



BPS Science Department Anatomy and Physiology

Anatomy and Physiology – Unit 5 - The Muscular System (Chapter 7)

Overview: The muscular system is composed of specialized cells called muscle fibers whose predominant function is contractibility. Muscles, attached to bones or internal organs and blood vessels, are responsible for movement. Muscle contraction also fulfills some other important functions in the body, such as posture, joint stability, and heat production. Posture, such as sitting and standing, is maintained as a result of muscle contraction. The skeletal muscles are continually making fine adjustments that hold the body in stationary positions. The tendons of many muscles extend over joints and in this way contribute to joint stability. Heat production, to maintain body temperature, is an important by-product of muscle metabolism. Nearly 85 percent of the heat produced in the body is the result of muscle contraction. Disruption of homeostatic mechanisms leads to a diseased state of the human muscular system.

Essential Questions:

- How are the anatomy and physiology of the human muscular system related?
- How does skeletal muscle contraction aid in movement?
- How does the sliding filament theory explain muscle contraction?
- Why is communication between the muscular and nervous systems of humans crucial to homeostatic regulation?
- How is muscle fatigue related to ATP production?

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 | |
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| Time Frame | Skills, Practices or Expectations | Textbook Resources | Online Resources | Vocabulary | Higher Order Questions |
| 11.21.22 - 12.09.22 NOTE: 11.24.2022 – 11.25.2022 Thanksgiving Recess | Anatomy and Physiology: The students will be able to: <ul style="list-style-type: none"> ● Describe the anatomy and physiology of the human muscular system. ● Describe the anatomy and physiology of a skeletal muscle fiber. ● Diagram a skeletal muscle fiber (sarcolemma, sarcoplasmic reticulum, thick filaments, thin filaments, myofibrils, T-tubules, sarcomeres) ● Explain skeletal muscle contraction. ● -describe the sliding filament theory of muscle contraction. ● Identify the major muscles of the body. ● Explain the contraction cycle. ● Explain muscle fatigue. ● Describe the effects of aging on the human muscular system. ● Explain rigor mortis in the human ● Describe the functional relationships between the human muscular system and other human body systems. Diseases/Disorders: The students will be able to: | Chapter 7 7-1 Skeletal Muscle Functions (p.195) 7-3 Skeletal Muscle Fibers (p.197-200) <ul style="list-style-type: none"> ● Figure 7-2 Skeletal Muscle Fiber (p.198) ● Figure 7-3 Sarcomere (p.199) 7-4 Neuromuscular Junctions (p.200-203) <ul style="list-style-type: none"> ● Figure 7-4 Neuromuscular Junction (p.201) ● Figure 7-5 Contraction Cycle (p.202-203) ● Table 7-1 Summary of Skeletal Muscle Contraction (p.204) 7-6 ATP is Energy Source (p.208-210) 7-7 Muscle Fiber Types (p.211-212) | Michigan State Histology Slides: Muscle Tissue Chicken Wing Dissection Lab (PDF of student lab guide) | skeletal muscle actin/ myosin sliding filament theory muscle contraction acetylcholine (ACh) neurotransmitter ATP muscle fatigue lactic acid cross bridges myoglobin rigor mortis Skeletal Muscle Fiber: sarcomere, myofilaments (thin filaments/ actin, thick filaments/ myosin), sarcolemma, sarcoplasm, t tubules, myofibrils,, sarcoplasmic reticulum homeostasis/ homeostatic regulation disease/ disorder symptoms negative feedback loop | <ul style="list-style-type: none"> ● How do two or more systems work together to maintain homeostasis in Muscular Dystrophy? ● Why does the aging process change the human muscles? ● Explain why the time of a murder victim's death can be reasonably predicted by the flexibility or stiffness of the human body. ● Explain the physiological effects of exercise on the interactions between the human muscular, cardiovascular, nervous, respiratory, and endocrine systems. ● Why might a sprinter experience muscle fatigue before a marathon runner would?? |



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| | <ul style="list-style-type: none"> • Explain the effects of lack of exercise on the human muscular system. • Describe a disease or disorder of the human muscular system including symptoms, diagnosis, medications, prevention, and treatment. • Diagnose a human muscular system disease/disorder given a data set of symptoms. • Explain homeostasis in the human muscular system through negative and positive feedback mechanisms. • Predict prevention and treatment of a human muscular system disorder based on a given data set. | <p>7-9 Naming Skeletal Muscles (p.214-218)</p> <ul style="list-style-type: none"> • Figure 7-11 Major Skeletal Muscles (p.215-216) <p>7-12 Aging (p.235-236)</p> <p>7-13 Exercise (p.137-238)</p> <p>Chapter 7 Review (p.242-243)</p> <p>Muscular System and Other Systems (p.244)</p> | | <p>positive feedback loop</p> | |
| <p>Resources</p> | <p>http://ngss.nsta.org/Classroom-Resources.aspx - Searchable NYSSLS/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> | | | | |



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| <p>English Language Learners (ELL) Enhancements</p> <p>To access hyperlinked material, you must be logged into your BPS Google Drive</p> | <p><u>Listening</u></p> <ul style="list-style-type: none"> ● <u>Cross- Linguistic Practices:</u> 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.) ● <u>Build background knowledge</u> ● <u>Activating Prior Knowledge</u> means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content ● <u>Visuals</u> - 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 ● <u>Word stretching / Vowel stretching</u> when instructing allows student to listen closely to the pronunciation of the word ● <u>Performance Level Descriptors</u> - description of expected output from students based on earned NYSESLAT levels in the modality of listening (Scroll for grades 9-12) | <p><u>Speaking</u></p> <ul style="list-style-type: none"> ● <u>Sentence Frames</u> - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i> ● <u>Academic Conversation Starters:</u> 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... ● <u>Choral Reading</u> - To build fluency, self-confidence and motivation with reading/speaking ● Create <u>movement</u> 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 ● <u>Performance Level Descriptors</u> - description of expected output from students based on earned NYSESLAT levels in the modality of speaking(Scroll for grades 9-12) | <p><u>Reading</u></p> <ul style="list-style-type: none"> ● <u>Supplementary Text</u> to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension. ● <u>Visual Aids</u> - 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 ● <u>4 Square / Frayer models</u> to help students gain a deeper understanding of vocabulary. ● <u>Highlighting</u> important text to assist students in answering questions after the reading. ● <u>Chunking</u>-Break reading of text into chunks or paragraphs ● <u>Performance Level Descriptors</u> - description of expected output from students based on earned NYSESLAT levels in the modality of reading(Scroll for grades 9-12) ● <u>Vocabulary Morphology</u>- 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 be critical to expanding a student’s vocabulary. | <p><u>Writing</u></p> <ul style="list-style-type: none"> ● <u>Sentence Frames</u> - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is....</i> ● <u>Cloze passages</u> with word banks ● <u>Word banks</u> ● <u>Graphic Organizers</u> to help break down the writing process and organize thoughts ● <u>Standards-based sentence stems</u> ● <u>Performance Level Descriptors</u> - description of expected output from students based on earned NYSESLAT levels in the modality of writing(Scroll for grades 9-12) | <p><u>Instructional Accommodations</u> (depending on the student’s needs)</p> <ul style="list-style-type: none"> ● <u>Extended time</u> for tests in class, projects and assignments ● <u>Directions read.</u> Broken down as necessary ● <u>Model</u> how to complete the activity in the lesson ● <u>Oral simplification</u> of directions or questions ● <u>Translated version</u> 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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| <p>Special Education Modifications</p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p> | <p><u>Instructional</u></p> <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 | <p><u>Technology:</u></p> <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 <p><u>Other:</u></p> <ul style="list-style-type: none"> ● Arrange seating for maximum engagement and minimum distraction ● Accessible lab space (counter level) | <p><u>In Class Assessments</u></p> <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 |
| <p>Step Up to Writing</p> <p>Step Up to Writing materials can be found in BPS Science K-12 Schoology Folder 9-12 Resources Chemistry Resources Curriculum Materials</p> | <p><u>SUTW Strategy</u></p> <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 | | |
| <p>Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom</p> | <p>Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications</p> <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 <p>CLRT resources which align to Science content are denoted with a *</p> | | |