EXAMPLES OF HIGHER FUNCTIONS

Jessica

Tools to study brain activity
Language
Gender
Music
Genius

<table>
<thead>
<tr>
<th>Method</th>
<th>What it measures</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| PET    | Brain activity by change in blood flow/metabolism using tracers | OK spatial resolution | Invasive  
Bad temporal resol. |
| fMRI   | Brain activity by change in blood flow/metabolism using magnetic fields | Non-invasive  
Good spatial resol. | Bad temporal resol. |
| EEG    | Brain waves/ activity of groups of neurons | Good temporal resol. | Bad spatial resol. |
| Single Unit | Neural activity | Good temporal & spatial resol. | Only pertains to single or few neurons |
Dr. Marcus Raichle and his colleagues at Washington University pioneered the use of positron emission tomography (PET also developed here) to study complex behaviors such as language. Here he injects tracers into a volunteer. The volunteer’s head is in an early device to monitor regional changes in radioactivity.

LANGUAGE

Broca’s area

Wernicke’s area

Movement

Touch

Angular gyrus

Hearing

Vision
LANGUAGES ASYMMETRIES

Left Hemisphere
- Speech
- Writing
- Stereognosis (right hand)
- Lexical and syntactic language
- Analysis of right visual field

Right Hemisphere
- Rudimentary speech
- Spatial abilities
- Stereognosis (left hand)
- Prosodic aspects of language
- Analysis of left visual field

THUS...

LOSS OF LANGUAGE

Leads to “Aphasias” (disorders of speech CONTENT)...

<table>
<thead>
<tr>
<th>Type</th>
<th>Verbal Out</th>
<th>Sentence Repeat</th>
<th>Comprehension</th>
<th>Naming</th>
<th>Lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broca's</td>
<td>↓</td>
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</tr>
<tr>
<td>Wernicke's</td>
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<tr>
<td>Conduction</td>
<td>Fluent</td>
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<tr>
<td>Global</td>
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<tr>
<td>Anomic</td>
<td>Fluent</td>
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<tr>
<td>Trans-cortical Motor</td>
<td>↓</td>
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<tr>
<td>Sensory</td>
<td>Fluent</td>
<td>-</td>
<td>↓</td>
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</tbody>
</table>

If stroke is in the LEFT hemisphere, and…
If stroke is in the RIGHT hemisphere

Leads to “Aprosodias”
(disorders of speech AFFECT/EMOTION)

Can’t respond emotionally to a question - “flattened”

If stroke is in the RIGHT hemisphere

GENDER & LANGUAGE: 
Brain activation is more bilateral in females

MUSIC & PERFECT PITCH: 
Associated with larger left auditory cortex (planum temporale) than right (left asymmetry) and than individuals without perfect pitch

GENIUS (e.g. Einstein): 
Math ability and posterior parietal lobes; greater neuron/glial ratio; greater density of neurons