The human heart is a hollow muscle located to the left of the sternum between the second and fifth ribs. The heart is surrounded by and fits into notches in the lungs. The heart is the key organ of the circulatory system and is responsible for the pumping of blood throughout the body. The heart is enclosed in a membranous sac called the pericardium. The pericardium is composed of two layers which protect the heart and anchor it in place. To minimize friction when the heart beats there is a watery lubricant between the layers of the pericardium.

The human heart is slightly larger than the fist of an adult male and is composed of very thick cardiac muscles. It pumps involuntarily or without being commanded by the brain. Inside the heart are various sensors which monitor the body’s demands for more or less blood. On average, the heart beats 100-120 times per minute in children and 70-90 times per minute in adults.

The heart is made up of four distinct chambers. Each half of the heart has an atrium (pl. atria) and a ventricle and are separated by a wall or septum. The atria are the upper chambers and the ventricles are the lower chambers. As blood returns to the heart it enters the right atrium from three veins. The superior vena cava returns blood from head, neck and extremities, the inferior vena cava returns blood from the lower torso and limbs and the coronary sinus circulates venous blood through the walls of the heart. From the right atrium, the blood is pumped through the tricuspid valve to the right ventricle. The blood returns to the heart rich in carbon dioxide and low in oxygen. Therefore, it goes to the lungs via the pulmonary artery where it exchanges carbon dioxide for oxygen. The blood returns to the left atrium of the heart through the pulmonary vein and is pumped through the bicuspid or mitral valve into the left ventricle. Next, the fully oxygenated blood leaves the heart through the aortic semilunar valves and flows into the aorta.

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The Human Heart Vocabulary List

- aorta
- aortic arch
- artery
- atrioventricular (A-V) node
- blood
- blood pressure
- capillary
- chordae tendineae
- circulatory system (open and closed)
- coronary artery
- diastole
- erythrocyte
- fossa ovalis
- heart
- inferior vena cava
- left atrium
- left ventricle
- leukocyte
- lymphatic system
- lymphocyte
- mitral valve
- plasma
- platelet
- pulmonary artery
- pulmonary trunk
- pulmonary vein
- Purkinje fibers
- right atrium
- right ventricle
- semilunar
- sinoatrial (S-A) node
- superior vena cava
- tricuspid valve
- systole
- vein
- venule
In this activity students will become familiar with the terms and definitions associated with the human heart and circulatory system.

**Objectives:**
The student will be able to:
1. define the selected terms associated with the human heart and circulatory system;
2. explain the connection between the heart and circulatory system;
3. prepare for a graded assessment.

**Lesson Objectives:**
This lesson will:
1. allow research about the parts of the heart;
2. increase understanding of vocabulary and terminology associated with the heart and the circulatory system;
3. assist in the organization of the required material.

**National Standards:**
Grades 5-8
C.1.4 Different tissues are grouped together to form larger functional units called organs.
C.1.5 The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease.

**Missouri Frameworks:**
SC/VII.B/5-8/3 Complex multicellular organisms are interacting systems of cells, tissues, organs, and organ networks that carry out life processes through chemical and physical means.
SC/VII.C/5-8/2 Each structure in an organism is uniquely adapted to a particular function for enhancing the ability of the organism to survive.

**Materials:**
The Human Heart Vocabulary List - STUDENT PAGE
Textbook or resource materials
The Human Heart Definitions - STUDENT PAGE
The Human Heart Word Find - STUDENT PAGE

**Teacher Notes:**
This activity may be used in a variety of ways. The definitions and word find both use the same vocabulary list. The students can find the words in the word find and complete the definitions or they can use resource materials to find the answers.

Any part of this activity could also be used for review.

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**Procedure:**
The procedure will vary depending upon the format the teacher chooses.
1. Have the students complete the Human Heart Word Find and Human Heart Fill-in-the-Blank Definitions - STUDENT PAGES.
2. Review vocabulary with the students prior to attending the AIMS program.

**Assessment:**
Written vocabulary quiz.
Have the students construct a concept web using the vocabulary list.

---

In this activity students will become familiar with the anatomy of the human heart.

**Objectives:**
The students will be able to:
1. identify the protective structures of the heart;
2. identify the four chambers of the heart;
3. trace blood flow through the heart.

**Lesson Objectives:**
This lesson will:
1. allow observation of human hearts;
2. increase understanding of vocabulary and terminology associated with the heart;
3. provide an understanding of the role of a cardiologist or surgeon in treating diseases of the heart;
4. assist in the organization of required material.

**National Standards:**
Grades 5-8
C.1.4 Different tissues are grouped together to form larger functional units called organs.
C.1.6 Disease is a breakdown in structures or functions of an organism.
F.1.1 Regular exercise is important to the maintenance and improvement of health.
F.1.2 The potential for accidents and the existence of hazards imposes the need for injury prevention.
F.1.3 The use of tobacco increases the risk of illness.
F.1.4 Alcohol and other drugs are often abused substances.
F.4.4 Important personal social decisions are made based on perceptions of benefits and risks.
Missouri Frameworks:
SC/VII.B/5-8/3
Complex multicellular organisms are interacting systems of cells, tissues, organs, and organ networks that carry out life processes through chemical and physical means.

SC/VII.C/5-8/2
Each structure in an organism is uniquely adapted to a particular function for enhancing the ability of the organism to survive.

Materials:
AIMS 3-D program on the “Human Heart”
The Human Heart Diagram - STUDENT PAGE

Teacher Notes:
The auditorium is in which the AIMS programs is very dark, therefore it may be necessary for the students to complete the material immediately after the program or during the break.

Procedure:
1. Complete the “preparation activity” to familiarize students with the human heart vocabulary list.
2. Prior to the program, have the students generate 2 or 3 questions they would like answered by the AIMS speaker.
3. Ask students to observe the AIMS 3-D program paying close attention to the key terms from the vocabulary list and new terms introduced by the speaker.
4. If time allows, have the students ask their questions.
5. Complete the Human Heart Diagram - STUDENT PAGE.

Assessment:
Complete the student page.

ADVENTURES IN MEDICINE & SCIENCE
Activity 3
RISK FACTORS

In this activity students will model the risk for developing heart disease by simulating genetic and lifestyle choices which may lead to coronary artery disease.

Objectives:
The student will be able to:
1. characterize important factors which may increase the risk of heart disease;
2. conclude the choices needed to live healthy lifestyle;
3. explain the terms atherosclerosis, heart attack and stroke.

Lesson Objectives:
This lesson will
1. provide a better understanding of the risk factors that may contribute to heart disease;
2. increase recognition of healthy lifestyle choices.

National Standards:
Grades 5-8
C.1.4 Different tissues are grouped together to form larger functional units called organs.
C.2.3 Every organism requires a set of instructions for specifying traits.
C.2.5 The characteristics of an organism can be described in terms of a combination of traits

Missouri Frameworks:
SC/VII.B/5-8/3
Complex multicellular organisms are interacting systems of cells, tissues, organs, and organ networks that carry out life processes through chemical and physical means.

SC/VII.C/5-8/2
Each structure in an organism is uniquely adapted to a particular function for enhancing the ability of the organism to survive.

CA/I/K-4, 5-8/4
Process, organize, and evaluate information and ideas.

Materials:
small bowls or cups poker chips
four large bowls
Risk Factors - Student Page (Appendix I)
Risk Factors - Teacher Page (Appendix II)

Teacher Notes:
Prior to the beginning of class, prepare two containers of poker chips for each group of four students. Label one container “father’s genes” and the other container “mother’s genes”. Each container should have sixteen poker chips (eight of two different colors).

Label the large bowls; “A - Body Weight,” “B - Diet,” “C - Smoking” and “D - Exercise.” Divide the number of students in the class by five and make at least that number of copies of the environmental factors page. Cut the slips apart, fold in half and sort them by the letters into the bowls. If you have the time and resources, you may want to make copies on four different colors and sort by color (one color per letter) also.

Procedure:
1. Discuss with the students some of the risks associated with heart disease.
2. Pass around the large bowls and have each student take one slip, without looking, from each bowl.
3. Have the students record the characteristics and points on their worksheet.
4. Tell the students to add up the points. Point out that a higher score means a higher risk of heart disease.
5. Explain to the students that they have chosen a “lifestyle.”
6. Pass around bowls containing poker chips and ask the students to choose 3 chips from each bowl and then return the chips to the bowls.
7. Tell the students to record the information on their worksheets.
8. Announce that one of the colors of the poker chips, i.e., blue, represents alleles that add four points of additional risk of heart disease.
9. Have the students total their points.
10. Announce that a score of 26 points or more means they will suffer from heart disease.

**Discussion Questions:**
1. What are some factors that cause heart disease? Cancer?
2. How can you prevent heart disease? Cancer?
3. How great is the role of genetics in determining heart disease?
4. What was your score? What lifestyle choices could you change assuming that these were real?

**Assessment:**
Assess the students’ answers to discussion questions.
Have the students design a pamphlet (like in a doctor’s office) outlining a healthy lifestyle to avoid heart disease.
Written assessment.

**Enrichment:**
Have the students research and report on the connection between heart disease and one or more of the following:
atherosclerosis
myocardial infarct
 cholesterol (HDL & LDL)
diabetes
cigarette smoking
 alcoholism
 hypertension
exercise (lack of)

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**Funding provided by a grant from Group Health Foundation**

**Project Coordinator: Karen Montgomery**

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aorta
aortic arch
artery
atrioventricular (A-V) node
blood
blood pressure
capillary
chordae tendineae
circulatory system (open and closed)
coronary artery
diastole
erythrocyte
fossa ovalis
heart
inferior vena cava
left atrium
left ventricle
leukocyte
lymphatic system
lymphocyte
mitral valve
plasma
platelet
pulmonary artery
pulmonary vein
Purkinje fibers
right atrium
right ventricle
semilunar
sinoatrial (S-A) node
superior vena cava
tricuspid valve
systole
vein
venule
1. The largest artery in the vertebrate body; carries oxygenated blood away from the heart.

2. The hydrostatic pressure exerted by the blood in an animal’s circulatory system.

3. Any of the tiny, thin-walled blood vessels interwoven throughout body tissues.

4. A vessel that carries blood to tissues.

5. A dynamic, life-sustaining solution in animals with closed circulatory systems containing nutrients, waste products, hormones, other substances, and cells.

6. A cell of the immune system which responds to foreign substances.

7. An organ of specialized muscle tissue that acts as a pump.

8. A transport system in animals, consisting of specialized structures such as vessels and a heart and blood; carries nutrients to the cells and carries away wastes.

9. The fluid portion of blood; made of a variety of dissolved substances and water.

10. A red blood cell.

11. A vessel that carries blood toward the heart.

12. A special set of conducting fibers that carries impulses to another node.

13. Blood pressure during relaxation of the heart.

14. Blood leaves the heart and enters the aorta through the __________ valve.

15. Transports fluid lost from the capillaries back to the circulatory system.
16. Connects the heart to the lungs.
17. Carries blood from the head, neck and arms.
18. Blood pressure during contraction of the heart.
19. A white blood cell.
20. Circulates in the blood and plays an important role in blood-clotting.
21. The heart’s own “pacemaker”.
22. The cardiac impulse conducting system of the heart.
23. Carries blood from the legs and most of the body.
24. Tiny veins that connect capillaries to larger veins.
25. Carries oxygenated blood from the lungs to the heart.
26. Regulates blood flow from the auricle to the ventricle.
27. One of the two aeries that supplies blood to the heart.
28. Receives arterial blood from the left atrium and venous blood from the right atrium.
29. Blood flows from the veins to the right__________ of the heart.
30. Blood passes from the right atrium to the right ventricle through the_ __________ valve.
Diagram of the Human Heart

[Diagram of a human heart with labeled parts]
## Risk Factors

<table>
<thead>
<tr>
<th>Maintain desirable body weight at all times</th>
<th>Sometimes up to 20 pounds overweight</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCORE = 0</td>
<td>SCORE = 2</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Sometimes up to 20 pounds overweight</td>
<td></td>
</tr>
<tr>
<td>SCORE = 2</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Usually 10-20 pounds overweight</td>
<td></td>
</tr>
<tr>
<td>SCORE = 3</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Always 20-30 pounds overweight</td>
<td></td>
</tr>
<tr>
<td>SCORE = 4</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Always at least 50 pounds overweight</td>
<td></td>
</tr>
<tr>
<td>SCORE = 6</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Always at least 50 pounds overweight</td>
<td></td>
</tr>
<tr>
<td>SCORE = 6</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Strict vegetarian</td>
<td></td>
</tr>
<tr>
<td>SCORE = 0</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Eat chicken or fish, but no beef</td>
<td></td>
</tr>
<tr>
<td>SCORE = 2</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Eat beef or pork once or twice a week</td>
<td></td>
</tr>
<tr>
<td>SCORE = 3</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Eat beef or pork most days</td>
<td></td>
</tr>
<tr>
<td>SCORE = 4</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Eat beef or pork at least once a day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Never smoke</td>
<td></td>
</tr>
<tr>
<td>SCORE = 0</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Smoke less than five cigarettes a week</td>
<td></td>
</tr>
<tr>
<td>SCORE = 2</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Smoke one to four cigarettes a day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 4</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Smoke about one pack of cigarettes per day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 6</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Smoke more than one pack of cigarettes every day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 8</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Vigorous exercise every day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 0</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Vigorous exercise most days</td>
<td></td>
</tr>
<tr>
<td>SCORE = 1</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Exercise once a week or less</td>
<td></td>
</tr>
<tr>
<td>SCORE = 6</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Exercise every other day or so</td>
<td></td>
</tr>
<tr>
<td>SCORE = 3</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Vigorous exercise every day</td>
<td></td>
</tr>
<tr>
<td>SCORE = 0</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Exercise once a week or less</td>
<td></td>
</tr>
<tr>
<td>SCORE = 6</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>
Although lifestyle choices may contribute to heart disease, genetics may also play a role in the development of heart disease. Genetic risk of heart disease is a complex trait which involves many genes which are yet to be identified.

There are many genes which contribute to heart disease, but in this activity you will work with three genes.

Draw three poker chips from each container and record the colors below. Return the poker chips to the containers. The chips represent the different versions or “alleles” of genes.

Colors:

Mother’s genes  Father’s genes

Your teacher will tell you which of the alleles changes your personal risk of developing heart disease and how many points to add to your previous score.

Lifestyle risk (risk of developing heart disease based on lifestyle) = _________ points

Genetic risk (risk of developing heart disease based on alleles) = _________ points

Total points = Lifestyle points + Genetic risk points = _________ points

Generally, the higher the score the greater the risk of developing heart disease.