

<b>Modules Overview</b>	
<b>For grade level(s)</b>	<i>High School (9<sup>th</sup>-12<sup>th</sup>)</i>
<b>Duration</b>	<p>MESA Period: 3 weeks of daily 50-60 minute sessions</p> <p>MESA Afterschool: 6 total sessions of 60-90 minutes each</p> <p>MESA Saturday: 2 Saturdays for total of 8 hours</p>
<b>Purpose</b>	<p>The Human Heart module will introduce students to the field of biological science and it's corresponding careers.</p> <p>The module will introduce students to the role of the human heart; the location, functions, and appearance of it's various structures; and associated disorders and diseases.</p> <p>At the end of the module students will be prepared to construct and label a model of the Human Heart as well as answer questions prepared from information contained in the attached documents.</p>
<b>Objectives</b>	<p>Upon completion of this module, students will:</p> <ul style="list-style-type: none"> <li>• Be familiar with the MESA Day contest rules</li> <li>• Have a working knowledge of the function of the Human Heart</li> <li>• Be able to identify the structures and appearance of the Human Heart</li> <li>• Be familiar with diseases/disorders related to the Human Heart</li> <li>• Be able to construct a working model of the Human Heart based on the knowledge acquired in this module</li> <li>• Be prepared to answer a set of questions taken form the information contained in this module</li> </ul>
<b>Standards Addressed (Common Core and NGSS)</b>	<p><b>California Common Core</b></p> <ul style="list-style-type: none"> <li>• Grades 9-10               <ul style="list-style-type: none"> <li>○ <b>RST No. 4:</b> Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.</li> <li>○ <b>RST No. 5:</b> Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).</li> <li>○ <b>RST No. 7:</b> Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Grades 11-12               <ul style="list-style-type: none"> <li>○ <b>RST No. 4:</b> Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.</li> <li>○ <b>RST No. 9:</b> 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.</li> </ul> </li> </ul> <p><b>California’s Next Generation Science Standards (NGSS)</b></p> <ul style="list-style-type: none"> <li>• Grades 9-12               <ul style="list-style-type: none"> <li>○ <b>HS-LS1-2:</b> Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.</li> <li>○ <b>HS-LS1-2:</b> Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.</li> <li>○ <b>HS-LS1-2, HS-LS1-4</b> Crosscutting Concept: Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.</li> </ul> </li> </ul>
<p><b>Assessment</b></p>	<p>Students will be evaluated through the following methods:</p> <ul style="list-style-type: none"> <li>• Assessment Worksheets</li> <li>• Project Testing and Evaluation</li> <li>• Ability to correctly answer questions related to the function of the Human Heart</li> </ul>
<p><b>Additional Resources</b></p>	<p>The following supplemental materials are available on the California MESA website:</p> <ul style="list-style-type: none"> <li>What is the Study of Life (PowerPoint)</li> <li>Careers in Science (PowerPoint)</li> <li>The Human Heart (PDF)</li> <li>Label the Human Heart (PDF)</li> <li>Circulatory Word Search (PDF)</li> <li>Blood Flow (PDF)</li> </ul>

**Background**

Biological science is the study of living organisms, including their structure, function, organization, growth, evolution, and their interaction with the natural environment.

Some disciplines within biology include:

Anatomy: explores the structural organization of an organism

Astrobiology: explores the origin, evolution, distribution, and future of life in the universe

Biochemistry: explores the chemical processes within and related to living organisms

Botany: explores the biology of plant life

Cellular Biology: explores cellular structure and function including cell structure, cell division, and cell death

Ecology: explores how organisms interact in their environment

Evolutionary Biology: explores the origins and evolutionary processes of a species

Genetics: explores genes and their role in inheritance

Molecular Biology: explores cells, their characteristics, parts, chemical processes, and interactions among biological molecules

Neurobiology: explores the cells and tissue of the brain and nervous system

Physiology: explores the interaction between molecules, cells, muscles and organs

Refer to the PowerPoint “Careers in Science”.

### **Benefit To Society**

Biologists hold the key to unlocking solutions to some of the world's biggest challenges. Whether working to protect our planet's biodiversity, identifying new sustainable energy sources, researching diseases that affect our aging population, or identifying new agricultural techniques to improve conditions for our world's most vulnerable populations, science gives us an understanding of the natural world and helps ensure a more sustainable future.

12 Ways Science Can Save The World – In pictures

<http://www.businessinsider.com/12-ways-biology-can-save-the-world-pictures-2012-9?op=1>

### **Engineering Design Process**

The engineering design process will be a theme that spans all of the PBL modules, so an extensive lesson isn't required to be included in each module. However, it may be more effective to focus on particular parts of the process that work well with this module. For instance, there are various forms of brainstorming that could be recommended such as collaborative sketching (C-sketching) and mind-mapping.

### **Engineering Design Process/Module Content**

Using the four steps of the engineering design process students will produce a competition ready project.

- ✓ Investigate
- ✓ Plan
- ✓ Create
- ✓ Evaluate

**Note:** *All documents italicized below found in Supplemental Materials*

### Introduction

- *What is the Study of Life PowerPoint*
- *Careers in Science PowerPoint*
- 12 Ways Science Can Save The World – In pictures  
<http://www.businessinsider.com/12-ways-biology-can-save-the-world-pictures-2012-9?op=1>

### Investigate/Research

- Introduce students to the function of the Human Heart
  - How does the heart work? (3:29)  
<http://www.courseworld.com/bio/heartv.html>
  - How the Heart Works (3:03)  
<http://www.neok12.com/video/Circulatory-System/zX6675527e4700427e525855.htm>
  - Heartbeat Animation (1:00)  
<http://www.neok12.com/video/Circulatory-System/zX7879066255015f55015a77.htm>
  - Virtual human anatomy website with interactive model of the human heart  
<http://www.innerbody.com/image/card01.html>
- Review function and structures of the Human Heart using the *Human Heart Document*
- Review the *Path of Blood Flow Document*
- Students may test their knowledge with
  - Interactive Quiz
    - <http://www.purposegames.com/game/label-the-heart-quiz>
    - <http://sciencelearn.org.nz/Contexts/See-through-Body/Sci-Media/Animation/Label-the-heart>
  - *Label the Human Heart Activity*
  - *Circulatory Word Search Activity*
- Thoroughly review MESA Day Rules
- Students should create their own design notebook with
  - All organs and functions of the Human Heart

**Plan/Brainstorm**

- Using their design notebooks students should
  - Brainstorm possible materials for each structure of the Human Heart
  - Draw a diagram of their model
  - Answers all questions found in the MESA Day Rules
  - Devise a method for memorizing and testing knowledge of the GI Tract questions

**Create**

- Students should
  - Create a model using designs found in their notebook
  - A complete materials table

**Evaluate**

- Model may be judged using the rubric found in the MESA Day Rules
- Students should be independently tested on their knowledge of the Human Heart
- Using scores students should reexamine their design/materials and make the necessary enhancements, recording all results in their notebook.

**Pacing Guide**

**Note:** The MESA Curriculum is intended to be flexible and to meet the needs of all MESA delivery models. As the lessons are developed, please keep in mind what components can be “sacrificed” for the afterschool/lunch/Saturday models where the instruction time is usually less than a MESA period.

**Recommended pace for MESA Periods:**

Week One: Introduction to the Human Heart	
Monday	<ul style="list-style-type: none"> <li>• Introduction to Biological Science</li> </ul>
Tuesday	<ul style="list-style-type: none"> <li>• Human Heart Videos</li> <li>• Human Heart Function (Human Heart Document)</li> </ul>
Wednesday	<ul style="list-style-type: none"> <li>• Human Heart Function (Human Heart Document)</li> </ul>
Thursday	<ul style="list-style-type: none"> <li>• Label the Human Heart</li> <li>• Circulatory Word Search</li> <li>• Human Heart Function (Human Heart Document)</li> </ul>
Friday	<ul style="list-style-type: none"> <li>• Updating design notebook</li> <li>• Review of MESA Day Rules</li> </ul>
Week Two: GI Model Construction	
Monday	<ul style="list-style-type: none"> <li>• Design Model</li> </ul>
Tuesday	<ul style="list-style-type: none"> <li>• Design and Construct Model</li> </ul>
Wednesday	<ul style="list-style-type: none"> <li>• Construct Model</li> </ul>
Thursday	<ul style="list-style-type: none"> <li>• Construct Model</li> </ul>
Friday	<ul style="list-style-type: none"> <li>• Construct Model</li> </ul>

Week Three: Evaluate and Redesign	
Monday	<ul style="list-style-type: none"> <li>• Memorize and Test Knowledge of Human Heart</li> </ul>
Tuesday	<ul style="list-style-type: none"> <li>• Evaluate Model</li> </ul>
Wednesday	<ul style="list-style-type: none"> <li>• Test Knowledge of Human Heart</li> </ul>
Thursday	<ul style="list-style-type: none"> <li>• Reevaluate and Update Design</li> </ul>
Friday	<ul style="list-style-type: none"> <li>• Make necessary Design Improvements &amp; Test Knowledge of Heart Questions</li> </ul>

\*\* Add as many weeks as necessary for the module

**Recommended pace for MESA Afterschool Programs:**

Afterschool	
Day 1	<ul style="list-style-type: none"> <li>• Introduction to Biological Science</li> <li>• Human Heart Videos</li> <li>• Human Heart Function (Human Heart Document)</li> </ul>
Day 2	<ul style="list-style-type: none"> <li>• Label the Human Heart</li> <li>• Circulatory Word Search</li> <li>• Human Heart Function (Human Heart Document)</li> </ul>
Day 3	<ul style="list-style-type: none"> <li>• Design Model</li> <li>• Memorize and Test Knowledge of Heart Questions</li> </ul>
Day 4	<ul style="list-style-type: none"> <li>• Construct Model</li> </ul>
Day 5	<ul style="list-style-type: none"> <li>• Construct Model</li> </ul>
Day 6	<ul style="list-style-type: none"> <li>• Evaluate Model &amp; Test Knowledge of Heart Questions</li> </ul>

\*\* Add as many days as necessary for the module

**Recommended pace for MESA Saturday programs:**

Saturday	
Day 1	<ul style="list-style-type: none"> <li>• Introduction to Biological Science</li> <li>• Human Heart Videos</li> <li>• Human Heart Function (Human Heart Document)</li> <li>• Design Model</li> <li>• Memorize and Test Knowledge of Heart Questions</li> </ul>
Day 2	<ul style="list-style-type: none"> <li>• Construct Model</li> <li>• Evaluate Model &amp; Test Knowledge of GI Questions</li> </ul>

\*\* Add as many days as necessary for the module