Prefrontal Lobe and Regions
(Will be useful to have available during lecture on Sept 18 as not part of lecture presentation)
Frontal Lobes*

- Frontal lobes have three major divisions: motor, premotor, and prefrontal regions.
- The precentral gyrus, forming the posterior border of the frontal lobe, contains the primary motor cortex, which controls voluntary movements of specific body parts. Area 4
- Its location was confirmed in the mid-20th century in brain operations performed by neurosurgeons such as Dr. Wilder Penfield, in Montreal.
Two point threshold test
Premotor and Supplementary Motor areas*

- Penfield also showed that cortical Area 6, just rostral to Area 4, has two other somatotopic representations that induce complex movements when stimulated.
The prefrontal cortex is often divided into several regions.
The following can be seen via a side view: (a) ventrolateral (44,45,47), (b) dorsolateral (8,9,46 & sometimes 10 – (c) orbitofrontal (11 & 47)
Prefrontal cortex

- In the inside of the dorsolateral portion is the dorsomedial and ventromedial cortex (can’t see them in diagram/web slide)
Ventrolateral Region- the WHAT system*

Presumably, which features or attributes of the environment should be processed depends on the goals of individuals. Ventrolateral prefrontal cortex represents these goals and thus affects which features or attributes are extracted (paid attention to).

- That is, the ventrolateral prefrontal cortex biases or controls what becomes conscious e.g. baby cry
- Suppresses interference from irrelevant stimuli or stimulus dimensions
**Dorsolateral Region - the HOW system**

- 8,9,10,46
- Primarily underpinned by the parietal cortex (sensory information).
- It plays an important role in the integration of sensory information and the regulation of intellectual function and action.
- is normally inactive when we dream and sleep, hindering your logic, causing you to accept the bizarre nature of dreams.
- It is also involved in working memory (keeping information accessible while dealing with concurrent processes, distractions or attention shifts)
Dorsomedial Prefrontal Cortex

- linked with self-expression and activities that convey individuality; your uniqueness.
Orbitofrontal/Ventromedial region - Emotional/motivational*

- In broad outline these areas (47 & 11), which, with respect to other prefrontal areas, develop relatively early, are involved in the expression and control of emotional and instinctual behaviors.
7Orbitofrontal region - Emotional/motivational*

• It is mainly in orbitofrontal cortex that information about actual and expected rewards is collected -- through the dopaminergic system -- and funneled to the rest of the prefrontal cortex to drive and shape behavior.

• in controlling and correcting reward-related and punishment-related behavior, and thus in emotion.

• Thus we detect mistakes - in obsessive compulsive disorders there is greater activation

• Critical in drug addiction (discussed in later lectures)
BOLD (Blood-oxygen-dependent-level) Effect*  

- deoxyhemoglobin  
- oxyhemoglobin  

**Brain Activity**  

**Brain Activity**  

Increased Magnetic Signal  

As hemoglobin has different magnetic properties in its oxygenated and deoxygenated forms
Wisconsin Card Sort Test*

- It assesses the following "frontal" lobe functions:
  - strategic planning,
  - organized searching,
  - utilizing environmental feedback to shift cognitive sets,
  - directing behavior toward achieving a goal, and
  - modulating impulsive responding.
- Working memory
The sort of executive functions involved in this task include:

- Planning which, in turn, involves
- Ability to identify and resolve sub-goals-working memory
- Inhibiting prepotent response
- Dorsolateral prefrontal area
Stroop Test and Frontal Lobes*

• measures selective attention and how easily a person can suppress a habitual response, such as reading, in favor of a less familiar task, such as naming the color.
• Inhibition of prepotent response
• Stroop test causes the subject’s dorsolateral frontal lobe to become activated during the task in fMRI
• Interestingly as the subject continues to do this task, frontal activity diminishes
• Speaking words- Area 6 - motor tongue mouth region
• Generating words (silently) - Area 44 & 45 Ventrolateral (focused attention)