Subcortical Anatomy
1. Be able to locate the following structures and be able to indicate whether they are located in the forebrain, diencephalon, midbrain, pons, or medulla: amygdala, hippocampus, caudate, putamen, globus pallidus, cingulate gyrus, cerebellum, corpus callosum, anterior commissure, fornix, septum, thalamus, massa intermedia, hypothalamus, mammillary bodies, pituitary gland, superior colliculus, inferior colliculus, tectum, tegmentum, substantia nigra, periaqueductal gray, red nucleus, basis pontis, pyramids, lateral ventricle, third ventricle, cerebral aqueduct, fourth ventricle.

2. Which of the above structures are "white matter"?
3. What two subcortical systems are located in the telencephalon?
4. Which parts of the brain are included in the diencephalon?
5. What are the rostral and caudal boundaries of the midbrain (mesencephalon)?
6. What four major brain areas compose the brainstem?
7. What is the name of the liquid contained within the ventricular system?
8. Where are the hippocampus and amygdala located in relation to the lateral ventricles?
9. What are four nuclei that are part of the basal ganglia?
10. What two nuclei are collectively called the striatum?
11. What nuclei are collectively called the lentiform nucleus?
12. What is the general role of the basal ganglia?
13. What five brain structures are normally included in the limbic system?
14. What brain areas does the fornix connect?
15. What is the role generally attributed to the limbic system?
16. Which part of the limbic system is associated with emotional behaviors?
17. Which part of the limbic system is associated with long-term memory?
18. What is the major function of the thalamus?
19. What is the name of the fiber tract connecting the two thalami?
20. What is the name of the structure that connects the pituitary gland to the hypothalamus?
21. What is the hypothalamus important for?
22. What kind of information does the superior colliculus process?
23. What kind of information does the inferior colliculus process?
24. The red nucleus receives information from which major brain structure?
25. The major neurotransmitter contained by cells of the substantia nigra is?
26. What are the ventral and dorsal portions of the pons called?
27. What kind of information do the axons located in the pyramidal tracts carry?
28. The nuclei of several cranial nerves are located in which two areas of the brain (hint brainstem)?

Basic Chemistry and Biochemistry
1. What are the four most common elements utilized by molecules in our body?
2. What is an atom?
3. What is a molecule?
4. What is an ion?
5. What are some examples of ions?
6. What type of molecules are lipids made of?
7. What type of molecule forms the neuronal membrane bilayer?
8. In a cell membrane, what is the orientation of the polar headgroup and non-polar hydrocarbon chain?
9. What is an aqueous solvent (with example)?
10. What is a non-aqueous solvent (with example)?
11. What type of molecule are proteins made of?
12. What are the three principal molecules of amino acids?
13. What is the difference between the primary, secondary, tertiary, and quaternary structure of a protein?
14. What are some examples of proteins?
15. What are some examples of molecules that are not proteins (hint some neurotransmitters)?
16. What is an integral protein?
17. What is one modification of proteins that often acts as a "switch" to increase or decrease the function of a protein (hint phosphorus)?
18. What type of molecule is DNA made of?
19. What are the four organic bases that are found in DNA?
20. What three components make up a nucleotide?
21. What is the general sequence of events that leads to protein synthesis?
22. What is transcription? Where in the cell does it take place?
23. What is translation? Where in the cell does it take place?
24. What is the relationship between a gene and a protein?
25. What is the relationship between a gene and messenger RNA?
26. Are all stretches of DNA part of genes?
27. True or False. A liver cell is different from a neuron because it contains different genes.
28. True or False. A liver cell is different from a neuron because it contains different proteins.
29. Roughly how many genes does the human genome contain?
30. What is protein half-life?

Basic Neurochemistry
1. What are neurotransmitters?
2. Name 8 small molecule neurotransmitters that are well characterized:
3. What are 5 examples of biogenic amine neurotransmitters?
4. What are 4 examples of monoamine neurotransmitters?
5. What are 3 examples of catecholamine neurotransmitters?
6. What are 3 examples of amino acid neurotransmitters?
7. What amino acid neurotransmitter is the most widely utilized inhibitory neurotransmitter in the brain?
8. What amino acid neurotransmitter is the most widely utilized inhibitory neurotransmitter in the spinal cord?
9. What amino acid neurotransmitter is the most widely utilized excitatory neurotransmitter in the brain?
10. What is the neurotransmitter that is utilized by neocortical pyramidal neurons?
11. What are the two soluble gas neurotransmitters?
12. What is a neuropeptide?
13. What are endorphins?
14. What is Dale’s principle?
15. Is Dale’s principle true?
16. What is meant by "co-localization of neurotransmitters"?
17. Where are small neurotransmitters synthesized?
18. Where are large neurotransmitter molecules synthesized (hint neuropeptides)?
19. True or False. Some neurons are able to release one type of neurotransmitter from some of its axon terminals and a different type of neurotransmitter from some of its other axon terminals.
20. Know the major constituents of presynaptic boutons and postsynaptic terminals.
21. What are the 7 criteria used for classification of a molecule as a neurotransmitter?
22. What are the 4 criteria used for classification of a neuropeptide as a neurotransmitter?
23. What are the major events involved in the release of neurotransmitters?
24. What is quantal content?
25. What are the two major mechanisms for neurotransmitter deactivation?
26. Distinguish between "wiring transmission" and "volume transmission".
27. What are two types of neurotransmitters that mediate wiring transmission?
28. What are four types of neurotransmitters that mediate volume transmission?
29. True or False. Each dopaminergic neuron has only a few axon terminals.
30. What are neurotransmitter receptors?
31. What determines the effects of neurotransmitters?
32. What are the two main types of neurotransmitter receptors?

Psychopharmacology and General Principles of Drug Action
1. What is a pharmacological drug?
2. What does exogenous mean when talking about pharmacology?
3. What does endogenous mean when talking about pharmacology?
4. What is a ligand?
5. What is an agonist?
6. What is an antagonist?
7. Distinguish between the pharmacodynamic vs. pharmacokinetic properties of a drug.
8. What are three barriers that orally taken drugs, such as aspirin, have to cross?
9. What is the blood-brain barrier?
10. What types of molecules are able to passively diffuse across the blood-brain barrier?
11. What is the process of active transport?
12. What is metabolism?
13. What type of molecules mediate metabolism?
14. Where in the body does most drug metabolism take place?
15. What is the "first pass" syndrome?
16. True or False. The route of administration of a drug has no effect on its plasma and tissue concentration.
17. Which route of administration usually gives rise to the steepest concentration levels in the body?
18. What are eight well-known routes of drug administration?
19. Describe four factors that can contribute to individual differences in the pharmacokinetic properties of a drug (i.e. people variables).
20. What is the potency of a drug?
21. What is the efficacy of a drug?
22. What is the therapeutic ratio of a drug?
23. What is a drug’s side-effects?
24. What do ED50 and LD50 mean?

Extrapyramidal Motor System
1. What are the basic components of the extrapyramidal motor system?
2. What is the general function of the extrapyramidal motor system?
3. How must the input from the extrapyramidal system to the thalamus change in order for movement to be modulated?
4. What neurotransmitter is produced by the cortical afferents to the striatum?
5. Where are dopaminergic cell bodies located?
6. Where are dopaminergic axon terminals located?
7. Where are GABAergic cell bodies located?
8. Where are GABAergic axon terminals located?
9. Where are Glutamatergic (glutamate) cell bodies located?
10. Where are Glutamatergic axon terminals located?
11. Which nucleus of the basal ganglia is normally active?
12. What are the basic neuronal components of the direct and indirect pathways of the extrapyramidal motor system (where are the neuronal cell bodies and axon terminals located? What neurotransmitter is produced by each of these neurons?)
13. What effect does dopamine have on GABAergic cells in the striatum on the direct pathway (inhibitory or excitatory)?
14. What effect does dopamine have on GABAergic cells in the striatum on the indirect pathway?

Parkinson's disease
1. What are the 4 primary clinical signs of Parkinsonism?
2. What are some other signs of Parkinsonism?
3. Is the tremor associated with Parkinsonism greater during voluntary acts or at rest?
4. Is Parkinsonism a progressive disorder?
5. When typically is the onset of Parkinsonism?
6. What is known about the etiology of Parkinsonism?
7. What are the underlying mechanisms of Parkinsonism (hint dopamine neurons)?
8. How were the underlying mechanisms of Parkinsonism determined? (For example: What kind of clues were obtained from animal studies and/or postmortem human studies?)
9. What are two precursors to dopamine?
10. What is the enzyme that mediates the conversion of tyrosine to L-DOPA?
11. What is the enzyme that mediates the conversion of L-DOPA to dopamine?
12. What events must occur at the axon terminal in order for dopamine to be released into the synaptic cleft?
13. What is the main means by which dopamine's actions are terminated after it has been released into the synaptic cleft?
14. What are two possible fates of dopamine after it has been taken back up into the presynaptic terminal?
15. Which type of monoamine oxidase is located inside dopamine neurons?
16. What are two different types of dopaminergic receptors present on the postsynaptic membrane?
17. Why can't dopamine be given as an effective therapy for Parkinsonism?
18. Why does L-DOPA help in the treatment of Parkinsonism?
19. Does L-DOPA treatment help slow down the progression of Parkinsonism? Why or why not?
20. How does carbidopa assist in the treatment of Parkinsonism?
21. What is the rationale behind giving a dopamine agonist, such as bromocriptine, to individuals with Parkinsonism?
22. How may treatment with reserpine produce a transient Parkinsonism?
23. What are two drugs that block dopamine re-uptake? What protein do these drugs bind to in order to produce their effect?
24. Which part of the basal ganglia is lesioned in an attempt to treat the symptoms of Parkinson’s disease?
25. Which part of the basal ganglia are stimulating electrodes implanted in an attempt to treat the symptoms of Parkinson’s disease?
26. What kind of tissue has been used for brain transplants in Parkinson's patients? Why?
27. Where in the brain is the tissue transplanted?
28. What type of donor tissue (e.g. adrenal medulla, fetal mesencephalon), when transplanted into the brains of Parkinson's patients, has shown viability?
29. Which known drug produces permanent Parkinson’s syndrome in young adults?
30. Which drug can induce temporary (reversible) Parkinson’s syndrome?

Huntington's disease
1. What are the three main physical symptoms of Huntington's disease?
2. What are the cognitive deficits associated with Huntington’s disease?
3. When approximately is the typical age of onset?
4. Does the disorder exhibit a progressive worsening of symptoms?
5. What factors contribute to the etiology of Huntington's disease?
6. What does "autosomal dominant disorder" mean?
7. Has the gene responsible for Huntington's disease been found?
8. What is the significance of "trinucleotide repeats" for Huntington's disease?
9. What is the name of the protein mutated in Huntington's disease?
10. What are the underlying mechanisms (i.e. brain changes) responsible for Huntington's disease?
11. Which part of the basal ganglia is selectively affected in Huntington's disease?
12. What neurotransmitter is contained in the degenerating cells associated with Huntington’s disease?
13. Which dopamine receptor subtype appears to be selectively depleted in Huntington’s disease?
14. What is a possible mechanism that could explain the neuron degeneration in Huntington’s disease (hint glutamate)?
15. What classes of pharmacological compounds are used to treat involuntary movements in Huntington’s disease?
16. What classes of pharmacological compounds are used to treat the depressive mood associated with Huntington’s disease.
17. Why the current drug treatments employed to treat Huntington’s disease are only moderately effective?
18. What type of tissue is employed in an attempt to cure Huntington’s disease?
19. Where is this tissue implanted in the basal ganglia?
20. Are the results of these implants in Huntington’s patients more promising than for Parkinson’s disease?

Memory Disorders
1. What is declarative memory?
2. What is procedural memory?
3. What is short-term memory?
4. What is long-term memory?
5. What is retrograde amnesia?
6. What is anterograde amnesia?
7. What is the engram?
8. What are the two principles elaborated by Karl Lashley with regard to memory?
9. How does Hebb define memory traces?
10. How are memory traces “consolidated”, according to Hebb?
11. What two pieces of evidence provided support for the concept of memory consolidation?
12. H.M. underwent what type of surgery (which part of the brain)?
13. What class of memory was disrupted by H.M.’s surgery?
14. Why did H.M. undergo such a radical procedure?
15. Were all type of memories affected by H.M.’s operation?
16. What did H.M.’s case tell us about memory?
17. Is there a cure for H.M.’s memory deficit?
18. What are the four main symptoms of Korsakoff’s syndrome?
19. What is a common etiology of Korsakoff’s syndrome?
20. Does excessive alcohol exposure cause Korsakoff’s syndrome?
21. What amino acid is depleted in Korsakoff’s syndrome?
22. What is the underlying mechanism (i.e. brain changes) associated with Korsakoff’s syndrome?
23. How are the hippocampus, mammillary bodies, and the thalamus interconnected (i.e. what are the neural tracts connecting them)?
24. What intervention can improve some of the symptoms of Korsakoff’s patients?
25. Why is there no good treatment for the memory deficits of Korsakoff’s patients?
26. What are the four symptoms of dementias (all begin with “A”)?
27. Are dementias common before 40 years of age?
28. What protein is found in Alzheimer’s plaques?
29. What protein is found in Alzheimer’s tangles?
30. How many amino acids are contained in the normal form of the amyloid precursor protein product?
31. How many amino acids are contained in the mutated form of the amyloid precursor protein product?
32. Amyloid plaques are first observed in which brain region?
33. Neuronal loss is first observed in which brain region of Alzheimer’s patients?
34. Which protein, when present on both alleles, greatly increase the risk of Alzheimer’s disease in later life (> 80 years of age)?
35. Which chromosomes are associated with the presenilin proteins?
36. What are some of the drug treatment employed to reduce the symptoms of Alzheimer’s disease?
37. What other treatments might be used to reduce or reverse the symptoms of Alzheimer’s disease (2 additional treatments)?

Oliver Sacks Cases
What kind of disorder did the following individuals have, and what were the likely underlying mechanisms (e.g. which brain regions were damaged)?
a. the man in “The Lost Mariner”.
b. the man described in "A Matter of Identity".
c. the man described in "On the Level".
d. the woman in “Incontinent Nostalgia”. 