



BPS Science Department Anatomy and Physiology

Anatomy and Physiology – Unit 6 - The Nervous System (Chapter 8)

Overview: The nervous system is the major controlling, regulatory, and communicating system in the body. It is the center of all mental activity including thought, learning, and memory. Together with the endocrine system, the nervous system is responsible for regulating and maintaining homeostasis. Through its receptors, the nervous system keeps us in touch with our environment, both external and internal. Like other systems in the body, the nervous system is composed of organs, principally the brain, spinal cord, nerves, and ganglia. These, in turn, consist of various tissues, including nerve, blood, and connective tissue. Together these carry out the complex activities of the nervous system. The various activities of the nervous system can be grouped together as three general, overlapping functions which are sensory, integrative, and motor. The effect of the nervous system is of short duration, measured in seconds, and localized.

Essential Questions:

- How are the anatomy and physiology of the human nervous system related?
- How does the structure of a neuron aid in communication throughout the entire body?
- Why does communication depend upon passage of information from one neuron to another?
- Why is communication between the endocrine and nervous systems of humans crucial to homeostatic regulation?
- How do the central nervous system and the peripheral nervous system communicate?

NYSSLS Standards:

- **HS-LS1-1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.**
 - (DCI) **LS1.A: Structure and Function:** Systems of specialized cells within organisms help them perform the essential functions of life
 - (CCC) **Structure and Function:** Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.
 - (SEP) **Constructing Explanations and Designing Solutions:** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- **HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.**
 - (DCI) **LS1.A: Structure and Function:** Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.
 - (CCC) **Systems and System Models:** Models (e.g. physical, mathematical, computer models) can be used to simulate systems and interactions -- including energy, matter, and informational flows -- within and between systems at different scales.
 - (SEP) **Developing and Using Models:** Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. Use a model based on evidence to illustrate the relationships between systems or between components of a system.
- **HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis**
 - (DCI) **LS1.A: Structure and Function:** Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.
 - (CCC) **Stability and Change:** Feedback (negative or positive) can stabilize or destabilize a system.
 - (SEP) **Planning and Carrying Out Investigations:** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly



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3D Learning Overview: KNOW → <u>Disciplinary Core Ideas</u> (DCI): what students need to know UNDERSTAND → <u>Crosscutting Concepts</u> (CCC): what students look for/ applies across all science domains and <u>Science & Engineering Practices</u> (SEP): how students explore and apply		Crosscutting Concepts (CCC): <ul style="list-style-type: none"> ● Patterns ● Cause and Effect ● Scale, Proportion, and Quantity ● Systems and System Models ● Energy and matter ● Structure and function ● Stability and change 		Science and Engineering Practices (SEP): <ul style="list-style-type: none"> ● Asking questions (for science) and defining problems (for engineering) ● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data ● Using mathematics and computational thinking ● Constructing explanations (for science) and designing solutions (for engineering) ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information 	
Time Frame	Skills, Practices or Expectations	Textbook Resources	Online Resources	Vocabulary	Higher Order Questions
12.12.22 - 1.6.23 NOTE: 12.26.22-1.02.23 Winter Recess	Anatomy and Physiology: The students will be able to: <ul style="list-style-type: none"> ● Describe the anatomy and physiology of the human nervous system. ● Describe the anatomy and physiology of a neuron. ● Diagram a neuron including the cell body (soma), dendrites, axon, nucleus, myelin sheath, and axon terminal. ● Explain how information passes from one neuron to another neuron. ● Compare and contrast the three types of neurons based on function including sensory neurons, motor neurons, and interneurons. ● Compare and contrast the central nervous system and the peripheral nervous system. ● Compare and contrast the regions of the human brain including structure and function. ● Explain how an action potential occurs in the human body. ● Describe synaptic function and neurotransmitters including acetylcholine, norepinephrine, dopamine, and GABA. 	Chapter 8 8-1 Divisions of NS (p.247-248) <ul style="list-style-type: none"> ● Figure 8-1 Overview (p.248) 8-2 Neurons (p.248-254) <ul style="list-style-type: none"> ● Figure 8-2 Neuron Anatomy (p.249) ● Figure 8-4 Neuroglia (p.251) ● Figure 8-5 Schwann Cells (p.252) 8-3 Action Potentials (p.254-259) <ul style="list-style-type: none"> ● Figure 8-7 Resting Potential (p.255) ● Figure 8-8 Action Potential (p.257) 8-4 Synapse (p.259-262) <ul style="list-style-type: none"> ● Figure 8-10 Synapse Structure (p.259) ● Figure 8-11 Synapse Events (p.260) 8-5 Meninges (p.262-264) <ul style="list-style-type: none"> ● Figure 8-13 Meninges (p.263) 	Nervous System Gif Animation: The Brain (click start to view an MRI and labeled parts of a brain including meninges, lobes, corpus callosum and more) Make a Mad, Mad, Mad Neuron: Interactive to add and label parts of neuron The Brain: What's Inside Your Head (PBS Learning Media video) Cow Eye Dissection (video, step-by-step virtual, PDF of student lab guide) PBS Cow Eye Dissection videos Action Potential (PDF of notes and graph to label)	action potential central nervous system (CNS) peripheral nervous system (PNS) neurotransmitter gray matter/ white matter <u>Parts of Neuron:</u> soma/ cell body, dendrites, axon, myelin sheath, axon terminal, nodes of Ranvier, synapse <u>Types of Neurons:</u> sensory/ afferent, motor/ efferent, interneuron <u>Neurotransmitters:</u> acetylcholine, norepinephrine, dopamine, GABA (gamma aminobutyric acid), serotonin <u>Parts of CNS:</u> spinal cord, cerebrum, cerebellum, diencephalon, brainstem (midbrain, pons, medulla oblongata)	<ul style="list-style-type: none"> ● How do two or more systems work together to maintain homeostasis in Shingles? ● How does the aging process change the human nervous system? ● How does Parkinson's Disease affect homeostatic regulation of the human nervous system? ● Explain the physiological effects of narcolepsy on the interactions between the human nervous system and other body systems. ● How does the "message" to move travel from the brain to a particular muscle?



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	<ul style="list-style-type: none"> Compare and contrast gray and white matter in the central nervous system. Describe the functional relationships between the human nervous system and other human body systems. <p>Diseases/Disorders: The students will be able to:</p> <ul style="list-style-type: none"> Describe a disease or disorder of the human nervous system including symptoms, diagnosis, medications, prevention, and treatment. Diagnose a human nervous system disease/disorder given a data set of symptoms. Explain homeostasis in the human nervous system through negative and positive feedback mechanisms. Predict prevention and treatment of a human nervous system disorder based on a given data set. 	<p>8-7 The Brain (p.267-278)</p> <ul style="list-style-type: none"> Figure 8-16 The Brain (p.268) Figure 8-19 Lobes (p.271) Figure 8-20 Lateralization (p.272) Figure 8-24 Brain Stem (p.277) <p>8-8 PNS (p.278-283)</p> <ul style="list-style-type: none"> Figure 8-26 Peripheral Nerves (p.282) <p>8-9 Reflexes (p.283-286)</p> <ul style="list-style-type: none"> Figure 8-28 Reflex Arc (p.285) <p>8-11 Autonomic Nervous System (p.289-293)</p> <ul style="list-style-type: none"> Figure 8-34 Sympathetic (p.292) Figure 8-35 Parasympathetic (p.294) Table 8-5 Sympathetic and Parasympathetic (p.295) <p>8-12 Aging (p.295-296)</p> <p>Chapter 8 Review Questions p.301-303</p> <p>Nervous System and Other Systems (p.304)</p>	<p>Patricia Bath*</p> <ul style="list-style-type: none"> Biography: Dr. Patricia Bath discovered and invented a new device and technique for cataract surgery. Learn about the inequalities and discrimination she faced during her career and how she overcame those obstacles. <p>Z Space Activities: (code)</p> <p>Human Anatomy - Nervous System (A051) investigate structures and functions of the nervous system Teacher Resource pdf Student Resource pdf</p> <p>Human Anatomy - The Brain (A284) investigate the parts and functions of the human brain Teacher Resource pdf Student Resource pdf</p> <p>Exploring Anatomy - Nervous System (E455) learn the major structures of nervous system and how the two divisions work together to provide reflexes Teacher Resources pdf Student Resource pdf</p> <p>Chemical Impacts - Human Response (A046) learn how caffeine impacts physical and chemical responses in the body Teacher Resource pdf Student Resource pdf</p>	<p>homeostasis/ homeostatic regulation disease/ disorder symptoms negative feedback loop positive feedback loop</p>	
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Resources	<p>http://ngss.nsta.org/Classroom-Resources.aspx - Searchable NYSSL/NGSS aligned resources curated by NSTA</p> <p>Dissection Videos (these videos -- dissection of heart, liver, uterus and eye -- were created in collaboration with the Jacobs School of Medicine and Biomedical Sciences. All dissection videos have two separate segments - an introduction segment and a dissection segment. All segments have an accompanied student activity resource)</p> <p>Access via Schoology BPS Science K-12 Group Resources 9-12 Resources Anatomy & Physiology Dissection Videos</p> <p>Virtual Frog Dissection (step by step virtual dissection)</p> <p>PBS Learning Media Dissection Videos and Resources (Sheep Heart, Cow Eye, Frog)</p> <p>Virtual Fetal Pig Dissection (from Whitman College)</p> <p>Cow Eye Dissection (video, step-by-step virtual dissection, PDF of student lab guide)</p> <p>NYSED Bilingual Glossaries – NYS Statewide Language Regional Bilingual Education Resource for NYSED approved bilingual glossaries.</p>				
English Language Learners (ELL) Enhancements To access hyperlinked material, you must be logged into your BPS Google Drive	<p>Listening</p> <ul style="list-style-type: none"> ● Cross- Linguistic Practices: Gives students opportunities to make connections between what they hear and their home language (ex: allow students to listen to a passage and identify cognates.) ● Build background knowledge ● Activating Prior Knowledge Activating Prior Knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content ● Visuals - GIFs, pictures- assist students in understanding. Use visual thinking strategies to set learning lens ● Video to review/ introduce topics– use closed captioning to help students see the words and pronunciations while they listen ● Word stretching / Vowel stretching when instructing allows student to listen closely to the pronunciation of the word ● Performance Level Descriptors - description of expected output from 	<p>Speaking</p> <ul style="list-style-type: none"> ● Sentence Frames - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i> ● Academic Conversation Starters: Have a visual of a list of academic sentence starters that students can refer to in a discussion (helps students have a more science focused dialogue). Examples include- I expect ___ to happen. My data shows that... ● Choral Reading - To build fluency, self-confidence and motivation with reading/speaking ● Create movement to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning ● Performance Level Descriptors - description of expected output from students based on earned NYSESLAT levels in the modality 	<p>Reading</p> <ul style="list-style-type: none"> ● Supplementary Text to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension. ● Visual Aids - Pictures or models to support vocabulary words and concepts ● Video to review or introduce a topic - use closed captioning to help students read along while they listen to the content ● 4 Square / Frayer models to help students gain a deeper understanding of vocabulary. ● Highlighting important text to assist students in answering questions after the reading. ● Chunking-Break reading of text into chunks or paragraphs ● Performance Level Descriptors - description of expected output from students based on earned NYSESLAT levels in the modality of reading(Scroll for grades 9-12) ● Vocabulary Morphology- Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can 	<p>Writing</p> <ul style="list-style-type: none"> ● Sentence Frames - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is...</i> ● Cloze passages ● Word banks ● Graphic Organizers to help break down the writing process and organize thoughts ● Standards-based sentence stems ● Performance Level Descriptors - description of expected output from students based on earned NYSESLAT levels in the modality of writing(Scroll for grades 9-12) 	<p>Instructional Accommodations (depending on the student's needs)</p> <ul style="list-style-type: none"> ● Extended time for tests in class, projects and assignments ● Directions read. Broken down as necessary ● Model how to complete the activity in the lesson ● Oral simplification of directions or questions ● Translated version of test when available. Student may have both version English and native language version ● Use of approved bilingual glossaries from NYS in each subject



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	students based on earned NYSESLAT levels in the modality of listening (Scroll for grades 9-12)	of speaking(Scroll for grades 9-12)	be critical to expanding a student's vocabulary.		
Special Education Modifications Special Education students must have accommodations as per Individual Educational Plan (IEP)	Instructional <ul style="list-style-type: none"> ● Pre-teach vocabulary ● Use picture vocabulary ● Scaffold Depth of Knowledge questions ● Provide copy of notes/notes in “cloze” form ● Use of Think, Pair, and Share strategy to help process information ● Scaffold written assignments with the use of graphic organizers ● Allow for multiple ways to respond (verbal, written, response board) ● Provide model of performance task ● Modify informational text to fit the needs of the students ● Provide a digital or paper interactive notebook ● Present complex tasks in multiple ways ● Provide mnemonic strategies for Chemistry concepts 		Technology: <ul style="list-style-type: none"> ● Audio reading of text ● Text to type functions ● Videos to clarify/visualize Chemistry concepts ● Record class lecture/discussions and make accessible to student ● Nearpod- interactive presentations of notes ● Playposit - show a video clip about the topic and add your own questions for them to answer as they watch ● Allow students to type answers in chat on Teams Other: <ul style="list-style-type: none"> ● Arrange seating for maximum engagement and minimum distraction ● Accessible lab space (counter level) 		In Class Assessments <ul style="list-style-type: none"> ● Provide review packet or review sheet of concepts covered on the test ● Practice similar questions prior to the test ● Provide multiple options for projects ● Give a timeline of when things are due and remind them of the process often. ● Use of timer in class ● Break all complex tasks into chunks
Step Up to Writing Step Up to Writing materials can be found in BPS Science K-12 Schoology Folder 9-12 Resources Chemistry Resources Curriculum Materials	SUTW Strategy <ul style="list-style-type: none"> ● Informal Outline ● Color-Coding – Informative/Explanatory Text ● Two-column notes ● I-V-F Topic Sentence progressing to Four Step Summary Paragraph ● CUPS – Capitalization, Usage, Punctuation, Spelling ● Transitions 				
Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom	Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications <ul style="list-style-type: none"> ● Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population ● All students are given an opportunity to engage in science discourse ● Teacher demonstrates high expectations for all students CLRT resources which align to Science content are denoted with a *				