



## BPS Science Department Anatomy and Physiology

### Anatomy and Physiology – Unit 4 - The Skeletal System (Chapter 6)

**Overview:** The human skeletal system consists of bones, cartilage, ligaments and tendons and accounts for about 20 percent of the body weight. It is an amazing and complex human body system which is involved in vital functions such as supporting bodily organs, providing points of attachment for the muscular system to allow movement, maintaining body shape, and protecting vital organs such as the brain and spinal cord. The living bones in our bodies use oxygen and give off waste products in metabolism. They contain active tissues that consume nutrients, require a blood supply and change shape or remodel in response to variations in mechanical stress. A disruption to the anatomy or physiology of the human skeletal system may lead to diseases or disorders.

#### Essential Questions:

- How does the structure of the human skeletal system determine its function?
- Why does ossification occur in human bones?
- How does the structure of a “typical” human bone reveal its function?
- Why are there limits on the structure of each type of joint?
- How can you prove that the human skeletal system maintains homeostasis?
- What are the functional relationships between the human skeletal system and other human systems?

#### 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:		Crosscutting Concepts (CCC):		Science and Engineering Practices (SEP):	
<p><b>KNOW</b> → <u>Disciplinary Core Ideas</u> (DCI): what students need to know</p> <p><b>UNDERSTAND</b> → <u>Crosscutting Concepts</u> (CCC): what students look for/ applies across all science domains and <u>Science &amp; Engineering Practices</u> (SEP): how students explore and apply</p>		<ul style="list-style-type: none"> <li>● Patterns</li> <li>● Cause and Effect</li> <li>● Scale, Proportion, and Quantity</li> <li>● Systems and System Models</li> <li>● Energy and Matter</li> <li>● Structure and Function</li> <li>● Stability and Change</li> </ul>		<ul style="list-style-type: none"> <li>● Asking questions (for science) and defining problems (for engineering)</li> <li>● Developing and using models</li> <li>● Planning and carrying out investigations</li> <li>● Analyzing and interpreting data</li> <li>● Using mathematics and computational thinking</li> <li>● Constructing explanations (for science) and designing solutions (for engineering)</li> <li>● Engaging in argument from evidence</li> <li>● Obtaining, evaluating, and communicating information</li> </ul>	
Time Frame	Skills, Practices or Expectations	Textbook Resources	Online Resources	Vocabulary	Higher Order Questions
<p><b>10.31.22 - 11.18.22</b></p> <p><b>NOTE:</b>  <b>11.8.2022 – Election Day</b>  <b>11.11.22 – Veterans Day</b></p>	<p><b>Anatomy and Physiology:</b>  The students will be able to:</p> <ul style="list-style-type: none"> <li>● Describe the anatomy and physiology of the human skeletal system.</li> <li>● Compare and contrast the shapes of bones including long, short, flat, and irregular bones.</li> <li>● Describe anatomy of a “typical” bone.</li> <li>● Diagram anatomy of a “typical” bone.</li> <li>● Compare and contrast the major types of bone cells including osteoblasts, osteoclasts, and osteocytes.</li> <li>● Compare and contrast endochondral and intramembranous ossification.</li> <li>● Compare and contrast spongy and compact bone.</li> <li>● Identify spongy and compact bone.</li> <li>● Compare and contrast the axial and appendicular skeleton</li> <li>● Locate the major human bones.</li> <li>● Classify synovial joints based on structure including gliding, hinge, ellipsoidal, saddle, and ball and socket.</li> <li>● Identify various bone fractures.</li> </ul>	<p><b>Chapter 6</b>  6-1 Functions (p.143)</p> <p>6-2 Classify Bones by Shape &amp; Structure (p.143-146)</p> <ul style="list-style-type: none"> <li>● Figure 6-1 Shapes of Bones (p.144)</li> <li>● Figure 6-2 Long Bone Structure (p.145)</li> <li>● Figure 6-3 Osteons (p.146)</li> </ul> <p>6-3 Ossification (p.147-149)</p> <ul style="list-style-type: none"> <li>● Figure 6-5 Endochondral Ossification (p.148)</li> <li>● Figure 6-6 Appositional Growth (p.149)</li> </ul> <p>Fractures (p.150-151)</p> <ul style="list-style-type: none"> <li>● Clinical Note: Fractures (p.150)</li> <li>● Figure 6-7 Fracture Repair (p.151)</li> </ul> <p>Bones of the Skeleton</p> <ul style="list-style-type: none"> <li>● Axial &amp; Appendicular (p.152)</li> <li>● Figure 6-8 The Skeleton (labeled bones)</li> <li>● Figure 6-9 Bones of Axial &amp; Appendicular (p.155)</li> <li>● Figure 6-13 Sinuses (p.160)</li> <li>● Figure 6-14 Hyoid (p.160)</li> <li>● Figure 6-15 Newborn Skull (p.161)</li> </ul>	<p>HASPI:</p> <ul style="list-style-type: none"> <li>● <a href="#">Skeletal System</a> - use <a href="#">resources</a> to complete stations about bones, long bone strength, histology, long bones and height, diseases and proportions</li> <li>● <a href="#">Identifying X-Rays</a> - use <a href="#">X-ray charts</a> to give details about specific fractures</li> <li>● <a href="#">Fractures</a> - learn about fractures and healing; practice immobilization techniques</li> </ul> <p><a href="#">No Bones About it Activity</a> (CSI Activity PDF to calculate height and analyze a skeleton with both student and teacher sheets)</p> <p>Ask a Biologist:</p> <ul style="list-style-type: none"> <li>● <a href="#">Skeleton Viewer</a> (game to identify bones)</li> <li>● <a href="#">Bone Anatomy Viewer</a> (game to identify parts of a long bone)</li> </ul>	<p>osseous tissue  bone  axial skeleton  appendicular skeleton  joints/ articulations  synovial joints  fracture  <b>Shapes of Bone:</b> long, short, flat, irregular  <b>Types of Bone Tissue:</b> spongy, compact  <b>Parts of Long Bone:</b> periosteum, diaphysis, epiphysis, bone marrow  <b>Types of Bone Cells:</b> osteoblasts, osteoclasts, osteocytes  <b>Types of Ossification:</b> intramembranous, endochondral</p> <p>homeostasis/ homeostatic regulation  disease/ disorder  symptoms</p>	<ul style="list-style-type: none"> <li>● How do two or more systems work together to maintain homeostasis in Osteopenia?</li> <li>● Why does the aging process change the human skeleton?</li> <li>● What signs would you expect to see in an individual who has damaged the menisci of the knee joint?</li> <li>● Why does walking become difficult when the fibula is fractured even though it doesn't bear weight or participate in the knee joint anatomy?</li> </ul>



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	<p><b>Disease/Disorders:</b> The students will be able to:</p> <ul style="list-style-type: none"> <li>Identify various bone fractures including greenstick, transverse, oblique, comminuted, buckled, stress.</li> <li>Describe a disease or disorder of the human skeletal system including symptoms, diagnosis, medications, prevention, and treatment.</li> <li>Diagnose a human skeletal system disease/disorder given a data set of symptoms.</li> <li>Explain homeostasis in the human skeletal system through negative and positive feedback mechanisms.</li> <li>Predict prevention and treatment of a human skeletal system disorder based on a given data set.</li> </ul>	<ul style="list-style-type: none"> <li>Figure 6-16 Vertebral Column (p.162)</li> <li>Figure 6-18 Atlas and Axis (p.164)</li> <li>Figure 6-20 Thoracic Cage (p.166)</li> <li>Figure 6-25 Bones of Wrist &amp; Hand (p.170)</li> <li>Figure 6-30 Bones of Ankle &amp; Foot (p.173)</li> </ul> <p>6-9 Joints (p.173-175)</p> <ul style="list-style-type: none"> <li>Table 6-2 Joint Classification (p.174)</li> <li>Figure 6-31 Synovial Joint Structure (p.175)</li> </ul> <p>Synovial Joints p.179</p> <ul style="list-style-type: none"> <li>Figure 6-35 Types Synovial Joints (p.180)</li> </ul> <p>Chapter 6 Review Questions p.189-191</p> <p>Skeletal System and Other Systems (p.192)</p>	<p>Aging Hand Activity (<a href="#">PDF/ DOC</a>) - color bones/ see how bones change over time</p> <p><a href="#">Chicken Bone Experiment</a> (PDF of student lab guide to determine bone strength)</p>	<p>negative feedback loop positive feedback loop</p>	
<b>Resources</b>	<p><a href="http://ngss.nsta.org/Classroom-Resources.aspx">http://ngss.nsta.org/Classroom-Resources.aspx</a> - Searchable NYSSLS/NGSS aligned resources curated by NSTA</p> <p><a href="#">Dissection Videos</a> (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) Access via Schoology BPS Science K-12 Group Resources 9-12 Resources Anatomy &amp; Physiology Dissection Videos</p> <p><a href="#">Virtual Frog Dissection</a> (step by step virtual dissection)</p> <p>PBS Learning Media Dissection Videos and Resources (<a href="#">Sheep Heart</a>, <a href="#">Cow Eye</a>, <a href="#">Frog</a>)</p> <p><a href="#">Virtual Fetal Pig Dissection</a> (from Whitman College)</p> <p><a href="#">Cow Eye Dissection</a> (video, step-by-step virtual dissection, PDF of student lab guide )</p> <p><a href="#">NYSED Bilingual Glossaries</a> – NYS Statewide Language Regional Bilingual Education Resource for NYSED approved bilingual glossaries.</p>				



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<p><b>English Language Learners (ELL) Enhancements</b></p> <p>To access <a href="#">hyperlinked</a> material, you must be logged into your BPS Google Drive</p>	<p><b><u>Listening</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Cross- Linguistic Practices:</u></b> 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.)</li> <li>● <b><u>Build background knowledge</u></b></li> <li>● <b><u>Activating Prior Knowledge</u></b> means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content</li> <li>● <b><u>Visuals</u></b> - GIFs, pictures- assist students in understanding. Use <b><u>visual thinking strategies</u></b> to set learning lens</li> <li>● Video to review/ introduce topics– use <b><u>closed captioning</u></b> to help students see the words and pronunciations while they listen</li> <li>● <b><u>Word stretching / Vowel stretching</u></b> when instructing allows student to listen closely to the pronunciation of the word</li> <li>● <b><u>Performance Level Descriptors</u></b> - description of expected output from students based on earned NYSESLAT levels in the modality of listening (Scroll for grades 9-12)</li> </ul>	<p><b><u>Speaking</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Sentence Frames</u></b> - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i></li> <li>● <b><u>Academic Conversation Starters:</u></b> 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...</li> <li>● <b><u>Choral Reading</u></b> - To build fluency, self-confidence and motivation with <b><u>reading/speaking</u></b></li> <li>● Create <b><u>movement</u></b> 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</li> <li>● <b><u>Performance Level Descriptors</u></b> - description of expected output from students based on earned NYSESLAT levels in the modality of speaking(Scroll for grades 9-12)</li> </ul>	<p><b><u>Reading</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Supplementary Text</u></b> to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension.</li> <li>● <b><u>Visual Aids</u></b> - Pictures or models to support vocabulary words and concepts</li> <li>● Video to review or introduce a topic - use <b><u>closed captioning</u></b> to help students read along while they listen to the content</li> <li>● <b><u>4 Square / Frayer models</u></b> to help students gain a deeper understanding of vocabulary.</li> <li>● <b><u>Highlighting</u></b> important text to assist students in answering questions after the reading.</li> <li>● <b><u>Chunking</u></b>-Break reading of text into chunks or paragraphs</li> <li>● <b><u>Performance Level Descriptors</u></b> - description of expected output from students based on earned NYSESLAT levels in the modality of reading(Scroll for grades 9-12)</li> <li>● <b><u>Vocabulary Morphology</u></b>- 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.</li> </ul>	<p><b><u>Writing</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Sentence Frames</u></b> - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is....</i></li> <li>● <b><u>Cloze passages</u></b> with word banks</li> <li>● <b><u>Word banks</u></b></li> <li>● <b><u>Graphic Organizers</u></b> to help break down the writing process and organize thoughts</li> <li>● <b><u>Standards-based sentence stems</u></b></li> <li>● <b><u>Performance Level Descriptors</u></b> - description of expected output from students based on earned NYSESLAT levels in the modality of writing(Scroll for grades 9-12)</li> </ul>	<p><b><u>Instructional Accommodations (depending on the student’s needs)</u></b></p> <ul style="list-style-type: none"> <li>● <b><u>Extended time</u></b> for tests in class, projects and assignments</li> <li>● <b><u>Directions read.</u></b> Broken down as necessary</li> <li>● <b><u>Model</u></b> how to complete the activity in the lesson</li> <li>● <b><u>Oral simplification</u></b> of directions or questions</li> <li>● <b><u>Translated version</u></b> of test when available. Student may have both version English and native language version</li> <li>● Use of <b><u>approved bilingual glossaries</u></b> from NYS in each subject</li> </ul>
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<p><b>Special Education Modifications</b></p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p>	<p><b><u>Instructional</u></b></p> <ul style="list-style-type: none"> <li>● <b>Pre-teach</b> vocabulary</li> <li>● Use <b>picture vocabulary</b></li> <li>● Scaffold <b>Depth of Knowledge</b> questions</li> <li>● Provide copy of notes/<b>notes in “cloze”</b> form</li> <li>● Use of <b>Think, Pair, and Share</b> strategy to help process information</li> <li>● <b>Scaffold</b> written assignments with the use of <b>graphic organizers</b></li> <li>● Allow for <b>multiple ways to respond</b> (verbal, written, response board)</li> <li>● Provide <b>model of performance task</b></li> <li>● <b>Modify informational text</b> to fit the needs of the students</li> <li>● Provide a digital or paper <b>interactive notebook</b></li> <li>● Present complex <b>tasks in multiple ways</b></li> <li>● Provide <b>mnemonic strategies</b> for Chemistry concepts</li> </ul>	<p><b><u>Technology:</u></b></p> <ul style="list-style-type: none"> <li>● <b>Audio</b> reading of text</li> <li>● <b>Text to type</b> functions</li> <li>● <b>Videos</b> to clarify/visualize Chemistry concepts</li> <li>● <b>Record class lecture/discussions</b> and make accessible to student</li> <li>● <b>Nearpod-</b> interactive presentations of notes</li> <li>● <b>Playposit</b> - show a video clip about the topic and add your own questions for them to answer as they watch</li> <li>● Allow students to type answers in chat on <b>Teams</b></li> </ul> <p><b><u>Other:</u></b></p> <ul style="list-style-type: none"> <li>● Arrange seating for maximum engagement and minimum distraction</li> <li>● Accessible lab space (counter level)</li> </ul>	<p><b><u>In Class Assessments</u></b></p> <ul style="list-style-type: none"> <li>● Provide <b>review packet or review sheet</b> of concepts covered on the test</li> <li>● Practice similar questions prior to the test</li> <li>● Provide <b>multiple options</b> for projects</li> <li>● Give a <b>timeline</b> of when things are due and remind them of the process often.</li> <li>● <b>Use of timer</b> in class</li> <li>● Break all complex tasks into chunks</li> </ul>
<p><b>Step Up to Writing</b></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><b><u>SUTW Strategy</u></b></p> <ul style="list-style-type: none"> <li>● Informal Outline</li> <li>● Color-Coding – Informative/Explanatory Text</li> <li>● Two-column notes</li> <li>● I-V-F Topic Sentence progressing to Four Step Summary Paragraph</li> <li>● CUPS – Capitalization, Usage, Punctuation, Spelling</li> <li>● Transitions</li> </ul>		
<p><b>Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom</b></p>	<p>Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications</p> <ul style="list-style-type: none"> <li>● Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population</li> <li>● All students are given an opportunity to engage in science discourse</li> <li>● Teacher demonstrates high expectations for all students</li> </ul> <p>CLRT resources which align to Science content are denoted with a *</p>		