

# Chapter 2 Review Guide

## Chapter 2: Neuroscience

### The Neuron

**Soma** (cell body): Contains nucleus and support systems

**Dendrites**: Tree-like branches that receive information from other neurons

**Axon**: Long fiber that passes info to other neurons

**Myelin**: Fatty substance on some axons--speeds up neural transmissions

**Terminal Branches of Axon**: Form junctions with other cells and contain synaptic vesicles

**Synaptic vesicles**: sac-like structures that contain neurotransmitters

**Synapse**: The tiny gap between the sending and receiving neurons

**Neural Networks**: Clusters of neurons that work together and become strengthened with use.

**Neural Communication**: Neurons communicate via an electrochemical process

### Electrical Process

**Resting Potential**: Neuron is at rest and is said to be Polarized (-70 milivolts). The inside of the cell is more negative than the surrounding fluid.

**Action Potential**: When stimulated at or above threshold, the cell becomes depolarized (+50 milivolts) as positively charged sodium ions rush into the cell. The neuron has now "fired". It is an all-or-nothing response. The cell then returns to its polarized state.

**Refractory Period**: For 1/1000 of a second after firing, the cell cannot fire again. This is somewhat like a camera flash recharging itself.

### Chemical Process

1. When the action potential reaches the terminal buttons, it causes the synaptic vesicles to release neurotransmitter into the synapse.

2. The neurotransmitters then bind to receptor sites on the receiving neuron (key fitting into a lock). Some neurotransmitters are *excitatory* (increasing the potential) while others are *inhibitory*.

3. After neurotransmitters have done their job, they are removed from the synapse by chemicals released into the synapse. Or, reuptake may occur.

**Reuptake**: Neurotransmitters are reabsorbed by the neuron for future use.

### Neurotransmitters

**Acetylcholine (Ach)**: Muscle movement, learning, and memory. Also involved in Alzheimer's disease.

**Dopamine**: Involved in learning, attention, and emotion. Also involved in schizophrenia.

**Serotonin**: Affects mood, hunger, sleep, and arousal. Also involved in depression.

**Norepinephrine**: Helps control alertness and arousal. An oversupply can lead to manic symptoms.

**GABA (gamma-aminobutyric acid)**: Major inhibitory neurotransmitter. An undersupply can lead to tremors, seizures, and insomnia.

**Glutamate**: Major excitatory neurotransmitter; involved in learning and memory. An oversupply can overstimulate the brain leading to migraines (this MSG in food).

**Endorphins**: natural opiate-like neurotransmitter linked to pleasure.

### Drugs and Neurotransmitters

**Agonists**: Drugs that are so similar to a neurotransmitter that they bind to receptor sites. **Antagonists**: drugs that block the effects of neurotransmitters-or-they may block the reuptake of a neurotransmitter. **Inhibitors**: drugs that inhibit a neurotransmitter's release-or-they may occupy receptor sites, thus blocking the neurotransmitter from working.

### The Nervous system

#### I: Central Nervous System

a) **Brain**

b) **Spinal Cord**

#### II. Peripheral Nervous System

a) **Somatic (skeletal) nervous system:**

Voluntary behaviors

b) **Autonomic: Self-regulation of internal organs and glands.**

1. **sympathetic NS: arousing**

Pupils dilate, HR, BP, respiration increase, and digestive processes slow down.

Fight or flight response.

2. **parasympathetic NS: calming-opposite of sympathetic nervous system response.**

### Studying the Brain (cont.)

**EEG (electroencephalogram)**: amplified recordings of electrical activity of the brain.

**CT (computerized tomography) scan**: X-ray photo (or CAT) scans show structures within the brain b

**PET (positron emission tomography)**: visual display that detects where a radioactive form of glucose is being used by the brain during tasks. The brain performs certain tasks.

**MRI (magnetic resonance imaging)**: technique that uses magnetic fields and radio waves to see structures within the brain.

**fMRI (functional MRI)**: allows us to see where oxygenated blood flows while various tasks are being performed.

### Structure and Function of the Brain

**Brainstem**: Oldest area of the brain. Also called the brain stem.

1. **Medulla**: the base of the brainstem; controls heart rate and breathing.

2. **Reticular Formation**: A neural network within the brainstem that influences arousal and wakefulness.

### **Three types of Neurons**

**1. Sensory (afferent) neurons of the peripheral NS take incoming sensory information to the spinal cord and brain.**

**2. Motor (efferent) neurons take information from the spinal cord out to muscles and glands.**

**3. Interneurons are neurons in the central NS (brain & spinal cord). They communicate with each other and connect the sensory and motor neurons.**

### **The Simple Reflex**

A simple reflex involves afferent (sensory) neurons carrying sensory information to the spinal cord.

Interneurons connect the afferent neurons to the efferent (motor) neurons. A reflex does not involve the brain.

### **The Brain**

#### **Studying the Brain**

##### **Phineas Gage**

##### **Lesions: Destruction of brain tissue**

##### **Structures of the Brain (cont.)**

**Cerebral Cortex:** The intricate fabric of interconnected neural cells that covers the cerebral hemispheres. The ultimate information-processing center of the brain.

##### **Lobes of the Brain**

**Frontal Lobes:** Contain the motor cortex which control voluntary movement. In the LEFT frontal lobe is Broca's Area which controls our ability to speak.

**Parietal Lobes:** Contain the somatosensory cortex which registers bodily sensations (touch).

**Temporal Lobes:** Contain the primary auditory cortex (audition) and areas for the senses of smell (olfaction) and taste (gustatory sense). The LEFT temporal lobe contains Wernicke's Area which control language comprehension and expression.

**Occipital Lobes:** Contains the Primary Visual Cortex.

**Association Areas:** Areas of the cortex not involved in sensory or motor functions. They are involved in higher mental functions such as learning, remembering, thinking, planning, and language. About 75-80% of the brain is composed of association areas.

### **arousal including sleep.**

**Thalamus:** Sits on top of the brainstem; received all incoming sensory information (except smell) and sends it to the appropriate part of the brain for further processing.

**Cerebellum:** The "little brain" attached to the back of the brainstem. Coordinates voluntary movement and balance.

**The Limbic System:** A doughnut-shaped structure between the brainstem and the cerebral hemispheres. It is considered the "seat of emotion" and involved in motivated behavior like eating, drinking, and sex.

**1. Amygdala:** Involved in rage and fear as well as emotional memory.

**2. Hippocampus:** Involved in memory

**3: Hypothalamus:** Involved in eating, drinking, and sexual behavior. Controls the endocrine (hormonal system) via the pituitary gland. It is sometimes referred to as "the pleasure center" of the brain.

### **Hemispheres of the Brain**

Virtually all activities require BOTH hemispheres. However, the Left Hemisphere receives sensory information from the right side of the body and controls movement of the right side of the body. It is also involved in science, math, etc. The Right Hemisphere receives sensory information from the left side of the body and controls movement of the left side of the body. It is involved in music, artistic ability, and spatial skills.

**Split Brain Research:** Review information in your text and check out [handouts](#).

### **Hypothalamus: Controls pituitary gland**

**Pituitary:** Secretes growth hormone and many other hormones that regulate other glands.

**Thyroid:** Affects metabolism

**Parathyroids:** Regulate calcium levels in the blood

**Adrenal Glands:** Secret the hormones epinephrine and norepinephrine which trigger the "fight or flight" response.

**Pancreas:** Regulates glucose levels in the blood through the release of insulin and glucagon.

**Ovaries and Testes:** Secret female and male sex hormones.