Functional subdivisions of PFC

- Lateral prefrontal cortex
- Frontal pole
- Premotor areas
- Primary motor areas
- Ventromedial prefrontal cortex
- Medial frontal cortex
- Orbito frontal cortex
- Posterior cingulate gyrus?

Functions of regions of frontal cortex

- Lateral prefrontal:
    - Cognitive control
    - Short-term memory
    - Inhibition of response selection
    - Selective attention
- Frontal pole
    - Cognitive control
    - Memory retrieval
    - Representation of action goals
- Medial prefrontal
    - Cognitive control
    - Error detection
        - Feedback on actions
    - Resolving conflict

The size of prefrontal cortex across species

- All mammals have a PFC
- Proportion of brain that is devoted to PFC varies across mammals

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Effects of bilateral lesions of prefrontal cortex

- Prefrontal lesions cause behavior to be relatively more stimulus-driven. Information that is out of sight is not used. Goal-oriented behavior is lost.
- Unilateral lesions cause mild deficits. Common behaviors seem relatively normal. Subtle effects include perseveration, inflexibility in behavior, some deficits in working memory, forgetfulness.
- Bilateral lesions cause severe deficits in free recall memory and goal-oriented behavior (sequencing of subtasks), loss of motivation (i.e., loss of "ego"), lack of care or concern about future outcomes, poor impulse control, and over-reliance on immediate rewards and discounting of future rewards.

Prefrontal lesions cause memory deficits

- During list recall prefrontal patients do not show a benefit for related versus unrelated lists (Hirst & Volpe 1988). This suggests a failure to make use of intrinsic semantic organization. This deficit can be overcome by explicit instruction to exploit semantic organization.

- During list recall prefrontal patients are susceptible to cross-list interference (Gershberg & Shimamura, 1985) and show deficits in recalling temporal order.
- more

Prefrontal lesions cause metacognitive deficits

- Poor awareness of memory deficits and poor metacognitive strategies
- Check lecture slides

Prefrontal deficits may reflect…

- Poor use of memory encoding and retrieval strategies (metacognition)
- Source monitoring errors during encoding and retrieval (source, space and time)
- Working memory impairments
- Poor motivation
- Language deficits, particularly with left prefrontal lesions

Goal-oriented behavior and working memory

- Focus on most salient thing
- No acknowledgement of consequences

Sustained neural activity in the PFC

- It seems unlikely that this sustained activity reflects long-term memory directly, because PFC patients don't have deficits in LTM

MPFC and attentional control of working memory
PFC as a working memory buffer & link to LTM

- Location:Parietal
- Color: Temporo-occipital
- Shape: Inferotemporal
- Both activation and inhibition

Does selection reflect activation or inhibition?

- Evoked N1 (100ms after cue) responses to auditory clicks are **stronger** in PFC patients (failure of inhibition of irrelevant stimuli?), but **weaker** in temporal-parietal patients

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PFC and error prediction and error detection