

## BIOLOGICAL BASIS OF BEHAVIOR

### CRUCIAL VOCABULARY

- Autonomic nervous system
- Parasympathetic nervous system
- Peripheral nervous system
- Somatic nervous system
- Sympathetic nervous system
- Broca's area
- Arachnoid matter
- Neuroplasticity
- Reflex arc
- Ablation
- Wernicke's area
- Reticular formation

### ESSENTIAL QUESTIONS

1. How can biology influence our behavior and mental processes?
2. What happens when a particular neurotransmitter is absent from the body?
3. How do biological and environmental factors interact to influence our behaviors and mental processes?

The structure of the human biological systems, and their functions, influence not only our mental processes, but our behavior as well. Heredity, environment, and our consciousness also play an important role. The questions above are the three that encompass the primary learning targets for the entire unit. Take time to reason through each. Imagine opening your free-response question (FRQ) and finding one of these questions before you. How would you go about answering it?

### THIS UNIT ENCOMPASSES

(8–10% AP® Exam Weighting)

- Interaction of Heredity and Environment
- Endocrine System
- Nervous System and Neuron
- Neural Firing
- Influences of Drugs on Neural Firing
- The Brain
- Tools for examining Brain Structure and Functions
- The Adaptive Brain
- Sleep and Dreaming

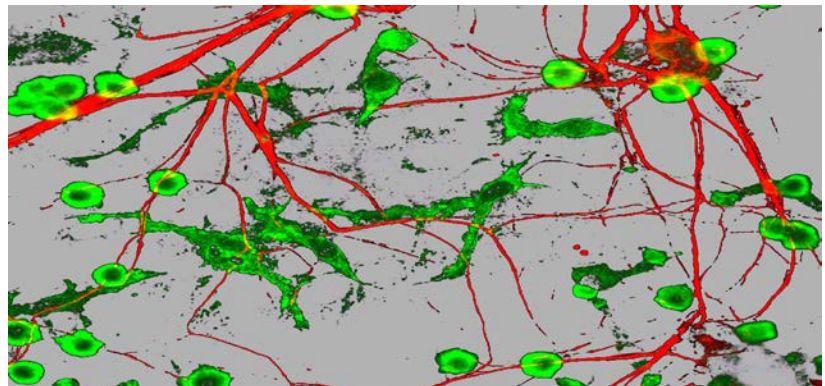


Image credit: Gerry Shaw

### INTERACTION OF HEREDITY AND ENVIRONMENT

There are three main learning targets for this topic. Be prepared to explain why the field of psychology had a long standing investigation into how **heredity, environment,** and evolution work simultaneously to shape behavior.

Also, you will need to be able to identify the key scientific researchers in the areas of heredity and environment, and how this research has benefitted our understanding of these two areas. **Charles Darwin** is viewed as the main contributing scientist in this area. This is where nature vs. nurture is incorporated into discussions as well. Did we inherit it, learn it, or a combination of both?

Review your materials so that you are prepared to explain how scientists predict how biological traits and behavior can be selected for their adaptive value. In other words, how do our human biological traits enable our survival? To demonstrate that you comprehend these concepts, in an FRQ question, you would need to explain a behavior in an authentic context, using appropriate examples. Demonstrating comprehension of the concept will be key.

## ENDOCRINE SYSTEM

The key to this section of this unit is to understand *the effect of the endocrine system on behavior*. Below is a starting point to refresh your memory. Consider how an alteration of each of these could impact mood and resulting behavior.

**Pineal:** Key to our circadian rhythms.

**Pituitary:** Controls behavior and growth.

**Parathyroid:** Maintains calcium; which impacts sleep, irritability, and memory decline.

**Thyroid:** Imbalance affects mood. Depression and/or anxiety is possible.

**Adrenal Gland:** Releases hormones related to stress and anxiety.

**Pancreas:** Controls digestion; blood sugar impacts mood.

**Ovary:** Reproductive cycle impacts mood and our reaction to it.

**Testes:** An abnormal level of testosterone can result in aggressive behavior.

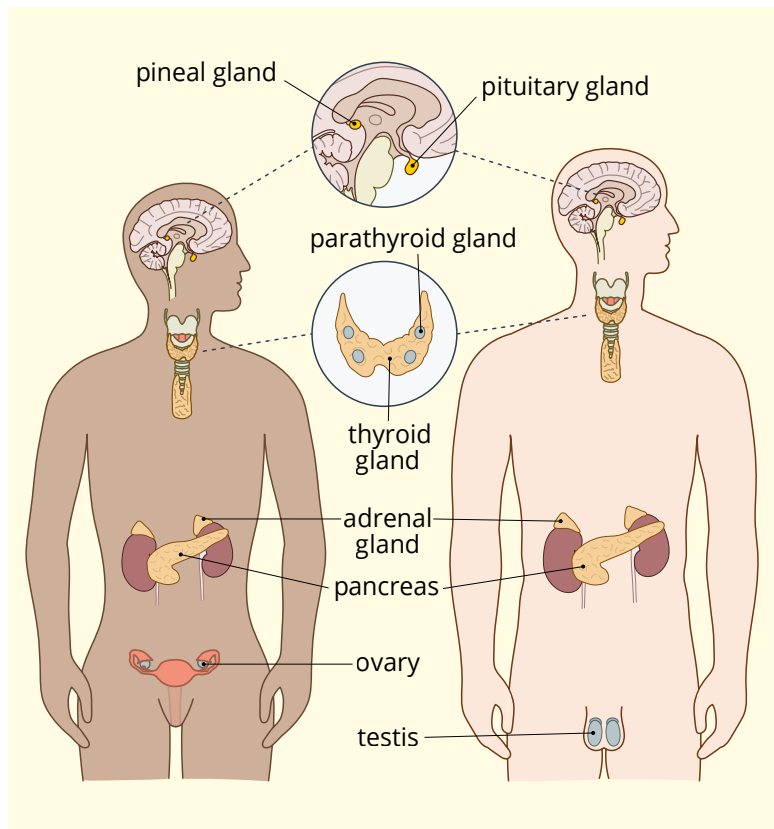
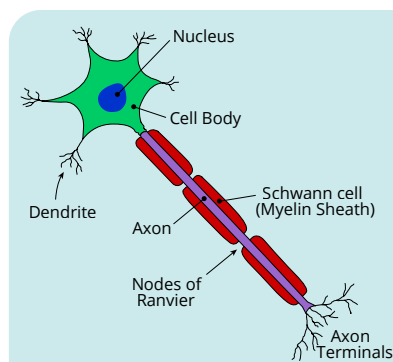


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## OVERVIEW OF THE NERVOUS SYSTEM AND THE NEURON

While there are two main learning targets in this section of the unit, they encompass a vast amount of information. The good news is that most of us have covered these topics in other coursework, such as Biology or Anatomy and Physiology.

First, be prepared to describe the nervous system, the subdivisions, and the functions of the components of each of these.

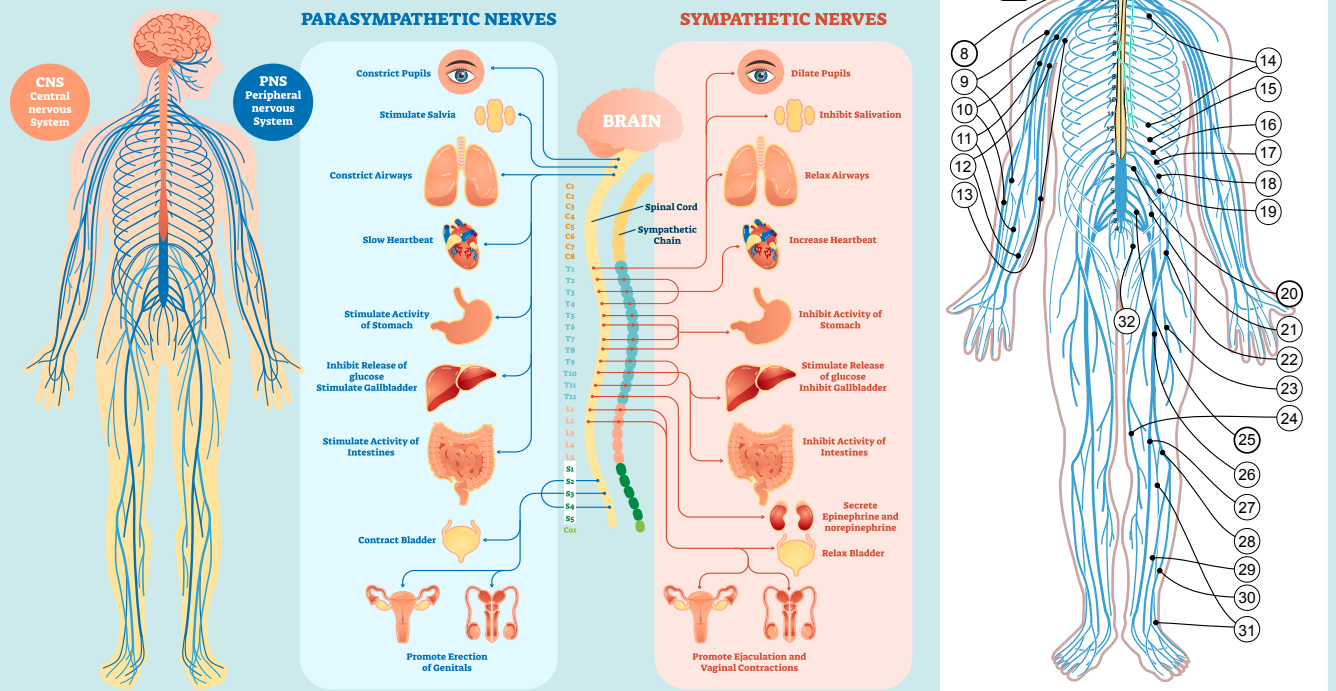
Next, identify the basic processes and interaction of systems that are the foundations of the *biological basis of behavior*. In other words, you know the “parts,” and the main purpose. How does that “part” *impact our behavior*, both when it is functioning properly, and otherwise? Although dysfunction will be delved into more intensively in later units, it is still an important aspect to recognize here. This can be key if the free-response question (FRQ) requires you to explain the biological reason that a behavior, or disorder, could be occurring.

*Continued on next page...*

## NEURAL FIRING

Be able to explain the basic process of transmission of a signal within and between neurons. There are three phases of communication within a neuron. The first is **action potential**, the impulse when a neuron fires. There is a brief **refractory period** when the neuron is recharging, followed by the **resting potential**, when the recharged neuron is awaiting the next action potential to be generated. Review how sodium and potassium help alter the transmission.

One of the most effective ways to accomplish this is to accurately label a blank replica of the human nervous system, as well as a human nerve cell, and include the main purpose of each component. Make sure that you define the main component systems as well.



**IMPACT OF DRUGS ON NEURAL FIRING**

Drugs, of all origins, alter the way we feel, think and behave, primarily due to their disruption of neurotransmitters.

Dependence and addiction can lead to brain disorders as this neurotransmission can be accelerated or restricted. Review the typical methods utilized in this research (brain tissue analysis, live studies, brain scans, genetic studies, modified gene implantation).

**Neurotransmission** can be significantly impacted, often dramatically increasing or decreasing communication across cells. Studies focus on learning which neurotransmitter the drug affects, and how the drug alters that neurotransmission. Also, what are the long-term affects?

As an example, a study investigated how cocaine motivates intensified use and causes addiction. Conclusions were that there was an initial reward, then a transition to addiction, and craving, which often led to relapse. This study demonstrated that by altering neurotransmission, addictive drugs can produce the desire to use, more often, typically due to a disruption of dopamine.

Identify the major psychoactive drug categories, and the psychological and physiological effects.

**Drug categories:**

- Depressants
  - Alcohol
  - Barbiturates
  - Opiates

**Drug categories, cont'd.:**

- Stimulants
  - Caffeine
  - Nicotine
  - Cocaine
  - Amphetamines
  - Methamphetamines
  - Ecstasy
- Hallucinogens
  - LSD
  - Marijuana

Psychological and physiological effects vary for each category and which substance is consumed. The effects also vary by combining drugs, age of user, level of dependency, family health history, and genetic factors. A chart with this information compared and contrasted will help significantly.

### Brain Lateralization

<ul style="list-style-type: none"> <li>• Analytical thought</li> <li>• Detail-oriented perception</li> <li>• Ordered sequencing</li> <li>• Rational thought</li> <li>• Verbal</li> <li>• Cautious</li> <li>• Planning</li> <li>• Math/science</li> <li>• Logic</li> <li>• Right field vision</li> <li>• Right side motor skills</li> </ul>		<ul style="list-style-type: none"> <li>• Intuitive thought</li> <li>• Holistic perception</li> <li>• Random sequencing</li> <li>• Emotional thought</li> <li>• Non-verbal</li> <li>• Adventurous</li> <li>• Impulse</li> <li>• Creative writing/art</li> <li>• Imagination</li> <li>• Left field vision</li> <li>• Left side motor skills</li> </ul>
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**Study Hint**  
Practice an extra FRQ for every unit!

### THE ADAPTIVE BRAIN

#### Neuroplasticity

is our brain's ability to change and adapt through experience, and when following a traumatic brain injury.

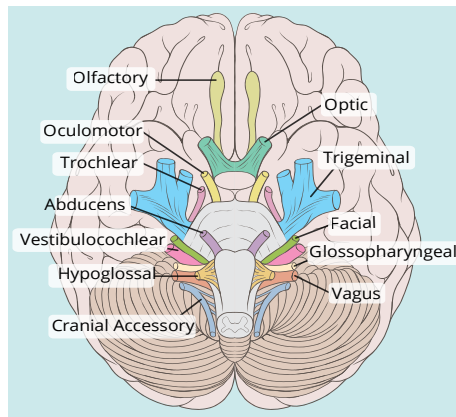


### THE BRAIN

The key to understanding this broad topic is to master the parts and functions of the brain. Approach this review with each part's location within the brain and its main function in a short, three to four word phrase. This is also an excellent time to quiz with peers pertaining to part and purpose. Crucial components covered within this unit include:

Amygdala	Corpus callosum	Limbic system
Brainstem	Dual processing	Medulla
Cerebellum	Frontal lobes	Motor cortex
Cerebral cortex	Glial cells	Parietal lobes
Cognitive neuroscience	Association areas	Reticular formation
Consciousness	Hypothalamus	Somatosensory cortex
Temporal lobes	Thalamus	Split-brain

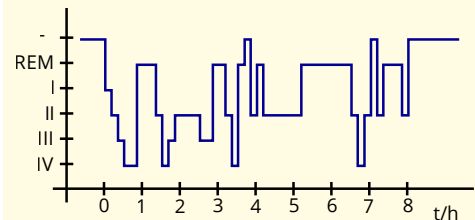
Exploring the above material will help you recall the major brain regions, lobes, cortical area, brain lateralization, and hemispheric specialization. This is a critical learning goal for this section.



Be prepared to identify the contributions of key researchers to the study of neuroplasticity, particularly Michael Gazzaniga.

You'll want to also focus on the various states of consciousness and their impact on behavior. Sleep cycles are key.

Study the cycle of sleep carefully. Many students mistakenly believe that REM sleep comes directly after deep NREM-3 sleep. It does not. Generally NREM-2 follows NREM-3, followed by REM. Review the graphed examples from your study materials, textbook, or online.



Two of the major contributors in the field of consciousness research were William James and Sigmund Freud. Review the point of view of each researcher.

**TOOLS FOR EXAMINING BRAIN STRUCTURE AND FUNCTIONS**

**Q:** What tools are used for examining the brain?

**A:** There are a variety of methods used to view and understand brain structures and functions. Review the benefits and purposes of each, particularly why one is chosen rather than another. Those most commonly utilized and included in the AP® Psychology curriculum are listed here. **Electroencephalography (EEG)** records electrical activity produced through neurons. **Functional magnetic resonance imaging (fMRI)** is a brain scan that uses a magnetic field to create images in each brain area. **Positron Emission Tomography (PET)** scans help us see the activity in the brain. **Magnetic Resonance Imaging (MRI)** creates visual images of the brain's soft tissue. **Computer Tomography (CT)** uses a variety of X-ray photos to create a brain image.



**Study Hint**  
Log into practice tests through study guides, and via AP® Classroom, which offers actual AP® College Board released tests previously administered! Marco Learning has indispensable resources!

**SLEEPING AND DREAMING**

There a variety of aspects in regards to sleep and dreaming that will be key as you review for the AP® Psychology Exam. Review the sleep cycle, along with the neural and behavioral characteristics that correspond to each.

Theories of sleep and dreaming, particularly those of William James, Ernest Hilgard, and Sigmund Freud, as well as symptoms and treatments of sleep disorders are encompassed within this topic section.

- Narcolepsy
- Sleep apnea
- Night terrors
- Insomnia
- Sleepwalking
- Sleepwalking

The AP® Exam could have you identify and differentiate between the sleep disorders. For example, what is the difference between a nightmare and a night terror?

Dream theories covered throughout this unit include:

- **Freud's wish fulfillment**
- **Information-processing**
- **Physiological function**
- **Activation-synthesis**
- **Cognitive development**

**REVIEW**

- How does sleep loss affect us?
- What are the major sleep disorders?
- Why do we dream?
- What functions have theorists proposed for dreams?
- How does Freud differentiate between manifest content and latent content?
- How could diversity influence what we dream?
- What are the benefits of dreaming based on research?
- What is REM rebound?
- What are the effects of sleep deprivation?

**Study Hint**  
Pair up with fellow classmates, in person or online to quiz one another on terminology, parts and functions, and evaluating one another's FRQ responses.