

Part A – Multiple Choice (20 points) – circle the letter of the correct answer

1. In which part of the neuron are synaptic vesicles found?
 - a. Cell body
 - b. Dendritic spines
 - c. Axon hillock
 - d. Axon terminals

2. The major function of Schwann cells is
 - a. transmission of nutrients to neurons.
 - b. myelination of peripheral nerve fibers.
 - c. scavenging of cellular debris.
 - d. myelination of axons in the brain.

3. The sodium–potassium pump is responsible for
 - a. removing three sodium ions for every two potassium ions from the cell membrane.
 - b. initiating the action potential.
 - c. returning the membrane potential to the resting state.
 - d. Both a and c

4. ACh is the main transmitter used at mammalian
 - a. cerebral cortical synapses.
 - b. spinal cord synapses.
 - c. neuromuscular junctions.
 - d. visual system synapses.

5. The specialized presynaptic membrane receptors that remove molecules of transmitter from the synapse are called
 - a. translators
 - b. transponders
 - c. transporters
 - d. ligand-gated channels

6. Which of the following is *not* a consequence of parasympathetic activation?
 - a. Increased salivation
 - b. Increased heart rate
 - c. Decreased blood pressure
 - d. Increased digestion

7. In its common usage, the term *stroke* refers to
 - a. brain lesions caused by a reduction or blockage of blood flow to the brain.
 - b. brain lesions caused by leakage of cerebrospinal fluid.
 - c. brain injury due to head trauma.
 - d. any process that causes a sudden intellectual deterioration.

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8. Which of these is *not* a catecholamine neurotransmitter?
- a. Dopamine
 - b. Serotonin
 - c. Epinephrine
 - d. Norepinephrine
9. For an NMDA receptor channel to open
- a. Both GABA needs to be present and the membrane needs to be depolarized
 - b. Both GABA needs to be present and the membrane needs to be hyperpolarized
 - c. Both glutamate needs to be present and the membrane needs to be depolarized
 - d. Both glutamate needs to be present and the membrane needs to be hyperpolarized
10. The process of transcription
- a. is from DNA to RNA, and occurs in the nucleus
 - b. is from DNA to RNA, and occurs in the ribosome
 - c. is from RNA to protein, and occurs in the nucleus
 - d. is from RNA to protein, and occurs in the ribosome
11. RNA
- a. is double stranded
 - b. is single stranded
 - c. is found only in the nucleus
 - d. is always a template for protein synthesis
12. The phenotype
- a. will always be guided by recessive alleles
 - b. express the genotype only
 - c. will be guided by dominant alleles only if heterozygous
 - d. is affected by both nature and nurture
13. Crossing over
- a. creates new combinations of maternal and paternal genes on any given chromosome
 - b. describes the situation when axons from different neurons meet but each continues to a different direction (as in traffic junctions)
 - c. is when the information in a postsynaptic cell from one neuron is being displaced by the information from another neuron
 - d. is a process in which chromosomes exchange equivalent segments of DNA during mitosis
14. Contralateral structures are
- a. one is caudal to the other (which is rostral to the first)
 - b. on opposite sides of the midline
 - c. lateral to each other
 - d. one is proximal and the other is distal

15. The blood–brain barrier

- a. is a part of the immune system, involving the release of antibodies to protect the brain from infectious agents.
- b. is a property of the closely packed cells that build the walls of brain capillaries, preventing large molecules from entering the brain.
- c. is a property of the blood vessels of the brain that prevents the diffusion of water into the tissue of the brain.
- d. is a property of neurons that prevents them from accidentally releasing their neurotransmitters into the blood circulation.

16. Which of the following is *Wrong* regarding opiates

- a. there are opioid receptors in the periaqueductal gray
- b. endogenous substances which activate receptors for opiates are called endorphins
- c. THC-9 is synthesized from opium
- d. at high doses, opiates depress respiration

17. Which of the following is *Wrong* regarding MRI images

- a. Under specific magnetic and radio conditions, different tissues with different physical traits react differently
- b. Differences in physical reactions of tissues are translated into different colors
- c. The strength of commonly used MRI scanners is at least 30,000 times the earth's magnetic field
- d. In a strong magnetic field hydrogen atoms are randomly aligned

18. fMRI

- a. measures electrical neural activity directly
- b. is based on the fact that a local increase in neural activity demands increased glucose
- c. is based on the Blood Oxygenation Level Dependent signal
- d. uses a radioactive tracer injected into the bloodstream in order to see changes in neurovascular coupling

19. Cocaine

- a. is mainly a serotonin agonist
- d. especially blocks the reuptake of dopamine
- c. mainly affects the sympathetic system directly
- d. can produce schizophrenia-like symptoms

20. Split-brain patients:

- a. have difficulty to verbally describe stimuli presented in the left-visual-field
- b. have difficulty to verbally describe stimuli presented in the right-visual-field
- c. both a and b
- d. neither a or b

Part B – Short Answer (40 points)

1. What disease is related to the degeneration of the substantia nigra?

2. During their absolute refractory period, neurons don't _____.
3. What characteristic of the neural membrane is responsible for the differential concentrations of ions inside and outside the neuron?

4. The neural membrane must become _____ relative to its resting membrane potential in order for an action potential to occur.
5. Conduction velocity of action potentials is increased in axons with _____ diameters.
6. True or false? Metabotropic receptors liberate chemical second messengers.

7. A gas that is a neurotransmitter is _____.
8. One important way that alcohol alters the functioning of the brain is as an agonist of _____ receptors.
9. Serotonergic neurons are located in the _____.
10. _____ is the cellular organelle responsible for cellular respiration.
11. The processes of cell division for growth is called _____.

12. A sequence of 3 nucleotides coding for 1 amino-acid is called a _____.
13. How many neurons does the human brain contain? _____.
14. Cells with numerous branching dendrites are called _____ neurons.
15. The choroid plexus produces the _____.
16. The primary visual cortex is in the _____ lobe.
17. Receptors that contain channels for sodium or chlorine, e.g., are _____; those without channels are _____.
18. Norepinephrine is produced from _____, and _____ is produced from Norepinephrine.
19. fMRI temporal resolution is in the order of _____.
20. The degree of chemical attraction between a ligand and a receptor is called _____.

Part 3 – Essay Questions (25 points)

Answer 5 out of the following 8 questions (5 points each = 25 points).

You may also answer one more question for 5 bonus points.

At the beginning of your answer, write the number of the question you are answering.

You may continue on the other side of the page if needed.

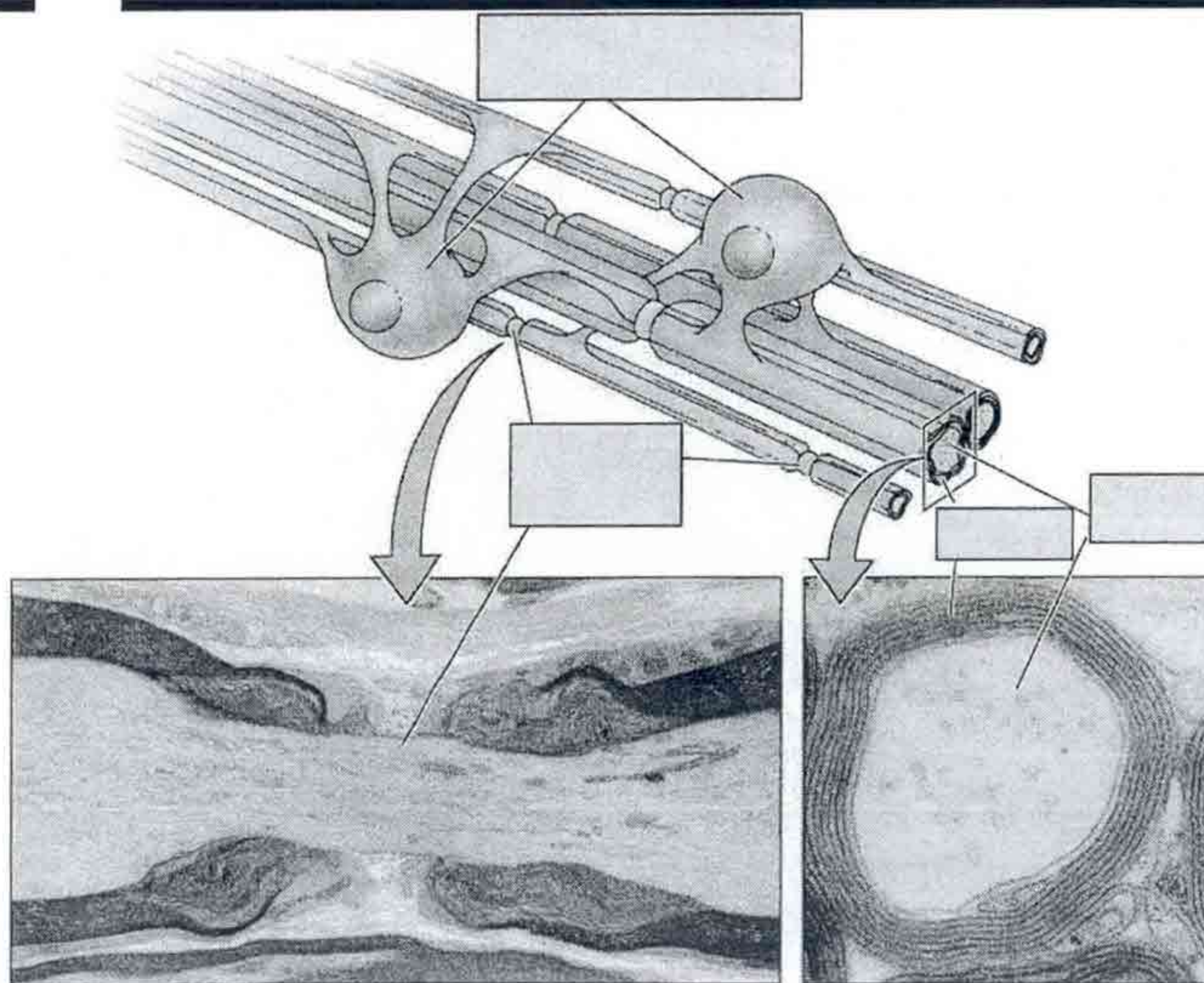
- 1. Name four types of glial cells, and describe three important functions that glial cells perform.**
- 2. Compare and contrast at least three different human brain imaging technologies through discussion of their technical bases and the types of information each provides.**
- 3. Explain temporal and spatial summation of IPSPs and EPSPs.**
- 4. List 5 characteristics (properties) of a substance necessary for it to be considered a neurotransmitter.**
- 5. Describe up to 5 ways that medicinal drugs or drugs of abuse may affect post-synaptic processes.**
- 6. Describe the process leading from a gene to the creation of a mature protein – how is a gene recognized, which molecules are involved, what are the names of the sub-processes, where does each sub-process take place, how is the correct protein sequence created.**
- 7. Describe the production, functions, and structures containing cerebrospinal fluid, and problems that can be caused when the CSF system malfunctions.**
- 8. Describe mitosis and meiosis, when and in which cells does each one occur, and how many chromosomes are in each daughter cell by the end of each process.**

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Part 4 – Labeling (15 points; 1 point for each label)

(4 points)

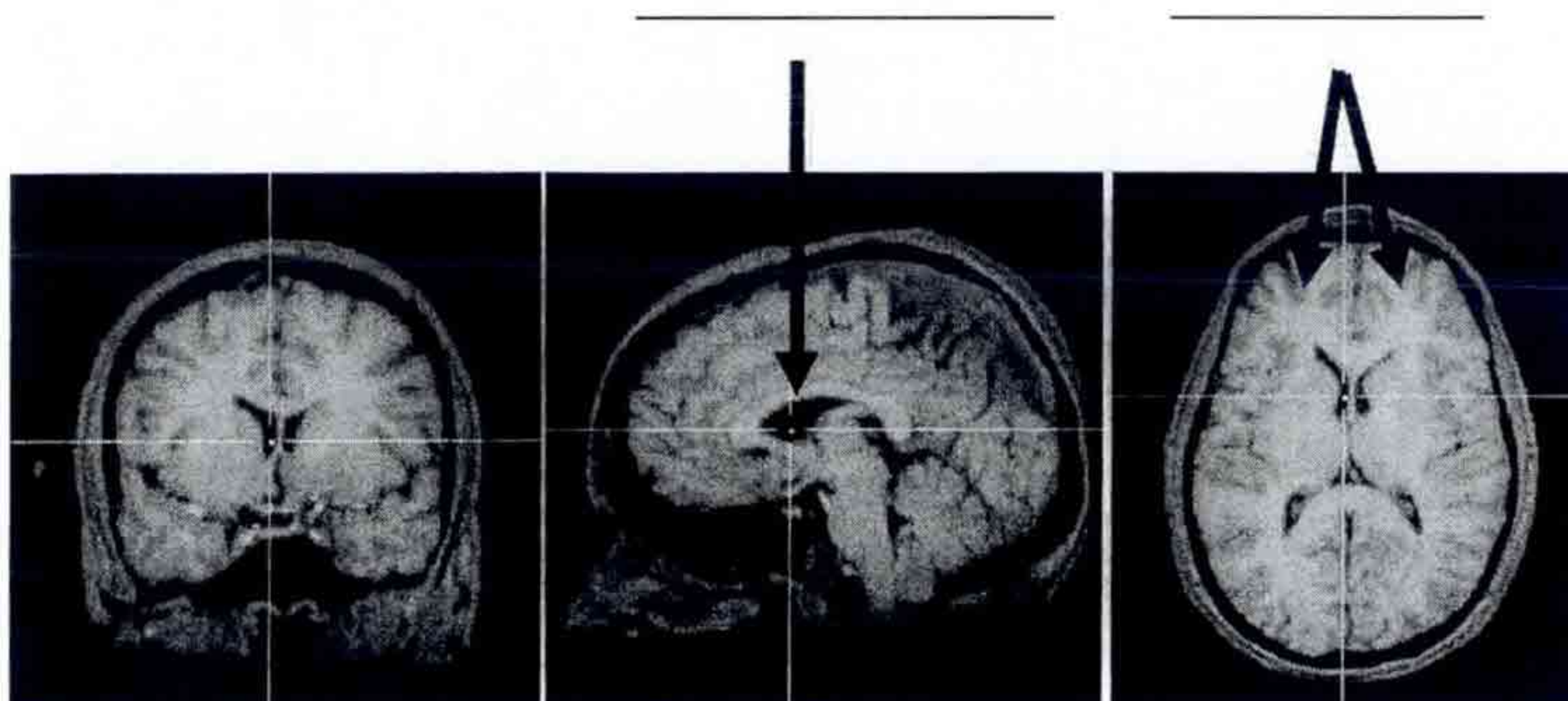


(6 points)

A. The white cross is positioned on the same structure in all the three planes.

This structure is the _____.

Write the name of each plane under each figure, and fill the name of the structures marked by the arrows.



A brain surgeon, who needs to remove a tumor from a sub-cortical structure, will "meet" the following layers on the way:

(5 points)

