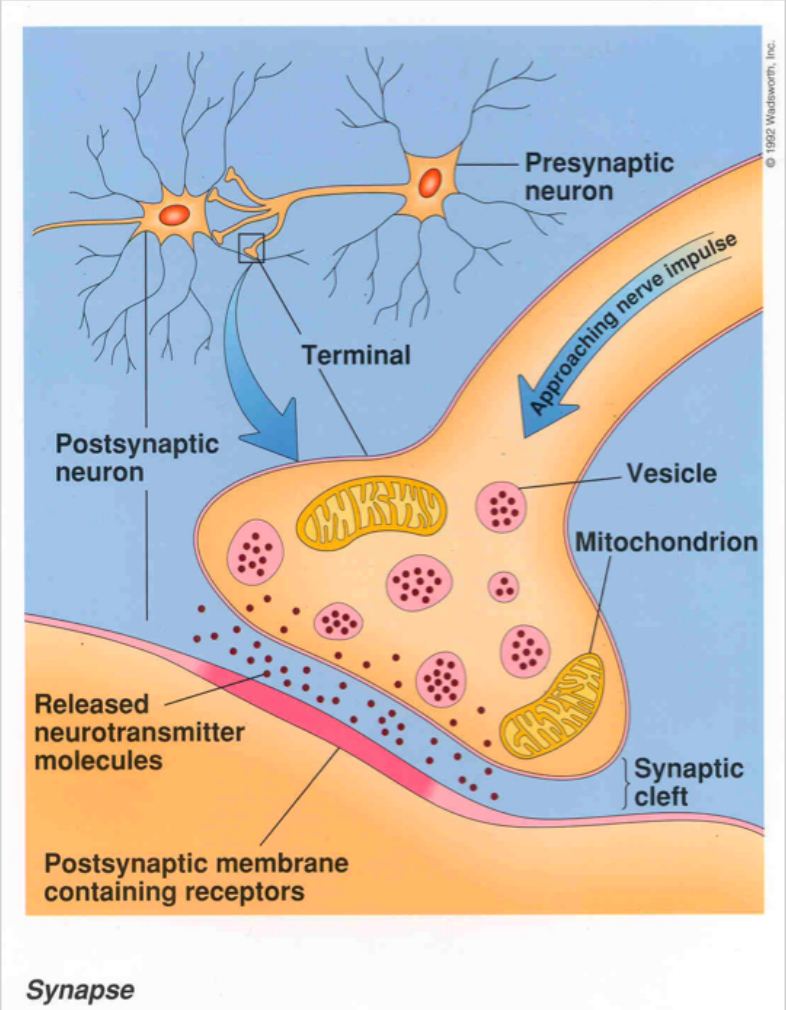
SA Question #1

A) Draw and label a synapse with as much detail as possible. Include in your answer the way(s) to end the action of a neurotransmitter (either in your drawing or by a written description).

Drawing should generally look like this:



Had to draw/label 4 of the following:

- Presynaptic neuron
- Postsynaptic neuron
- Synaptic cleft
- Vesicles carrying neurotransmitters
- Axon
- Dendrite

- Receptors on the dendrite
- K+ channel
- Na+ channel
- Myelin sheath

And had to name 2 of the 3 different ways to end the action of a Neurotransmitter:

1. reuptake back into the presynaptic cell
2. enzymatic degradation in the synaptic cleft
3. Autoreceptors on the presynaptic neurons that detect how much of a neurotransmitter has been released into the synapse and signal the neuron to stop releasing the neurotransmitter when an excess is present.

B) Name 10 parts of the brain and the functions of each as described in lecture. DO NOT include the brain area identified in the matching section.

hindbrain
- Coordination of information into and out of the spinal cord
- Controls the basic functions of life
- (medulla, reticular formation, cerebellum, pons)

midbrain
- important for orientation and movement
- (tectum, tegmentum)

forebrain
- highest level of brain; critical for complex cognitive, emotional, sensory, and motor functions
- (cerebral cortex, subcortical structures)

basal ganglia
- (caudate, putamen, globus pallidus, subthalamic nucleus, substantia nigra)
- implicated in Parkinson's disease
- direction of intentional movements
- dopamine

hippocampus
- memory, integration

thalamus
- sensory relay
  - relays and filters information from the senses and transmits the information to the cerebral cortex

limbic system
- (hypothalamus, amygdala, hippocampus)

- motivation, emotion, learning, memory
- amygdala – fear and emotion
- hypothalamus – regulates body temp, hunger, thirst, sexual behavior
- hippocampus – memory

frontal lobe
- judgment, decision making, motor planning, language

parietal lobe
- motor, motion perception

occipital lobe
- vision

temporal lobe
- object recognition, language, hearing

pituitary gland
- master gland of the body's hormone-producing system
  - releases hormones that direct the functions of many other glands in the body

reticular formation
- sleep cycles

SA Question #2

A) Explain visual form agnosia and motion blindness. Using the methods of neuroscience research explain how researchers might identify the brain regions implicated. What important aspects of visual processing can be understood from studying disorders of this type (be sure to include information about the brain areas involved in visual processing in your answer)?

-Visual agnosia = the inability to recognize and identify objects by sight. Motion blindness is the inability to detect the motion of objects. Neither is due to a simple impairment of vision.
-Researchers could use fMRI to identify any differences in function or structure of the brains of people with these impairments relative to control participants.
-Studying these disorders has revealed:
-The ventral stream (from occipital lobe to temporal lobe) is important for object recognition and this area is impaired in people with visual form agnosia.
-The dorsal stream (from occipital lobe to parietal lobe) is important for detection of motion and damage to this area is seen in people with motion blindness.
-General principle: The visual system does not do everything in one path or one brain region; rather there is parallel processing where different streams of information flow are responsible for processing different information about the visual stimulus.

B) A number of people are discovered to be very poor at processing emotional stimuli. In fact, they show little to no response to things that control participants find fear-provoking or threatening. Dr. Svoboda hypothesizes that the individuals who show abnormally reduced fear responding have a specific brain deficit. What area would Dr. Svoboda be interested in studying in this group? What are two possible techniques he might use, and what are the strengths and weaknesses of each of these techniques? What is one technique that would be badly suited for these studies, and why? Finally, what do you expect his results to show about the brain for these people?

Dr. Svoboda would be interested in studying the subcortical structure known as the amygdala (frontal cortex – worth ½ point, not its main function).

One technique he could use is fMRI. This gives both a structural and functional image. It does so by measuring changes in blood flow, using oxygenated/deoxygenated hemoglobin to generate the BOLD signal. Advantages of this technique are that it gives a high spatial resolution and you can measure activity in the brain over short time durations. Weaknesses are that it is expensive, subjects cannot move, and people with ferrous metals in their body can't do an fMRI.
Another technique one could use is a PET scan. This will also give a functional measure of brain activity and it works by injecting a radiolabeled tracer into the participant and looking to see what areas of the brain have the highest signal. An advantage is that participants could move around prior to the actual scan, and it could be used on people with ferrous metals in their body. Weaknesses are that it has a lower temporal and spatial resolution than fMRI, and you are injecting something radioactive into people.
A technique that would not work particularly well would be EEG. This method records activity over large areas on the surface of the brain, but really can't tell you much about what is going on in the subcortical structures like the amygdala.
The results will most likely show that there is a structural abnormality or some alteration in the functioning of the amygdala of these people. It could also be possible that there is a structural or functional deficit in the brain areas that are sending information to the amygdala (upstream targets) or abnormalities in the areas the amygdala is sending information to (downstream targets).

SA Question #3

A) What are the common properties of sensory systems? How does each affect perception? Provide specific examples of each property.

4 properties:
Intensity Discrimination
Reliable Responses
Rapid Responses
Mechanism for Attention

Intensity Discrimination: This allows us to distinguish between intensities of any stimulus (i.e. a whisper versus a shout). It affects perception because different magnitudes of stimuli affect how we react. We perceive sensory input differently based on intensity, i.e. someone shouting will be interpreted with a greater sense of importance than someone whispering.

Reliable Response: The same strength or level of stimulus will produce the same response every time (i.e. a 40 decibel noise should produce the same response every time if the environment is constant). This affects perception in because the same stimuli will evoke the same perception every time we're able to expect certain responses from stimuli in our environment, rather than having to process each response every time. For example, if I pinch myself I'm going to expect it to hurt the same amount every time.

Rapid Response: This is the speed at which stimuli are processed. This affects perception in that we need to be able to respond to external stimuli rapidly enough to make sense of our environment and act accordingly. For example, we need to be able to perceive pain quickly in order to stop the pain and prevent further injury.

Mechanism for Attention: This is sensory adaptation. This affects perception in that sensory systems rapidly habituate so we are sensitive to change/attend to stimuli that are relevant or different. For example, after awhile we'll habituate to a bad smell, but if the smell changes we'll notice it immediately.

B) Knowing what you now know about memory, what would you recommend as effective ways to strengthen your memory for the information you learn in your classes? Include at least two examples from each aspect of memory.

Memory requires three aspects:
Encoding: the acquisition of knowledge, or converting sensory information into memory
Storage: the process of keeping this encoded information in memory over time
Retrieval: the process of bringing to mind information that has previously been encoded and stored

Encoding
Elaborative encoding is the most effective encoding method because of the depth of processing that occurs (meaning- based attention, connecting new information to already learned material). Material that "makes sense" will be encoded more efficiently and will result in superior recall. I can strengthen my memory by connecting material I learn in psychology to material I learned in another class or a past personal experience. **Visual** encoding creates a mental image of some material. Drawing a mental representation of the brain in my head can help me remember individual parts if I'm asked to label the brain on an exam. **Organizational**

encoding improves memory by organizing topics into separate categories. Categorizing all the individual techniques for measuring brain activity (PET, CAT, MRI, etc) as “neuro imaging methods” can help with recall.

Storage

Memory is best stored if consolidated. Getting a good night sleep is one way to help consolidate memory after studying. Since consolidation occurs over several hours I should spread out my studying and avoid last minute cramming. Chunking of memory (i.e. chunking individual numbers into meaningful ones 1,4,9,2 -> 1492), and frequent review of learned information will also help to strengthen my memory.

Retrieval

Whether I remember information depends on whether retrieval cues are available to trigger recall. According to the encoding specificity principle, external contexts often make powerful retrieval cues. Sitting in the same seat for the exam that I sit in everyday will help me to remember information on the exam. State-dependent retrieval is the tendency for the information to be recalled better if the person is in the same state during encoding and retrieval – If every time I study for an exam I’m highly caffeinated I should also be highly caffeinated during the exam. Finally, I can use retrieval cues that help remind me how I encoded the information – Remembering that a pigeon flew in the room when Professor Taylor was talking about the sensory systems helps me to remember the four properties.