Basic Neuroanatomy

Synthesis Questions

Video 1: The Neuron!

1. Recall the main parts of a neuron and list their functions. Write 1 sentence for each.
    - *Cell body* of neuron contains the normal cell stuff like nucleus and mitochondria
    - *Dendrites* are branches coming out from the cell body to receive information through neurotransmitters from another neurons
    - *Axons* transmit information from the axon hill to the axon terminal. They are sometimes wrapped around by *myelin sheath* made by oligodendrocytes to transfer information more quickly.
2. Fill out the following sentence An action potential travels from the direction of the *axon hill* along the *axon*, before reaching the *axon terminal*.
3. What happens if a neuron becomes unmyelinated? The information may not get passed through efficiently (not quick enough)
4. What is a synapse? What does it do? *Synapses* are the gap between the axon terminal of presynaptic cell (sending information) and the dendrite of the postsynaptic cell (receiving information). Through this gap, the neurons make connection by sending information through neurotransmitters.

Optional: Action Potential

Video 2: The Brain: Structure and Function

1. What distinguishes the forebrain, midbrain, and hindbrain? Spinal cord brings in the information and come up in an order of *hindbrain* → *midbrain* → *forebrain*. The closer to the spinal cord, the more basic their function is. *Hindbrain* is responsible for
2. What are several parts of the midbrain and what are their functions? From the bottom, we have *medulla oblongata* → *pons* → *midbrain* in the brainstem, and they are responsible for breathing, circulation, and digestion.
3. How did we discover what function(s) certain areas of the brain have? Most of the times in the past, we figured out through observation in animals and humans, as well as studying people with brain injuries. Nowadays, it is shifting more towards lesion and behavioral studies, as well as neuroimaging and electrophysiology.
4. What are the 4 lobes of the brain and their general functions? Write 2 sentences for each.

- **Frontal lobe:** controls higher-level thinking like reasoning, decision-making, problem-solving, and planning. It also manages voluntary movement, speech production (Broca's area), and personality traits.
- **Parietal lobe:** processes sensory information from touch, temperature, and pain. It helps you understand spatial relationships and body awareness—basically knowing where your limbs are even with your eyes closed.
- **Occipital lobe:** handles auditory perception, memory, and emotion. It contains the hippocampus for memory formation and Wernicke's area for language comprehension.
- **Temporal lobe:** devoted entirely to vision—interpreting colors, shapes, and motion. It receives input from the eyes and helps you make sense of what you see.

Video 3: MIT Neuroanatomy Lecture

1. What are the four major parts of the brain?
    - Brainstem & Cerebellum
    - Limbic System (subcortical regions)
    - White Matter
    - Cerebral Cortex
2. Summarize the main functions of each of the four major components above, or jot down some details about each
    - **Brainstem & Cerebellum**: brainstem is responsible for the basic functions like breathing and circulation. Cerebellum is responsible for balance and motor learning.
    - **Limbic System (subcortical regions)**: contains thalamus (routes all sensory information to correct cortical areas), amygdala (flight, flee, feed, mate), and hippocampus (memory and spatial navigation)
    - **White Matter**: bundles of myelinated axons, connect all the brain regions together. *Corpus callosum* is the biggest white matter, connecting the right and left hemisphere.
    - **Cerebral Cortex**: responsible for higher-order functions, divided to lobes ad includes primary motor cortex, visual cortex, and auditory cortex.
3. What is a receptive field? A **receptive field** is the specific region of sensory space (ex. part of visual field, patch of skin, range of sound frequencies) where a **stimulus** will cause a particular neuron to respond.
4. Describe characteristics of a cortical area. Find your favorite cortical area not described in the lecture and describe some things that make it interesting :) **Definition:** A cortical area is a region of cortex distinct from its neighbor in...
    - Function
    - Connectivity to other areas
    - Distinctive layer structure/cell types ("*cytoarchitecture*") My favorite cortical area is hippocampus, which is actually a subcortical area. The name came from the ancient Greek

words "hippos" (horse) and "kampos" (sea monster) — the region looks like a seahorse.

- Main focus
- Remember
- Keyword
- New idea
- Question
- Source
- Direct Quote

References