**Subject area/course**: Science/Biology

**Grade level/band**: High School

**Task source**: New Hampshire Task Bank; Author: Meghan Petruzzi

**Musculoskeletal System**

**TEACHER'S GUIDE**

1. **Task overview**:

The objective of this assignment is to investigate in depth the musculoskeletal system; sliding filament theory, the names of the bones/muscles, their features, and the connections of bones at joints, and how bones interact with the muscles. For this project students will be allowed to work with either the whole skeletal system, or to focus more on individual units. For example, they may choose to focus on specific joints, or an overall movement like throwing a ball. They will analyze the muscle contractions/relaxations that cause the movement by pulling on bone features while applying the sliding filament theory.

The summative product will include a group project with individual work where it describes a movement, how muscles contract, their attachment to bones, and how bones allow for movement.

1. **Aligned standards:**
2. **Primary Common Core State Standards**

CCSS.ELA-Literacy.WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

CCSS.ELA-Literacy.RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

CCSS.ELA-Literacy.RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

CCSS.ELA-Literacy.SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

1. **Next Generation Science Standards (NGSS)**

HS-LS1-1 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-LS1-1-1 Systems of specialized cells within organisms help them perform the essential functions of life.

HS-LS1-1 (cross-cutting) 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.

1. **Critical abilities**

**Research**: Conduct sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and demonstrate understanding of the subject under investigation. Gather relevant information from multiple authoritative print and digital sources, use advanced searches effectively, and assess the strengths and limitations of each source in terms of the specific task, purpose, and audience.

**Analysis of Information:** Integrate and synthesize multiple sources of information (e.g., texts, experiments, simulations) presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to address a question, make informed decisions, understand a process, phenomenon, or concept, and solve problems while evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

**Experimentation and Evaluation:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. Evaluate hypotheses, data, analysis, and conclusions, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

**Use of Technology:** Present information, findings, and supporting evidence, making strategic use of digital media and visual displays to enhance understanding. Use technology, including the Internet, to research, produce, publish, and update individual or shared products in response to ongoing feedback, including new arguments or information.

**Interpersonal Interaction and Collaboration:** Develop a range of interpersonal skills, including the ability to work with others, to participate effectively in a range of conversations and collaborations.

1. **Other standards**

*New Hampshire Competencies:*

*Nature of Science*: Student will demonstrate the ability to work collaboratively and individually to generate testable questions or define problems, plan and conduct investigations using a variety of research methods in various settings, analyze and interpret data, reason with evidence to construct explanations in light of existing theory and previous research, and effectively communicate the research processes and conclusions.

*Structure and Function* - Students will demonstrate the ability to use evidence to support claims about the relationship among structure and function of natural and human designed objects.

*Stability and Change of Systems* - Students will demonstrate the ability to investigate and analyze static and dynamic conditions of natural and human designed systems in order to explain and predict changes over time.

1. **Time/schedule requirements:**

This task will likely take 5 class periods to complete.

1. **Materials/resources:**

Materials:

* Cameras and or smart phone
* Computers with imaging software
* Printer access
* Internet access
* Poster supplies
* Current Human Anatomy and Physiology textbook
* Musculoskeletal System Graphic Organizer
1. **Prior knowledge:**

Students have previously completed a joint lab investigating how biceps and triceps cause movement. They have also worked through anatomy arcade for bone and muscle identification. Students have also complete a POGIL on the sliding filament theory, and completed a packet on muscles that included origin, insertion and students filled in action.

1. **Connection to curriculum:**

• This takes place mid-year between the unit on skin and the nervous system.

• Students should be familiar with the norms for working in groups for research and for presenting using posters.

• Students should be familiar with using cameras to take pictures/video of motion for a similar project.

1. **Teacher instructions:**

• Introduce the entire assignment and timeline first.

* Timeline - Because this task is to be embedded into the implementing teacher’s curriculum, some customization will be necessary. The lesson plan provided here is an aid or model for how the task might be implemented:
* Day 1: Introduction of assignment and begin clarifying the task. Students may access computers as deemed necessary but should begin background research.
* Day 2: Perform movement, take pictures and format as necessary. (Computers needed to print images)
* Day 3: Evaluate and analyze movement.
* Day 4: Create the poster.
* Day 5: Continue to work on the group poster and individual reflection.

* Students get excited about the movement pictures. This activity would work best if background information is completed before analysis can be started.

• Select an area in the school to do movements. Make sure that the area is free from innocent bystanders and will not disrupt the rest of the school. You may also wish to make sure the area is available at another time should a student miss class.

• Students should work in pairs or groups to take pictures of movements. You will need to determine if and when you plan to use computers to format and print the pictures.

• Each student should turn in their own individual reflections to assess individual knowledge.

1. **Student support:**

Students can use:

• Extra time

• Graphic organizers to help compare different joints/functions

• Read articles aloud

1. **Extensions or variations:**

Students will be allowed to work with either the whole skeletal system, or to focus more on individual units. For example, they may choose to focus on specific joints, or an overall movement like throwing a ball. The assignment can be modified to have students analyze workout exercises or exercise machines to evaluate targeted muscles.

1. **Scoring:**

Student work can be scored using Musculoskeletal System rubric.