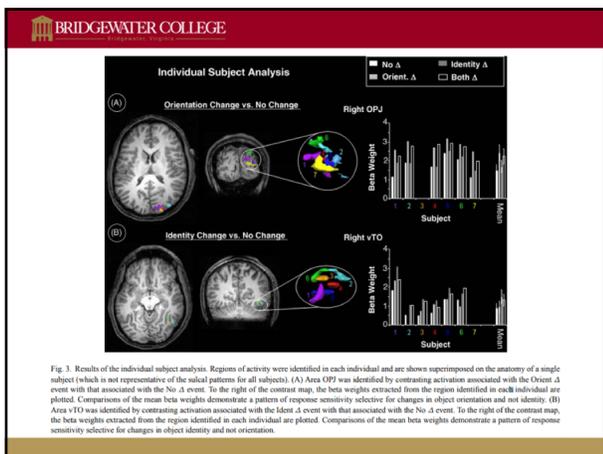


Fig. 3. Results of the individual subject analysis. Regions of activity were identified in each individual and are shown superimposed on the anatomy of a single subject (which is not representative of the subject patterns for all subjects). (A) Area OPJ was identified by contrasting activation associated with the Orient. A event with that associated with the No. A event. To the right of the contrast map, the beta weights extracted from the region identified in each individual are plotted. Comparisons of the mean beta weights demonstrate a pattern of response sensitivity selective for changes in object orientation and not identity. (B) Area vTO was identified by contrasting activation associated with the Ident. A event with that associated with the No. A event. To the right of the contrast map, the beta weights extracted from the region identified in each individual are plotted. Comparisons of the mean beta weights demonstrate a pattern of response sensitivity selective for changes in object identity and not orientation.

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## fMRI Issues

- Feedback or feedforward? Excitatory or inhibitory?
- Blood flow isn't discontinuous like neural activity
- What Neuroscience Can and Cannot Answer (Choi 2017)
  - Reverse-Inference Errors
    - Multiple functions of brain regions
  - Group-to-Individual Inference problems
    - Group variability
    - Different situations

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## Tips

- News article – cite the studies
- Peer-reviewed articles whenever possible
  - Read the intro – converging evidence
- Look for the experts
- Replication is key
- Contact:
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