1) **Below are some scenarios:** for each scenario, name whether the basal ganglia or the cerebellum is used mostly.

A) You’re up at bat in a softball game and intend to hit a grounder towards left field. However, when the ball arrives, you swing, pop the ball straight up in the air and (luckily) it lands uncaught in the foul zone. Strike 1. You take note of what you did wrong, adjust your 2nd swing accordingly, and hit your grounder and get on 1st base.

Which brain structure did you use to modify your motor output? (1 point)

Cerebellum – motor error

B) You’re participating in an fMRI experiment where you are told to lie still in the MRI scanner. What structure inhibits unwanted movements? (1 point)

Basal ganglia

C) Repeat the same process for the phrases below (label whether the phrase refers to the basal ganglia or cerebellum) (3 points)

- **CER** Prism goggles
- **BG** Degenerates in Parkinson’s Disease
- **BG** Major output is inhibitory
- **CER** Major output is excitatory
- **CER** Contains Purkinje cells
- **BG** Contains a large amount of Dopaminergic cells

2) **Describe the difference between functional and morphological plasticity (Lecture XXV: Experience and Critical period)?** (3 points)

Let’s first start with a definition of plasticity. Plasticity is the ability of neural circuits/systems/cells to change in response to environmental stimulation.

The main difference between functional and morphological plasticity is in what you actually measure as a function of plasticity. In functional plasticity, you use a technique that records neural activity (for instance, PET, fMRI or cellular recording) to show a change in response to stimuli. An example of this would be the different areas that are active during bilingual tests for early versus late learners. These differences in auditory areas only show up during a functional task (e.g. you ask the person to speak both of the languages). If you were to look at the physical areas with a microscope you would probably not be able to see any physical changes. In other words, the changes are in the connections between cells and in the firing rates of cells.
In morphological plasticity, you use a technique that records physical differences between brain areas (e.g. structural MRI, cell staining, synapse counting) to show a change in response to stimuli. An example would be the finding that depressed humans have physically smaller hippocampal regions. The difference in size could be related to cell number or the number of connections between cells.

Finally, it is important to note that functional and morphological plasticity can occur at the same time in the same place. For instance, depressed patients have physical differences in the size of their amygdalas AND they show functional amygdalar changes (increase in activity).

3) You decide to become a psychiatrist and you visit with two clients one day. It’s your job to diagnose each client. (2 points)

**Client 1:** A 27 year old male, who, for the last 6 months has been completely unmotivated to participate in all his usual hobbies. He has exhibited drastic changes in his eating and sleeping habits and thus has gained a lot of weight. Furthermore, he doesn’t show up to work some days and has been threatened to be fired, but he doesn’t care. His boyfriend just broke up with him because he showed no interest towards him either. He will frequently become very upset for no apparent reason. Without administering a brain scan, what diagnosis that we discussed in class, might this client fit best?

Major depression

**Client 2:** A 19 year old female was sent to you because she burned down a house and told the police that the voices made her do it. You interview her and notice that she is very withdrawn, and shows noticeable emotional (flattened) and language disturbances to the point that often times it is difficult to understand her. She often makes repeated movements and addresses another person (other than you) even though no one is actually there. Without administering a brain scan, what diagnosis that we discussed in class, might this client fit best?

Schizophrenia

4) For 1 point extra credit, write a short paragraph about one or two interesting Neuroscience-related things you learned about in the course.