PSYO111—Midterm 2—Study Guide

Chapter 3—Neuroscience and Behavior

**Neurons: The Origin of Behavior**

1. Explain the function of Neurons
2. Outline the components of the neuron
   1. cell body
   2. dendrites
   3. axon
3. Differentiate the three major types of neurons by their function
   1. *cell body (soma):* largest component of neuron
      1. coordinates information processing tasks
      2. keeps cell alive
      3. protein synthesis, energy production, metabolism
      4. contains nucleus that houses chromosomes with DNA
      5. enclosed by porous cell membrane (molecules can go in and out)
   2. *dendrites:* receive information form other neurons and relay it to the cell body
      1. comes from Greek word for tree
   3. *axon:* carries information to other neurons, muscles, or glands
      1. can be very long
      2. covered by a myelin sheath
4. What do neurons do?

Neurons communicate with each other to perform information processing tasks

1. What are the three primary components of the neuron?

cell body, dendrites, and the axon

1. Do neurons actually touch when they communicate? Explain.

They do not touch when they communicate because there is a small gap between one neuron’s axon and another’s dendrites that is part of the synapse, which is a fundamental component of communication between neurons.

1. What is the function of the myelin sheath?

It supports the nervous system by insulating axons so that they can carry information more efficiently.

1. What critical functions do the glial cells play?

The glial cells compose the myelin sheath in addition to digesting parts of dead neurons or providing physical and nutritional support for neurons.

1. How do the three types of neurons work together to transmit information

Sensory neurons receive information from the external world and convey this information to the brain via the spinal cord. Motor neurons carry signals from the spinal cord to the muscles to produce movement. Interneurons connect sensory, motor, and other interneurons together to form a neural network of communication.

Terms & Definitions:

*Neurons*: cells in the nervous system that communicate with each other to perform information-processing tasks

Names & Dates:

*Santiago Ramon y Cajal*: Spanish physician who learned a new technique for staining neurons in late 1880s that revealed that brain cells came in different shapes and sizes (Golgi stain).

**The Electrochemical Actions of Neurons: Information Processing**

1. Describe how an electrical signal moves across a neuron

Occurs in two stages: first is conduction; when the electrical signal moves from the dendrites through the cell body then throughout the axon, then a chemical signal across the synapse transmits the electrical signal from one neuron to another.

1. Outline the steps in synaptic transmission

* The action potential travels down the axon
* AP stimulates the release of neurotransmitters from vesicles
* neurotransmitters are released into the synapse and they float to bind with receptor sites on a dendrite of a postsynaptic neuron where a new action potential is initiated
* the neurotransmitters are then cleared out of the synapse by reuptake into the sending neuron
* neurotransmitters are broken down by enzymes in the synapse or diffusion aways from the synapse
* finally, neurotransmitters bind to auto receptors on the sending neuron, stopping the release of more neurotransmitters

1. Explain how drugs are able to mimic neurotransmitters

Drugs mimic neurotransmitters by having a chemical structure so similar to a neurotransmitter that the drug can then bind to that neurons receptor to either activate it or prevent it from activating.

1. What difference between the inside and outside of the neuron’s cell membrane creates the resting potential?

The difference between the inside and outside of the neuron’s cell membrane that creates the resting potential is in concentrations of ions. The inside of the membrane is negatively charged at -70 millivolts compared to the outside.

1. How does the neuron’s membrane change over the course of an action potential?

When the voltage across the membrane reaches the threshold value, the sodium-specific channels on the nearby axon open up like a floodgate which changes the charge from negative to positive inside the axon then the sodium positive channels in the membrane are deactivated entering a refractory period. Then the potassium positive channels open to flush out excess positively charged potassium ions. When the membrane’s charge returns to a negative state, the potassium channels close. Ion pumps push positively charged sodium ions out of the cell and intake positively charged potassium ions to return the concentration of ions to the resting potential.

1. What is the role of neurotransmitters in neural communication?

Neurotransmitters are the chemicals that transmit information across the synapse to a receiving neuron’s receptors in its dendrites to start or stop a new electrical signal.

1. Is L-dopa an agonist for dopamine or an antagonist? Why?

L-dopa is an agonist for dopamine because it increases its production.

**The Organization of the Nervous System**

1. Differentiate the functions of the central and peripheral nervous systems

The central nervous system is composed of the brain and spinal cord and processes external sensory information and sends commands to skeletal and muscular systems for action. Whereas the peripheral nervous system connects the central nervous system to the body’s organs and muscles.

1. Understand the nature of the reflex arc

A reflex arc is a neural pathway that controls reflex actions. It can include sensory neurons, interneurons, and motor neurons.

1. Demonstrate the hierarchical structure of the central nervous system
2. What is the neuron’s role in the body’s nervous system?

Neurons form the network of the nervous system that convey electrochemical information throughout the body.

1. What are the components of the central nervous system?

The central nervous system is composed of the brain and spinal cord.

1. What are the two divisions of the peripheral nervous system?

The somatic nervous system and the autonomic nervous system.

1. What triggers the increase in your heart rate when you feel threatened?

The sympathetic nervous system.

1. What important functions does the spinal cord perform on its own?

Spinal reflexes.

**Structure of the Brain**

1. Differentiate the functions of the major divisions of the brain
2. Explain the functions of the cerebral cortex according to organization across hemispheres, within hemispheres, and within specific lobes
3. Identify the causes and consequences of brain plasticity
4. Explain the progression of the human brain’s evolution
5. Which part of the brain controls the basic functions of life, such as respiration?
6. Which part of the brain helps with orientation to the environment?
7. How is the thalamus like a computer?
8. Which area of the brain is associated with emotional memories?
9. Why is Parkinson’s disease a good example of the interrelationship between the brain and behavior?
10. What is the main function of the pituitary gland?
11. Why is the part of the somatosensory cortex relating to the lips bigger than the area corresponding to the feet?
12. What types of thinking occur in the frontal lobe?
13. Give examples of research that proves the brain is able to change because of a person’s life experience
14. What is the structural difference between the brain of a reptile or bird and the brain of a mammal?

**Genes, Epigenetics, and the Environment**

1. Outline the structure of a gene
2. Differentiate between monozygotic and dizygotic twins
3. Explain how epigenetic influences work
4. What are the two ways that “genes” can be defined?
5. why do dizygotic twins share 50% of their genes, just as do siblings born separately?
6. Are abilities such as intelligence and memory inherited through our genes?