

COGS 17 A03 Oct 15 Problem Set (Midterm Review)

Answer Keys

1) (Anatomy) Match the following structures with corresponding functions:

- Corpus Callosum
 - This structure is located in CORTEX, for the connection between two hemispheres.
- Blood-Brain Barrier
 - This structure strictly controls chemicals in the brain. Astrocyte is involved in the formation of this structure.
- Cerebellum
 - This structure is located in HINDBRAIN, and it is for guiding movements, and it is also critical in timing actions & attention.
- Pons
 - This structure is located in HINDBRAIN, and it is the “bridge”. The main function of this structure is to carry sensory info from/to the lower/higher of the brain.
- Basal Ganglia
 - This structure is located in TELENCEPHALON, and it's involved in the control of movement, especially planned sequential behaviors. Also, it is involved in task settings.
- Meninges
 - This structure is for the protection of the central nervous system, and it has three layers.
- Hypothalamus
 - This structure is located in FOREBRAIN, and it oversees “4Fs”. It also controls endocrine systems via effects on another gland

2) (Anatomy) List the structures that construct the central nervous system & peripheral nervous system.

CNS: Spinal Cord and Brain (and all structures that construct them)
See lecture notes for more details

PNS: Somatic Nervous System & Autonomic Nervous System
See lecture notes for more details

3) (Anatomy) List the structures that construct the hindbrain, midbrain & forebrain.

Hindbrain: Medulla, Pons, Cerebellum
Midbrain: Tectum, Tegmentum
Forebrain: Diencephalon -- Thalamus, Hypothalamus; Telencephalon
-- Hippocampus, Amygdala, Cingulate gyrus, Olfactory Bulb, Basal
Ganglia, Basal Forebrain

4) (Anatomy) Indicate the effects of the Parasympathetic Nervous System and Sympathetic Nervous System.

	Parasympathetic	Sympathetic
Pupils	dilate	constrict
Lungs	open	constrict
Heart	pump fast	pump slow
genitals	hinder sexual arousal	facilitate sexual arousal
stomach	halt activity	motility & secretion

5) (Cells) What is an action potential? Briefly describe the process of an action potential.

Depolarization of neurons, in other words, changes in membrane permeability of axon propagated via ionic conduction.

Process of action potential: Voltage-activated Na^+ gates open >> Na^+ rushes in, reverses local polarization >> Na^+ moving inside causes adjacent Na^+ voltage-activated gates to open, & previously-open ones close >> As previous Na^+ gates close, local K^+ gates open wide, K^+ leave >> When depolarization reaches Terminal, Ca^{++} gates there open & Ca^{++} enters cell >> Release NT

6) (Cells) Which structure is responsible for the establishment of the resting potential? How does this structure help the neuron establish resting potential?

Na-K pump. It actively takes 3Na^+ out/ 2K^+ in, causing the membrane potential more negative.

7) (Cells) How do cells speed up the transduction of neural signals? Is this kind of transduction electrical or chemical?

By myelination and Saltatory Conduction. Electrical.

8) (Cells) Briefly explain the difference between ionotropic and metabotropic NTs.

Ionotropic: Directly affects ion gates; rapid, short-lived effects.

Metabotropic: Triggers metabolic changes in Postsynaptic cell >> Activates/triggers production of Second Messenger, which binds w/G-Protein to open separate ion Gate; slow, long-lasting effects.

9) (Cells) What is EPSP/IPSP? What are two types of summation of EPSP/IPSP and what are the differences between them?

EPSP: An increase in the cell's likelihood of releasing NT (Post-Syn cell becomes Hypopolarized)

IPSP: A decrease in the cell's likelihood of releasing NT (Post-Syn cell becomes Hyperpolarized)

When one (or more) cells repeatedly stimulate another in rapid succession, it is called Temporal Summation;

When multiple cells converge on a single cell at the same time, the effect is called Spatial Summation.

10) (Cells) Describe several ways that can change the effectiveness of NTs.

Agonist: a chemical that increases the effect of an NT

Antagonist: a chemical that decreases the effect of an NT

See lecture notes for other factors.

11) (Development) What is the cause of Spina Bifida?

Neural Folds fail to fuse at the early stage of development.

12) (Development) Briefly describe the proliferation, migration, and differentiation process.

Proliferation: Growth of new cells (Neurons and Glia Cells); Occurs primarily prenatally, some in infancy
See lecture notes for more details.

Migration: Some Neurons migrate by “crawling” along Radial Glia fibers, often aided by Glycoproteins; other Neurons may migrate by following chemical trails laid down by Glia Cells or by other Neurons

Differentiation: While and/or after Neurons migrate, cells differentiate, to vary widely in structure and function. Affected by genes, and chemicals.

13) (Development) What is synaptogenesis?

Developing junctions (Synapses) between cells
See lecture notes for more details.

14) (Development) What is apoptosis and what causes it?

Apoptosis: “cell death”. All Neurons have suicide genes – brain chemistry & activation patterns determine if activated/not

15) (Development) “Cells that fire together, wire together”.

16) (Development) Will adults grow new neurons in further brain development?

No. However, dendrites continue to develop.