# 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.

### Chemical Process
1. When the action potential reaches the terminal butt branches, it causes the synaptic vesicles to release neurotransmitters.
2. The neurotransmitters then bind to receptor sites of the key fitting into a lock. Some neurotransmitters are excitatory, while others are inhibitory.
3. After neurotransmitters have done their job, they are chemicals released into the synapse. Or, reuptake may occur.

### Reuptake: Neurotransmitters are reabsorbed by the future use.

### Neurotransmitters
- **Acetylcholine (Ach)**: Muscle movement, learning, and memory. An undersupply is involved in Alzheimer’s disease.
- **Dopamine**: Involved in learning, attention, and emotion. An excess dopamine is involved in schizophrenia.
- **Serotonin**: Affects mood, hunger, sleep, and arousal. Depression.
- **Norepinephrine**: Helps control alertness and arousal depression. 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 memory. An oversupply can overstimulate the brain leading to migraines (this is why some people avoid MSG in food).
- **Endorphins**: Natural opiate-like neurotransmitter linked to pain control and pleasure.

### Drugs and Neurotransmitters
- **Agonists**: Drugs that are so similar to a neurotransmitter that it can block reuptake of a neurotransmitter or may occupy the receptor site on the receiving neuron, thus blocking the neurotransmitter from binding.

### 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.

### 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.

### Studying the Brain (cont.)
- **EEG (electroencephalogram)**: amplified recording of brain wave activity.
- **CT (computerized tomography) scan**: X-ray photo (or CAT) scans show structures within the brain.
- **PET (positron emission tomography)**: visual display detects where a radioactive form of glucose is being used while 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 oxygen is used while various tasks are being performed.

### Structure and Function of the Brain
- **Brainstem**: Oldest area of the brain. Also called thalamus.
  1. Medulla: the base of the brainstem; controls heart and respiration.
  2. Reticular Formation: A neural network within
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.
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; coordinate voluntary movement and balance.
The Limbic System: A doughnut-shaped structure between the brain 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 memories.
2. Hippocampus: Involved in memory
3. Hypothalamus: Involved in eating, drinking, and sexual behavior. It 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 control movement of the right 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 the handouts.

Hypothalamus: Controls pituitary gland
Pituitary: Secretes growth hormone and many other hormones that activate glands.
Thyroid: Affects metabolism
Parathyroids: Regulate calcium levels in the blood
Adrenal Glands: Secrete the hormones epinephrine and norepinephrine to trigger the "fight or flight" response.
Pancreas: Regulates glucose levels in the blood through the release of insulin.
Ovaries and Testes: Secrete female and male sex hormones.