

Unit 2: Biological Bases of Behavior

Topic 2.1 – Interaction of Heredity and Environment

1. Define heredity. **The passing on of different physical and mental traits from one generation to another**
2. Describe the role Charles Darwin has in the area of heredity and environment?
Created the theory of evolution which stated that evolution happens by natural selection. Traits that would help with a species survival would be passed on while undesirable traits would die off
3. What is heritability? **A mathematical measure to estimate how much variation there is in a population related to genes. It shows how much of a trait is genetics and how much is from the environment**
4. Explain the difference between nature and nurture. **Nature is genetics, biology, heredity that shapes us as individuals. While Nurture is our environment, how we are raised and what we surround ourselves with**
5. Which psychological perspectives learn towards the nature side of the debate?
Biological, Cognitive, Evolutionary
6. Which psychological perspectives learn towards the nurture side of the debate?
Psychodynamic, Behaviorism, Sociocultural
7. What is the difference between epigenetics and brain plasticity? **Epigenetics is the study of how the environment and a person's behavior affect a person's genes and how they work. Brain plasticity is changes that happen with the structure of the brain on a cellular level, in response to what is happening in the environment**

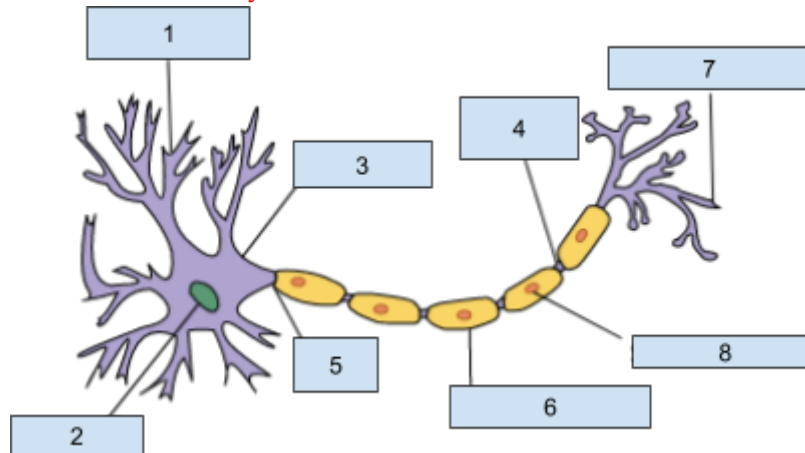
Topic 2.2- The Endocrine System

1. What is the difference between the nervous system and endocrine system? **The nervous system uses neurons to send and deliver messages to localized areas of the body, it uses fast, short-lived messages. The endocrine system uses glands to create hormones, these messages are slower moving and target larger broad areas of the body**
2. Explain what homeostasis is. **This is the body's ability to maintain internal stability. Example: Body temperature will stay around 98 degrees fahrenheit**
3. Explain the role of the hypothalamus in the endocrine system. **Directs different autonomic functions of the body and directs the pituitary gland**
4. Complete the table below.

Gland	Location/Function	Hormones
Pituitary Gland	Located at the base of your brain. It connects the nervous system and endocrine system. Also helps regulate all other glands in the body, in response to the hypothalamus	Growth hormones, oxytocin, and vasopressin
Pineal Gland	Above the brainstem in the middle of the brain. Helps regulate sleep cycles	Melatonin
Thyroid & Parathyroid gland	Located in the throat. Regulates the metabolism, growth, nervous system, Helps control calcium and phosphate levels in blood	Thyroid hormones, parathyroid hormones, and calcitonin
Adrenal glands	Above your kidneys. Helps regulate salt, blood pressure, and oxygen intake	Norepinephrine, epinephrine, glucocorticoids, and Mineralocorticoids (aldosterone)
Pancreas	By the stomach. Regulates sugar levels	Insulin and glucagon
Gonads	Ovaries or testes. Reproduction	Testosterone, estrogen, progesterone

Topic 2.3- Overview of the Nervous System and the Neuron

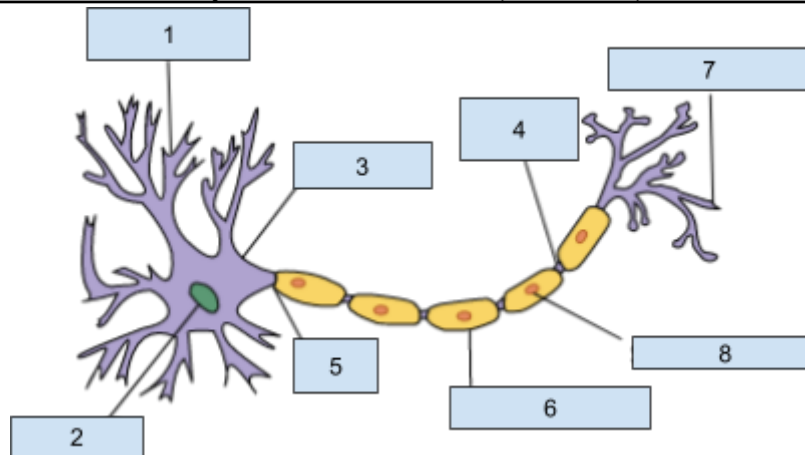
1. What is the difference between the central and peripheral nervous system? **The CNS is made up of the brain and spinal cord, it sends out orders to the body. The PNS consists of the different nerves that branch off from the brain and spine**
2. Describe the different parts of the peripheral nervous system. (Sensory & Motor) **The sensory division is made of afferent neurons that pick up sensory information from outside stimuli and send impulses to the brain about that information. The motor division uses efferent neurons to send impulses from the brain to the muscles and glands of the body to tell them to move**
3. How do afferent neurons differ from efferent neurons? **Afferent neurons are sending impulses to the brain from the body and outside stimuli, while efferent neurons send impulses from the brain to the rest of the body to control movement and more**
4. Explain the difference between the somatic nervous system and autonomic nervous system. **The somatic nervous system includes voluntary movements in your skeletal muscles and five senses. The autonomic nervous system controls involuntary actions, this is what keeps you breathing and digesting food**
5. Identify the two divisions of the autonomic nervous system. **Sympathetic division & parasympathetic division**
6. What is the function of the two different autonomic nervous systems? **The sympathetic division mobilizes your body, it makes your heart beat faster, your eyes dilate, and your breathing increases. The parasympathetic division relaxes your body, it slows your heart rate, increases your digestion, and focuses on saving and storing energy**
7. What is a glial cell? **A cell that provides support to the nervous system, providing neurons with nutrients. They are the most abundant cell in the nervous system**



8. Complete the table below.

Part of the Neuron	Name	Function
1	Dendrites	Extensions of the cell body that receive chemical information from adjacent neurons through receptor sites
2	Nucleus	Contains genetic material including information for cell development and other structures that allow the neuron to function
3	Soma	This is the cell body that contains the nucleus and most organelles
4	Nodes of Ranvier	Gaps in the myelin sheath where the axon is exposed, which helps promote the continuing action potential

Topic 2.3- Overview of the Nervous System and the Neuron (Continued)



8. Complete the table below. (Continued)

Part of the Neuron	Name	Function
5	Axon	The longest part of a neuron, it carries information away from the soma to other cells
6	Myelin Sheath	Insulating layer that increases how fast the action potential travels down the axon and protects the axon from damages
7	Axon Terminal or Terminal Button	This is at the end of the axon where neurotransmitters are released into the synapse
8	Schwann Cells	Helps produce the myelin sheath

Topic 2.4- Neural Firing

1. What is action potential? **This is when a neuron fires an electrical impulse down the axon**
2. What must happen for an action potential to occur? **An outside stimulus must cause a neuron to cross a specific threshold (typically 55 -55mV), this causes the neuron to depolarize as positive ions enter the neuron which causes an electrical signal to be sent down the axon**
3. What does permeability mean? **This is the ability for some ions to cross the membrane more easily than others**
4. Complete the table below.

Term	Description
Resting Neuron	When there is more positive ions outside the membrane of the neuron, here the neuron is polarized and will not send a signal (-70mV)
Depolarization	When the strong negative charge of the inside of the cell has enough positive ions enter so that the charge changes from around -70mV to at least -55mV. This will trigger the neuron to fire an action potential
Repolarization	The process in which the neuron goes back to its resting potential, channels will open up letting more positive ions outside of the cell membrane
Refractory period	A time when the neuron can not fire, the neuron is waiting for repolarization to occur. This prevents signals being sent in both directions down the axon

Topic 2.4- Neural Firing (Continued)

5. Describe the synapse. A small pocket of space between the axon terminal of one neuron and the dendrite of the next neuron, less than 1 millionth of an inch
6. What is the difference between an electrical synapse and chemical synapse? Electrical synapses are used for messages that need to be sent quickly and immediately, one neuron is typically connected to another. Chemical synapses use neurotransmitters to deliver messages across a synaptic gap, which takes more time than an electrical synapse
7. What is a neurotransmitter? A chemical messenger sent by a neuron, normally categorized as excitatory or inhibitory
8. Define the synaptic gap. A narrow space between two neurons, specifically the presynaptic terminal of one neuron and the postsynaptic terminal of the next neuron
9. Describe the difference between the presynaptic terminal and postsynaptic terminal. The ends of neurons that are connected by a synapse. The presynaptic terminal bud contains neurotransmitters to be released. The postsynaptic receives the neurotransmitters from the synapse
10. What does reuptake mean? This is when the sending neuron at the presynaptic terminal, reabsorbs neurotransmitters from the synapse
11. Explain how an excitatory neurotransmitter and inhibitory neurotransmitter impact a neuron. Excitatory neurotransmitters will increase the likelihood that a neuron will fire an action potential, while inhibitory neurotransmitters will decrease the likelihood that a neuron will fire an action potential
12. What is hyperpolarization? This is when the inside of a neuron becomes more negative which moves it farther away from its threshold or intensity needed for an action potential
13. Complete the table below.

Type of Neurotransmitter	Description
Acetylcholine	Enables muscle action, learning, and memory
Dopamine	Helps with movement, learning ,attention, emotions, known also as a natural drug because of how it impacts your feelings & emotions
Serotonin	Impacts hunger, sleep, arousal, and mood
Endorphins	Helps with pain control
Epinephrine	Same chemical as adrenaline, helps the body respond to high emotional situations by increasing blood pressure, heart rate, and alertness & helps form memories
Norepinephrine	Increases blood pressure, heart rate, and alertness
Glutamate	Involved with excitatory messages, helps with long term memory and learning
GABA	Helps with sleep and movement, this slows down your nervous system

Topic 2.5- Influence of Drugs on Neural Firing

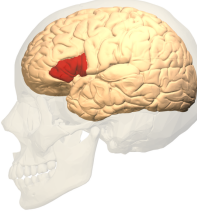

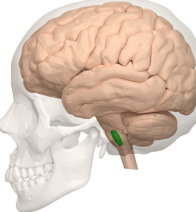
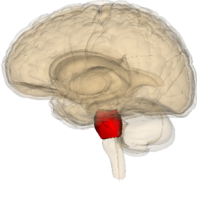
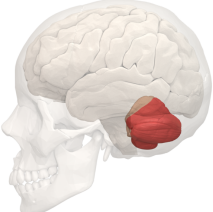

1. Describe the difference between agonists and antagonists drugs. Agonist drugs will increase the effects of a certain neurotransmitter, while antagonist drugs will minimize the effects of a neurotransmitter or stop them completely
2. Explain how agonist drugs impact receptors in the synapse. Agonist drugs work by either binding to receptors that are made for a certain neurotransmitter so that the body will act as though there are more of that neurotransmitter or will block the normal reuptake so that there are more of that neurotransmitter that will stay in the synapse available to be used
3. Explain how antagonist drugs impact receptors in the synapse. Antagonist drugs will either block the receptors on the postsynaptic neuron so that the neurotransmitters are not able to bind to them or will block the release of the neurotransmitter from the presynaptic axon terminal

Topic 2.5- Influence of Drugs on Neural Firing (Continued)

4. Describe the difference between agonists and antagonists drugs. **Agonist drugs will increase the effects of a certain neurotransmitter, while antagonist drugs will minimize the effects of a neurotransmitter or stop them completely**
5. Explain how agonist drugs impact receptors in the synapse. **Agonist drugs work by either binding to receptors that are made for a certain neurotransmitter so that the body will act as though there are more of that neurotransmitter or will block the normal reuptake so that there are more of that neurotransmitter that will stay in the synapse available to be used**
6. Explain how antagonist drugs impact receptors in the synapse. **Antagonist drugs will either block the receptors on the postsynaptic neuron so that the neurotransmitters are not able to bind to them or will block the release of the neurotransmitter from the presynaptic axon terminal**
7. Identify an example of an agonist substance and describe its impact on the body. **Examples include; 1) Anti-anxiety medications such as Xanax, which increases the neurotransmitter GABA, which calms the person down. 2) Prozac, which delays the reuptake of the neurotransmitter serotonin, making it more available and helping elevate or stabilize the person's mood. 3) Opioids, which act like the neurotransmitter endorphins, which will help relieve pain and boost happiness. 4) Alcohol, which will bind to GABA receptors, which is why a person can get tired/relaxed from drinking**
8. Identify an example of an antagonist substance and describe its impact on the body. **Examples include; 1) Schizophrenia medication, which blocks the receptors for dopamine because the person is thought to have an excess amount and will reduce their symptoms. 2) Alcohol, which will block the release of glutamate, which slows down the body's neural activity, such as slurred speech.**

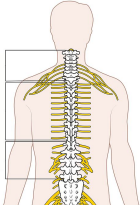

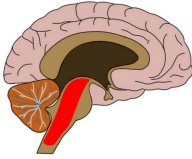
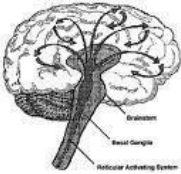

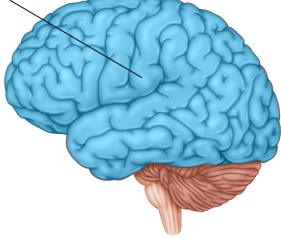

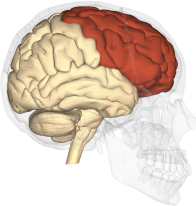

Topic 2.6- The Brain

1. Complete the table below.

 <p>Brain Structure: Broca's Area</p>	 <p>Brain Structure: Wernicke's area</p>	 <p>Brain Structure: Medulla Oblongata</p>
<p>Description: Responsible for controlling the muscles needed to speak. (Located in the Frontal lobe)</p>	<p>Description: Responsible for the ability to comprehend speech and create meaningful speech. (Located in the Temporal Lobe)</p>	<p>Description: Controls breathing, heart rate, and blood pressure.</p>
 <p>Brain Structure: Pons</p>	 <p>Brain Structure: Cerebellum</p>	 <p>Brain Structure: Brainstem</p>
<p>Description: Works with cerebellum to coordinate movement and helps coordinate sleep.</p>	<p>Description: Enables smooth muscle movements, maintains equilibrium.</p>	<p>Description: Contains the midbrain, pons, and medulla. Controls basic autonomic functions (breathing, heart rate, digestion, salivation)</p>

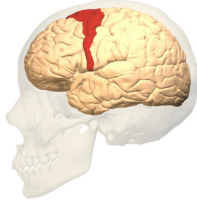
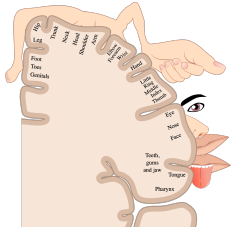
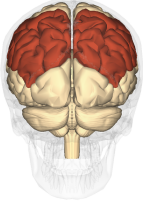
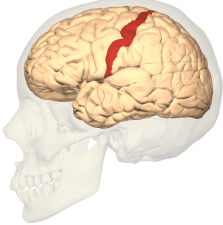

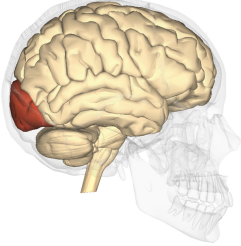
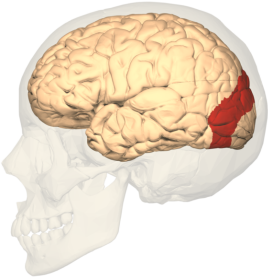
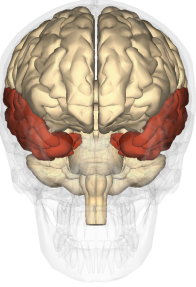
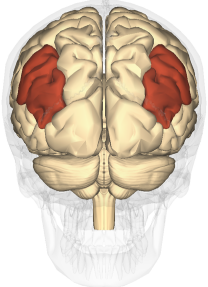
Topic 2.6- The Brain (Continued)

1. Complete the table below. (Continued)

 <p>Structure: Spinal Cord</p>	 <p>Brain Structure: MidBrain</p>	 <p>Brain Structure: Reticular Formation</p>
<p>Description: Track of nerve fibers that connects the brain to the rest of the body</p>	<p>Description: Part of the brainstem that relays information for the visual and auditory systems, and has motor and sensory tracts that go through it. Also contains the reticular formation and RAS</p>	<p>Description: A collection of nerve fibers that tunnel through the brainstem that are involved with alertness and arousal.</p>
 <p>Brain Structure: Reticular Activating System (RAS)</p>	 <p>Brain Structure: Cerebrum</p>	 <p>Brain Structure: Cerebral Cortex</p>
<p>Description: The part of the reticular formation that is specifically for arousal/alertness/sleep-wake cycles</p>	<p>Description: A general term to describe the brain, not including the brainstem and cerebellum</p>	<p>Description: A thin layer of gray matter that covers the entire brain</p>
 <p>Brain Structure: Corpus Callosum</p>	 <p>Brain Structure: Frontal Lobe</p>	 <p>Brain Structure: Prefrontal Cortex</p>
<p>Description: A tract of nerve fibers that runs longitudinally down the center of the brain and connects the two hemispheres</p>	<p>Description: One of the four lobes of the brain, involved in higher level thinking and motor functions</p>	<p>Description: Front part of the cerebral cortex where planning, emotional expression, & complex thought occurs(Location: frontal lobe)</p>

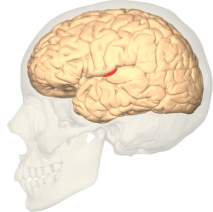
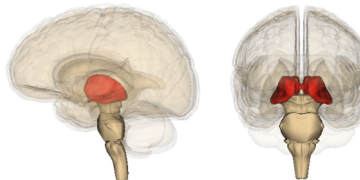
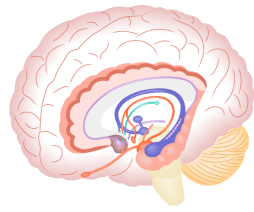
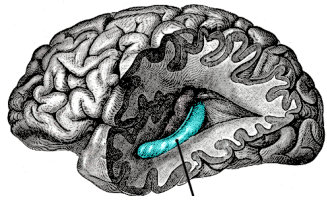
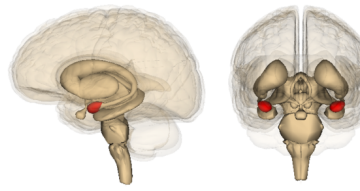
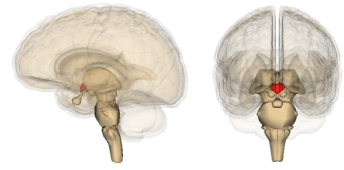
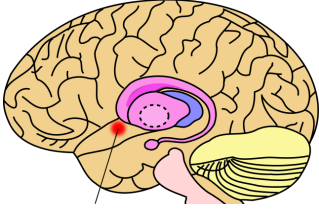
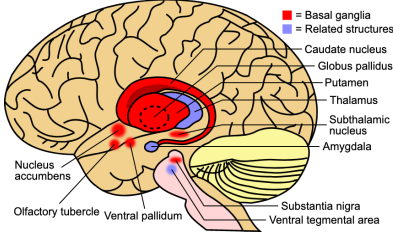
Topic 2.6- The Brain (Continued)

1. Complete the table below. (Continued)

 <p>Brain Structure: Motor Cortex</p>	 <p>Motor Homunculus</p>	 <p>Brain Structure: Parietal Lobe</p>
<p>Description: The part of the cortex that allows control of voluntary movement. (Located in the frontal lobe)</p>	<p>Description: A visual representation that shows how much brain area is devoted to the movement of each body part, showing how complex the movements are</p>	<p>Description: One of the four lobes of the brain, involved in processing sensory stimuli</p>
 <p>Brain Structure: Somatosensory Cortex</p>	 <p>Sensory Homunculus</p>	 <p>Brain Structure: Occipital Lobe</p>
<p>Description: Part of the cortex that processes touch sensations. (Located in the Parietal lobe)</p>	<p>Description: A visual representation that shows how much brain area is devoted to the sensations of each body part, showing how sensitive to stimuli they are</p>	<p>Description: One of the four main lobes, contains areas that process visual information</p>
 <p>Brain Structure: Visual Cortex</p>	 <p>Brain Structure: Temporal Lobe</p>	 <p>Brain Structure: Angular Gyrus</p>
<p>Description: The part of the cortex that processes the visual information and sends it to be further processed in other visual areas. (Located in the Occipital lobe)</p>	<p>Description: One of the four lobes of the brain, primarily processes auditory information, also is important in memory formation</p>	<p>Description: An area of the brain involved in reading and writing. (Located at the lower part of the Parietal lobe)</p>

Topic 2.6- The Brain (Continued)

1. Complete the table below. (Continued)

 <p>Brain Structure: Auditory Cortex</p>	 <p>Brain Structure: Thalamus</p>	 <p>Brain Structure: Limbic System</p>
<p>Description: The part of the cortex that processes auditory information. (Located in the Temporal lobe)</p>	<p>Description: A structure on the top of the brain stem serves as a relay station for impulses from the body to areas of the cerebral cortex</p>	<p>Description: A group of brain structures that are involved in emotion, learning, memory, and some basic drives</p>
 <p>Brain Structure: Hippocampus</p>	 <p>Brain Structure: Amygdala</p>	 <p>Brain Structure: Hypothalamus</p>
<p>Description: A structure that is involved in the creation of memories and learning. (Located in the temporal lobe, and part of the Limbic system)</p>	<p>Description: A structure that is important for emotion, threat/fear perception, and memory. Located in the Temporal lobe and part of the Limbic system)</p>	<p>Description: A structure that controls the autonomic functions of the body and works with the pituitary gland to control hormones</p>
 <p>Brain Structure: Nucleus Accumbens</p>	 <p>Brain Structure: Basal Ganglia</p>	
<p>Description: A structure that mainly functions in the pleasure/reward circuit and reinforcing behaviors</p>	<p>Description: A structure that is involved with voluntary movement</p>	

Topic 2.6- The Brain (Continued)

2. What are the three major regions of the brain and their locations? 1) Hindbrain, located at the bottom of the brain 2) Midbrain up from the base of the brain and is surrounded by the forebrain 3) Forebrain is the top of the brain and is what most people visualize about the brain
3. Explain what brain lateralization is. This is the differing functions between the right and left hemispheres of the brain
4. Describe what roles the left and right brain are better at due to hemispheric specialization. An individual is not right or left brained. The left hemisphere is generally better at recognizing words, letters, interpreting language, and the right hemisphere is generally better at spatial concepts, facial recognition, and discerning direction

Topic 2.7- Tools for Examining Brain Structures and Function

1. Explain what happened to Phineas Gage. He was a railroad worker who was injured by an explosion where a rod shot clean through his head. He was able to walk and suffered no cognitive defects, but had a severe personality change. This was because his limbic system was severed and his frontal lobe was damaged
2. What are Roger Sperry and Michael Gazzaniga known for? Split-brain research
3. Why would someone have a split brain procedure done? To treat severe epilepsy
4. Describe what happens to an individual when the corpus callosum is cut. The right and left hemisphere can no longer communicate. There is no loss of intelligence or change in a person's personality
5. What happened to a split-brain patient when shown a word in their right visual field? The patient would be able to say the word, because the word would be processed by the left hemisphere of the brain, which processes language
6. Explain when lesion studies would be used. This is when doctors or researchers will destroy specific parts of the brain, with the goal of treating a disorder, or gaining insight into different functions of the brain because they can isolate a specific area at a time to research
7. Identify two benefits to performing an autopsy on an individual's brain. 1) Helps understand the extent of a disease 2) Provides information for an individual's next of kin 3) Helps understand cause of death
8. Complete the table below.

Neuroimaging technique	Description
Electroencephalogram (EEG)	Electrodes are placed on an individual's scalp. This allows researchers to record electrical signals from neurons firing, which can be used for sleep and seizure research
Computed tomography (CT)	A series of advanced x-rays of the brain. Used to locate brain damage, tumors, and more.
Positron emission tomography (PET scan)	Involves injecting a small amount of radioactive glucose into an individual and then tracking the usage of glucose in specific regions of the brain.
Magnetic resonance imaging (MRI)	Provides a detailed picture of the brain by using a strong magnetic field to cause molecules to vibrate at different frequencies
Functional magnetic resonance imaging (fMRI)	Scan is similar to an MRI, but fMRI scans show the MRI images in real time while the brain is active.

Topic 2.8- The Adaptable Brain

1. What is neuroplasticity? The ability for the brain to change, modify itself, or repair itself
2. Identify three ways in which the brain can be damaged. 1) Tumors 2) Infections 3) A Stroke 4) Neurotoxins 5) Genetic factors 6) Head injuries
3. What happens when you learn new information or practice old skills? The brain creates neural pathways and the more you practice a skill or study information the more developed the path becomes
4. What is an individual's consciousness? When an individual is awake and aware of their external stimuli and their own mental activity

Topic 2.8- The Adaptable Brain (Continued)

5. Explain how Sigmund Freud and William James viewed consciousness. James argued our consciousness was a stream, that you could not break into parts. Freud believed that our consciousness was made up of the conscious mind, subconscious mind, and unconscious mind

6. Complete the table below.

Psychoactive Drugs	Description
Psychoactive	Substances that are used to purposefully alter an individual's perceptions, consciousness, or mood
Depressants	Drugs that cause drowsiness, muscle relaxation, lowered breathing, or possibly slurred speech
Opioids	Function as a depressant, but are addictive in nature. Give an individual pain relief (Example: Morphine, heroin, or oxycodone)
Stimulants	Drugs that excite and promote neural activity. (Example: caffeine, nicotine, or cocaine)
Hallucinogens	Drugs that cause an individual to sense things that are not there. (Example: Marijuana, peyote, or LSD)

Topic 2.9- Sleep and Dreaming

1. What is the circadian rhythm? The body's biological clock, that involves changing blood pressure, internal temperature, hormones, and regulates the sleep-wake cycle. (repeats every 24 hours)

2. Complete the table below.

Why Do We Sleep?	
Restoration Theory	We get tired from daily activities and we sleep to restore our energy and resources
Adaptive Theory	Sleep allows us to conserve energy so we can save it for when we will need it most. Focuses on the evolutionary aspects of sleep and how it protects us
Information processing theory	Focuses on how sleep allows us to restore and build memories

3. What type of neuroimaging technique can be used to visualize the sleep cycle? EEG

4. Describe the difference between alpha waves and beta waves. Alpha waves are high in amplitude and slower, these occur when you are feeling relaxed. Beta waves are low in amplitude and are the fastest brain waves, they occur when you are engaged in mental activities

5. Describe the difference between theta waves and delta waves. Theta waves are greater in amplitude compared to beta/alpha waves and even slower in frequency, they are strong during meditation, and periods of relaxation. Delta waves have the greatest amplitude and slowest frequency, and occur when you are the most relaxed, oftentimes during your deepest levels of sleep

6. Complete the table below.

Stages of Sleep	Description	Brain Waves
NREM Stage 1	Very light sleep that only lasts between 5-10 minutes. Here your body will start to relax and your mind starts to slow	Alpha waves
NREM Stage 2	Transitional stage. Normally it only lasts 10-20 minutes. Characterized by k-complexes and sleep spindles	Theta waves

Topic 2.9- Sleep and Dreaming (Continued)

6. Complete the table below. (Continued)

Stages of Sleep	Description	Brain Waves
NREM Stage 3	Deepest state of sleep. Normally it lasts around 30 minutes. Here growth hormones are produced and individuals may experience sleepwalking or sleep talking	Delta Waves
REM	External muscles are paralyzed, internal muscles and structures become active. Normally it lasts for 10 minutes. Here individuals experience dreams and brain activity is similar to when the person is awake.	Beta Waves

7. What are hypnagogic sensations and what stage of sleep would they occur? Sensations that you imagine feel real. For example feeling that you are falling. This happens in NREM stage 1

8. Complete the table below.

Dream Theory	Description
Activation-synthesis model	Dreams are our brain trying to make sense of random neural activity that is happening
Cognitive development theory	Dreams are a reflection of our cognitive development, so dreams are more simple for children then they are for adults
Activation theory	Specific areas are activated and depending on which area of the brain is active, your dreams will have different content
Physiological function	Dreams stimulate our neural pathways and allow them to be preserved and grow

9. Complete the table below.

Sleep Disorder	Description
Insomnia	When an individual has trouble falling asleep or staying asleep. This could be caused due to stress, pain, medication, or an irregular sleep schedule
Sleep apnea	When an individual struggles with their breathing while sleeping. This prevents an individual from being able to go into REM
Sleep terrors/ Night terrors	When an individual will experience intense fear while sleeping. Causing an individual to have sleep deprivation and a disrupted sleep schedule
Narcolepsy	Individuals may struggle to go asleep at night but uncontrollably fall asleep during the day. (Very rare)