

Grade 6 - Unit 3 - Human Body Movement

Unit Focus

This unit was developed through a collaboration with Yale Professor of Biomechanical Engineering, Dr. Stuart Campbell, as part of a National Science Foundation grant. During this unit, students will investigate the muscular, skeletal and nervous systems from the cellular level through the organism level, by performing several inquiry-based lessons that will help students understand how the three systems work together to allow our bodies to move and function. Students will use Vernier sensors to graph and analyze heart rate and muscle strength and fatigue. As they navigate the content, they will have several experiences to design and build models to represent cells and body systems, culminating in the creation of a prosthesis that integrates all three systems.

Stage 1: Desired Results - Key Understandings

Established Goals	Transfer	
<p>Next Generation Science <i>Middle School Engineering Design: 6 - 8</i></p> <ul style="list-style-type: none"> Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. <i>MS-ETS1-3</i> <p><i>Middle School Life Science: 6 - 8</i></p> <ul style="list-style-type: none"> Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. <i>MS-LS1-1</i> Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. <i>MS-LS1-2</i> Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. <i>MS-LS1-8</i> Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. <i>MS-LS1-3</i> <p>Next Generation Science Standards (DCI) <i>Science: 6</i></p> <ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. <i>ETS1.6.B1</i> All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell 	<p>T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.</p> <p>T2 Make observations and ask questions to define a problem based on prior knowledge and curiosity that stimulates further exploration, analysis, and discovery.</p>	
	Meaning	
	Understandings	Essential Questions
<p>U1 Cells are the basic unit of life.</p> <p>U2 Cells have organelles and other structures that help them survive, grow, and meet their needs.</p> <p>U3 In multicellular organisms cells work together in groups to form tissues and organs with specific functions.</p> <p>U4 Organisms consist of multiple, interacting sub-systems that work together to allow the organism to function.</p> <p>U5 Each sense receptor responds to different inputs, transmitting them as signals that travel along nerve cells to the brain; The signals are then processed in the brain, resulting in immediate behavior or memories.</p> <p>U6 Established knowledge provides the foundation for future scientific and engineering advances.</p>	<p>Q1 How does structure relate to function?</p> <p>Q2 How do systems work together?</p> <p>Q3 How can cause and effect relationships be used to understand and predict how our bodies work?</p> <p>Q4 In what ways have engineers worked to improve our health and well-being?</p>	

Stage 1: Desired Results - Key Understandings

<p>(unicellular) or many different numbers and types of cells (multicellular). LS1.6.A1</p> <ul style="list-style-type: none"> Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. ETS1.6.C1 Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. LS1.6.D1 In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. LS1.6.A3 Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. ETS1.6.B4 The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. ETS1.6.C2 Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. LS1.6.A2 <p>Student Growth and Development 21st Century Capacities Matrix</p> <p><i>Critical Thinking</i></p> <ul style="list-style-type: none"> Synthesizing: Students will be able to thoughtfully combine information/data/evidence, concepts, texts, and disciplines to draw conclusions, create solutions, and/or verify generalizations for a given purpose. MM.1.3 <p><i>Creative Thinking</i></p> <ul style="list-style-type: none"> Design: Students will be able to engage in an appropriate process to refine their product. MM.2.3 	Acquisition of Knowledge and Skill	
	Knowledge	Skills
	<p>K1 All living things are made of cells. K2 Cells are the smallest unit that is said to be alive. K3 Living organisms can be either unicellular or multicellular. K4 The body is a system made up of multiple interacting groups of cells. K5 Groups of cells form tissues; groups of tissue form organs; groups of organs form systems; systems work together to form a living more complex system. K6 The musculoskeletal system provides: structure & support for the body; allows for movement (bones and muscles working together); creates blood cells; protects internal organs; stores nutrients and minerals. K7 Bones are comprised of a variety of layers -- each serving a different purpose. K8 Bones (including joints), muscles and connective tissue (tendons and ligaments) allow the body to move. K9 Muscles work in pairs by contracting and relaxing in opposition. K10 The musculoskeletal systems interact closely with the nervous system. K11 <u>Vocabulary</u>: cell, tissue, organ, organ system, organelle, nucleus, chromosome, cell wall, cell membrane, mitochondria, vacuole, chloroplast, DNA, cytoplasm, unicellular, multicellular, tendon, ligament, joints, marrow, contracting and relaxing muscles, vertebral column, neuron, synapse, dendrite, axon neurotransmitters.</p>	<p>S1 Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function. S2 Create a prosthetic hand complete with appropriate bone, muscle and connective tissue components. S3 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior.</p>