REVIEW OF FRONTAL LOBE STRUCTURES

Main organization of frontal cortex:

1. **Motor area** (precentral gyrus).

2. **Premotor & supplementary motor areas** (immediately anterior to motor area). Includes premotor, frontal eye fields, and Broca’s area.

3. **Prefrontal cortex** broken into:
   
   a) dorsolateral prefrontal area;
   
   b) inferior frontal area (containing orbitofrontal area), and
   
   c) medial frontal area, often associated with the anterior cingulate cortex.

In humans, approximately ______ of association cortex is located in frontal lobe.

Development of the frontal lobe connections is not completed until late adolescence (____________________________) which correlates with social context behavioral adaptation.
FRONTAL LOBE FUNCTIONS

Whereas the function of the parietal lobe was generally involved with the spatial organization of behavior, the frontal lobe appears to specialize in the general ____________ organization of behavior.

Frontal cortical regions and functional correlates:
1. Motor cortex: executes individual muscle movements.

2. Premotor cortex: selects movements to be executed often based on ___________________________ cues or events.

3. Supplementary motor cortex: selects movements to be executed based on ________________________________.

4. Dorsolateral prefrontal cortex: cognitive processing for behavioral selection based on ____________________________ _________ for internalized knowledge (based on information gathered from dorsal visual stream).

5. Inferior frontal cortex: cognitive processing for behavioral selection based on ________________________________ (from information gathered from ________ visual stream).
   - particularly important for social interactions (context).
   - this includes affective context which is contributed by amygdala.

Functional relationship in frontal lobe is organized such that:
________________________________________________________
__________________.
Symptoms associated with frontal lobe damage

1. Disturbances of motor functions:
   - *loss of fine movements*, associated with _____________ lesions.
   - *loss of strength* associated with both motor cortex and ________________ lesions.
   - *poor movement programming* (__________________________), associated with premotor and dorsolateral prefrontal cortex lesions.
   - *poor voluntary gaze* (eye movement, “saccade”) associated with ____________________________.
   - *poor corollary discharge* (________________________________________________) associated with dorsolateral prefrontal cortex and premotor cortex lesions.
   - *language expression* (Broca’s aphasia) associated with ventral premotor cortex.
Symptoms associated with frontal lobe damage (continued)

2. Loss of divergent thinking

- opposite to ________________, which is usually measured in traditional IQ tests (reduced by parietal/temporal lobe damage but usually not by frontal lobe damage).

- example of divergent thinking:
  a) ________________
  b) ________________.

- reduced behavioral spontaneity, seriously reducing __________
  ____________________.

- can be categorized as ________________.

- associated with ________________ lesions.

- poor strategy formation, leading to incapacity or disruption of carrying out relatively simple sequences of instruction (not because of poor memory).

- probably associated with prefrontal cortex damage.
Example of loss of verbal spontaneity in a patient with orbitofrontal cortex lesion (left) as compared to an age-matched control (right).

Similar results are obtained in __________ tasks in a patient with right dorsolateral prefrontal cortex damage (control, left - patient, right).
3. Impairment in environmental control of behavior
   - general difficulty in using _______________________ to regulate changes in behavior. Leads to several impairments:
   a) ___________________ consists of behavioral perseveration in the face of changing environmental demands. Most deleterious cases associated with left prefrontal cortex lesions.

   Wisconsin card-sorting test, significantly disrupted in frontal cortex lesioned patients.

   b) ______________________ are also characteristic of patients with prefrontal cortex lesions. These behaviors may arise from impairments in response inhibition and failure to comply with instructions.

   c) ______________________ are also obtained after relatively large dorsolateral frontal cortex lesions. These deficits cannot be attributed to simple long-term memory deficits since patients can perform relatively normally on such memory tasks.
Symptoms associated with frontal lobe damage (continued)

4. Poor temporal (working) memory
   - short-term memories can be significantly impaired in patients with ________________________________.
   - examples of short-term memory deficits can be observed from disruption in ________________________________
                   ____________________.

Example of delayed nonmatching to sample task in non-human primate.
Symptoms associated with frontal lobe damage (continued)

5. Impaired social and sexual behaviors (personality change)

- patients with damage to dorsolateral frontal cortex have a tendency to __________________________________________________.

- patients with damage to the orbital frontal cortex usually show __________________________________________________ as well as abnormal sexual behaviors.

Famous case of Phineas Gage, who suffered a penetrating wound to the frontal cortex, and exhibited severe personality changes from a well liked workman to an antisocial individual.