

Delaware Science Coalition



Grade 6 My Body and Me Unit Template



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Delaware Recommended Curriculum Unit Template

Preface: This unit has been created as a model for teachers in their designing or redesigning of course curricula. It is by no means intended to be inclusive; rather it is meant to be a springboard for teacher thought and creativity. The information we have included represents one possibility for developing a unit based on the Delaware Science Content Standards, the Delaware Science Coalition units, and the Understanding by Design framework and philosophy.

Brief Summary of Unit:

Part 1: Studying People Scientifically. Students investigate the various methods of scientific problem solving and compare it to a historical experimental design in terms of evidence and trade offs. Data is collected and examined through a simulated clinical trial involving a placebo. The concept of variables is examined through inquiry into human sensitivity to touch. Both qualitative and quantitative data are examined and compared. Finally, students evaluate different experimental designs and discuss ethical issues.

Part 2: Body Works. Students learn about the major organs and systems in the human body and their functions including the digestive, respiratory, excretory, circulatory, muscular, skeletal, reproductive, and nervous systems. Students examine the relationship between structure and function and how circulatory, respiratory and digestive systems interact to support life processes. Students critically evaluate information in order to make ethical and life style decisions.

Stage 1: Desired Results Delaware Science Content standards

Delaware Science Content Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1 and 6 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: Nature and Application of Science and Technology

Understandings and Abilities of Scientific Inquiry

Students will know and be able to:

1. Understand that: Scientific investigations involve asking testable questions. Different kinds of questions suggest different scientific investigations. The current body of scientific knowledge guides the investigation.
 - Be able to: Frame and refine questions that can be investigated scientifically, and generate testable hypotheses.
2. Understand that: A valid investigation controls variables. Different experimental designs and strategies can be developed to answer the same question.

- Be able to: Design and conduct investigations with controlled variables to test hypotheses.
3. Understand that: In a scientific investigation, data collection involves making precise measurements and keeping accurate records so that others can replicate the experiment.
 - Be able to: Accurately collect data through the selection and use of tools and techniques appropriate to the investigation. Construct tables, diagrams and graphs, showing relationships between two variables, and display and facilitate analysis of data. Compare and question results with and from other students.
 4. Understand that: There is much experimental and observational evidence that supports a large body of knowledge. The scientific community supports known information until new experimental evidence arises that does not match existing explanations. This leads to the evolution of the scientific body of knowledge.
 - Be able to: Form explanations based on accurate and logical analysis of evidence. Revise the explanation using alternative descriptions, predictions, models and knowledge from other sources as well as results of further investigation.
 5. Understand that: Evaluating the explanations proposed by others involves examining and comparing evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Conflicting data or conflicting interpretations of the same data suggest the need for further investigation. Continued investigation can lead to greater understanding and resolution of the conflict.
 - Be able to: Communicate scientific procedures, data, and explanations to enable the replication of results. Use computer technology to assist in communicating these results. Critical review is important in the analysis of these results.
 6. Understand that: Scientific habits of mind and other sources of knowledge and skills are essential to scientific inquiry. Habits of mind include tolerance of ambiguity, skepticism, openness to new ideas, and objectivity. Other knowledge and skills include mathematics, reading, writing, and technology.
 - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society

Students should know that:

1. Advances in technology can expand the body of scientific knowledge. Technological tools allow people to observe objects and phenomena that otherwise would not be possible. Technology enhances the quality, accuracy, speed and analysis of data gathered.

Students should know that:

2. Science and technology in society are driven by the following factors: economical, political, cultural, social, and environmental. Increased scientific knowledge and technology create changes that can be beneficial or detrimental to individuals or society through impact on human health and the environment.

History and Context of Science

Students should know that:

1. Over the course of human history, contributions to science have been made by different people from different cultures. Studying

some of these contributions and how they came about provides insight into the expansion of scientific knowledge.

Students should be able to:

- Use knowledge of human body systems to synthesize research data and make informed decisions regarding personal and public health.
- Research and report on how body systems are affected by lifestyle choices such as diet or exercise (for example lack of exercise leads to cardiovascular disease).

Standard 6: Life Processes

Structure/Function Relationship

Students should know that:

2. Living systems in all kingdoms demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, tissues, organs, organ systems, and organisms.

Students should be able to:

- Explain that human body systems are comprised of organs (e.g., the heart, the stomach, and the lungs) that perform specific functions within one or more systems.

Students should know that:

6. The human body has systems that perform functions necessary for life. Major systems of the human body include the digestive, respiratory, reproductive, and circulatory systems.

Students should be able to:

- Label and describe the functions of the basic parts of the circulatory system including the heart, arteries, veins and capillaries.
- Label and describe the functions of the basic parts of the male and female reproductive systems.
- Label and describe the functions of the basic parts of the respiratory system including the trachea, bronchi and lungs.
- Label and describe the functions of the basic parts of the digestive tract including the mouth, esophagus, stomach, small intestine, liver, large intestine (colon), rectum and anus.
- Express how the human circulatory, respiratory, and digestive systems work together to carry out life processes.
- Trace how the circulatory, respiratory, and digestive systems interact to transport the food and oxygen required to provide energy for life processes.

Regulation and Behavior

Students should know that:

1. Regulation of an organism's internal environment involves sensing external changes in the environment and responding physiologically to keep conditions within the range required for survival (e.g. changes in environmental temperature leading to changes in color of fur).

Students should be able to:

- Conduct simple investigations (how the body reacts to exercise, changes in temperature, etc.) to determine how the systems in

the human organism respond to various external stimuli to maintain stable internal conditions.

Life Processes and Technology Application

Students should know that:

1. Technological advances in medicine and improvements in hygiene have helped in the prevention and treatment of illness.

Students should know that:

2. The functioning and health of organisms are influenced by many factors (i.e., heredity, diet, lifestyle, bacteria, viruses, parasites, and the environment). Certain body structures and systems function to protect against disease and injury.

Students should be able to:

- Use knowledge of human body systems to synthesize research data and make informed decisions regarding personal and public health.
- Research and report on how body systems are affected by lifestyle choices such as diet or exercise, for example lack of exercise leads to cardiovascular disease.

Big Ideas

Systems- the human body has interrelated systems that are composed of related organs and other components. Systems and organs are part of the way people organize living systems from cells, to tissues, organs, to organ systems to organisms. (Discuss further).

Investigations – There are multiple methods of solving problems in science. There are trade-offs associated with various methods of collecting data.

Evidence- People use observations and data to support scientific explanations.

Models- Models are used to study body systems and understand how they function.

Structure and function- The structure of body systems and organs is related to the function in a complementary manner.

Unit Enduring Understandings

Students will understand that...

1. Scientific inquiry of human body systems involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to prior scientific knowledge and theory, and communicating and justifying the explanation. There are many ways to problem solve in science, not just one scientific method.
2. Science and technology drive each other forward.
3. Understanding past contributions is essential in building scientific knowledge.
4. Human body systems, from tissues to organ systems, demonstrate the complementary nature of structure and function.
5. Organisms respond to internal and external cues, which aids in their survival.

6. The life processes of organisms are affected by their interactions with other organisms and with their environment. They and may be altered by human manipulation. Life style decisions impact the health of the body.

Unit Essential Question(s)

What makes a question scientific? What constitutes evidence? When do you know you have enough evidence?
Why is it necessary to justify and communicate an explanation? What ethical issues arise when studying people scientifically?

How do science and technology influence each other in studying people scientifically?

How have past scientific contributions influenced current scientific understanding of the world?

How does structure relate to function in human body organs and systems?

How do responses to internal and external cues aid in an organism's survival?

What can we do to benefit the health of humans and other organisms?

Knowledge & Skills

Students will know....

1. The traditional scientific method involves asking a question, generating a testable hypothesis, collecting evidence, analyzing data, and drawing conclusions. Scientific problem solving, however, is a varied process.
2. Good experimental design involves an accurately described procedure, variables and constants, the use of a control, appropriate use of qualitative or quantitative data, and a large sample size. This structure allows other scientists to then replicate the experiment.
3. Scientists use research and experimentation to prove or disprove some hypothesis.
4. When making a decision involving a complex issue, there are trade offs.
5. Historically, people have contributed to the development of scientific ideas.
6. Scientific ethics must be considered when discussing whether investigations should be conducted.
7. In medicine, clinical trials are used to test the effectiveness of medicines. Clinical trials involve a placebo group and use a large sample size.
8. Graphed data often reveals patterns that are not apparent otherwise.
9. Human responses to stimuli may vary (example: response to touch).
10. A variable is a factor that may affect the result of an investigation if it is not held constant. Good experimental design involves controlling variables.
11. Human sensory receptors for touch detect environmental stimuli. This information travels through the nervous system where it is processed in the brain.
12. Data can be either qualitative or quantitative. Both are important when studying people scientifically.

13. Major systems of the human body include the digestive, respiratory, excretory, circulatory, muscular, skeletal, reproductive, and nervous.++
14. Body systems are composed of organs. Each organ has a specific structure that relates to its function.
15. The liver removes toxins, digests fats, and regulates sugar and cholesterol. The liver helps the body respond to toxic substance that have been ingested.
16. Mechanical and chemical processes help to break down food. The greater the surface area, the faster the chemical break down. Mechanical break down increases this surface area.
17. The digestive system is a group of organs that breaks food down into smaller particles and contributes to food absorption. ++
18. Food must be broken down in order to be absorbed. Nutrients are absorbed into the circulatory system which carries them throughout the body. Waste is eliminated.
19. Weight gain or loss results when the input of food and output of energy (exercise) are not in balance.
20. Foods differ in nutritional content. Reading and interpreting nutritional labels is necessary to make good dietary decisions.
21. The respiratory system brings in oxygen and releases carbon dioxide for use in the body. Lungs provide a surface area for oxygen to enter and carbon dioxide to leave the blood.
22. Blood is part of the circulatory system. Blood transports gases, nutrients, and wastes.
23. Cells in organs use the oxygen and nutrients carried by the blood, and produce carbon dioxide as a waste.
24. The liver, kidneys, and large intestine help remove waste. The stomach and small intestine help in absorbing nutrients.
25. The heart functions to pump blood around the body. It has four chambers to pump blood to the lungs and body. Valves control the direction and the flow of blood and allow it to move under pressure.
26. Heart rate changes to keep blood oxygen levels in the range needed to survive. Heart rate can be quantified and is an indicator of health.
27. Cardiovascular disease is the number one cause of death in the United States. Understanding how the body works can help people make decisions about health.
28. The circulatory system is composed of the heart, blood, arteries, veins, and capillaries which function to transport gases, nutrients, and wastes in the body.

Students will be able to...

1. Describe and use scientific problem solving and experimental design.
2. Compare and contrast different ways science is used to study people.
3. Design and conduct an investigation using elements of good experimental design.
4. Use a variety of models to illustrate the components, functions, and interactions of the circulatory, digestive, and respiratory systems.
5. Evaluate a nutritional label to determine the nutritional value of the source of food as a part of a balanced diet.
6. Evaluate and use qualitative and quantitative data to form explanations and make decisions. Choices can then be made know that are appropriate to various situations.

7. Use specific equipment to measure various circulatory and respiratory functions.

**Stage 2: Assessment Evidence
(Design Assessments To Guide Instruction)**

Suggested Performance Task(s)

Assessment questions and rubrics are taken from the *My Body and Me* curricular teacher guide. (*My Body and Me*. Science Education for Public Understanding Program. 2001. The Regents of the University of California. Published by Lab Aids. Ronkonkoma, NY.)

1. Activity 2: Question 2b. Formative assessment on evidence and trade offs in experimental design.
2. Activity 2: Question 5. Formative assessment on evidence and trade offs in experimental design.
3. Activity 4: Question 5. Formative assessment of understanding of representational models, a placebo, and reading a data table.
4. Activity 7: Touch Test Data, Sensitivity to Two Points: Class Results Graph. . Formative analysis of data collection, graphing, and use of good experimental design.
5. Activity 8: Question 4. Formative assessment of student understanding of the elements of good experimental design
- 6.

Rubrics/checklists for Performance Tasks

Assessment questions and rubrics are taken from the *My Body and Me* curricular teacher guide. (*My Body and Me*. Science Education for Public Understanding Program. 2001. The Regents of the University of California. Published by Lab Aids. Ronkonkoma, NY.)

Other Evidence

1. Activity 2- Notes on Pellagra Story. These notes serve as evidence of student understanding of scientific problem solving (stating the problem being investigated, hypothesis, evidence, and conclusions).
2. Activity 3- Collection of data on student worksheets provides formative evidence of student understanding of scientific data collection and graphing.
3. Activity 4-Testing Medicines Scientifically- Students read about placebo-controlled testing and make decisions about complex

issues often involving trade-offs (giving up one thing in favor of another)

4. Activity 5-Can You Feel the Difference?-Students are introduced to variables while conducting an exploratory investigation into human sensitivity to touch. This concept is expanded in Activity 7: Human Variation
5. Activity 8-Studying People- Students read about how qualitative and quantitative data are used to study people and how this data is important in providing a complete description of an experiment and its results. Activity 9-Data Toss reinforces the idea of collecting both quantitative and qualitative data using an activity testing student's ability to catch a ball with one vs. two hands.
6. Activity 12-Whats Happening Inside? Students create a 3 D model of the human body system to expose their misconceptions about the sizes and locations of human organs.
7. Activities 13 (Living With Your Liver), 14(Breakdown) 15 (Digestion) 17 (Gas Exchange) all reinforce the idea of systems in the body and how they help regulate the internal environment.
8. Activities 18 (The Circulation Game) Students use a class modeling game to demonstrate the path of blood as it travels through the human circulatory system.
9. Activity 21- Inside a Pump and Activity 22: The Heart-A Muscle- mechanical pumps are used to serve as a model showing how the human heart pumps blood throughout the body.
10. Activity 26: Heart Sounds-Students listen to an audiotape of normal and abnormal heart sounds to introduce the idea of ways to diagnose heart problems.
11. Activity 27: The Pressure's On-Students use models to demonstrate the effects of high blood pressure

Student Self-Assessment and Reflection

Students will keep a journal throughout this unit. All notes, questions, data and reflections will be recorded in the journal.

Daily warm ups, bell ringers will be given to self assess and will also be recorded in the student's journal.

Students take a heart risk quiz to evaluate their own voluntary and involuntary risk factors for heart disease

Stage 3: Learning Plan (Design Learning Activities To Align with Goals and Assessments)

Key learning events needed to achieve unit goals

Resource: The Regents of the University of California. *SEPUP: My Body and Me*. 2005.

Part I: Studying People Scientifically

1. Activity 1: *Solving Problems: Saving Fred*. Students investigate scientific problem solving through saving Fred (a gummy worm) from drowning and discuss the variations among problem solving techniques Prelude to this activity lets students know where the

unit, Studying People Scientifically, is headed and what is expected of them.

2. Activity 2: *The Pellagra Story*. Students watch a video on the story of pellagra (H) and consider the common elements shared by all scientific problems solving as they analyze Dr. Goldberg's research. Question 2b provides formative assessment on student recognition of evidence and trade offs. Question 5 provides formative assessment on evidence and trade offs.
3. Activity 3: *A Clinical Trial*. Students investigate how medicines are tested in clinical trials through simulation of a clinical trial using lemonade. Following procedures, students collect and analyze data and evaluate the trade offs.
4. Activity 4: *Testing Medicines Scientifically*. Students read about the role of the FDA on product safety and effectiveness then discuss informed consent, treatment and control groups, and the placebo effect.
5. Activity 5: *Can You Feel the Difference?* Students learn about variables through experimentation involving the sense of touch. Analysis questions allow for students to rethink and revise their findings.
6. Activity 6: *Finding the Nerve*. Students are introduced to the role of touch receptors in the nervous system through reading about the nervous system. Analysis questions provide discussion on student thinking.
7. Activity 7: *Human Variation*. Variation among individuals is investigated through inquiring into touch sensitivity. Students are challenged to determine the smallest distance between two points felt, follow procedures, and discuss the investigation through analysis journaling questions. The SALI web site provides an opportunity to post data and explore data form other schools.
8. Activity 8: *Studying People*. Students are challenged to think about how qualitative and quantitative data are used when testing a hypothesis and do this through reading and discussion of Dr. Goldberg's pellagra experiment, data, and conclusions.
9. Activity 9: *Data Toss*. Concepts of good experimental design are used to collect both qualitative and quantitative data on catching a ball with one hand versus two hands. Students follow a procedure in designing the experiment and follow up with discussion. Mathematics integration on calculation of the mean, median, and mode of the class is done.
10. Activity 10: *Evaluating Clinical Trials*. Students use knowledge of good experimental design to evaluate different clinical trial proposals. Students identify trade offs, elements of good design, and reflect on how scientists solve problems.

Part II- Body Works

11. Activity 11: *Sick Day*. Students consider the trade offs of taking a medicine when ill by weighing simulated information from doctors, relatives, siblings, and the medicine label. Evidence, placebo, trade offs, data (qualitative and quantitative) are analyzed.
12. Activity 12: *What's Happening Inside*. Student misconceptions about body systems are brought forth as they construct a clay model of the human body's muscular, nervous, excretory, digestive, respiratory, circulatory, and reproductive systems. After analysis and discussion, they create a full size model. Students learn to identify organs within the systems and describe the major function of the organ.
13. Activity 13: *Living with Your Liver*. Students take on roles in a play about the function of the liver. Discussion of the function of the liver, disease of the liver (cirrhosis) and keeping the liver healthy are discussed.
14. Activity 14: *Breakdown*. Students model the processes of mechanical and chemical breakdown of food to learn the importance of chewing food in providing nutrients to the body. They plan an investigation using good experimental design techniques, identify the variables kept constant, and discuss how the digestive system functions to provide nutrients to the body.
15. Activity 15: *Digestion*. Students read an article about food breakdown, absorption of nutrients, and getting rid of waste products,

and discuss each segment as they read the article.

16. Activity 16: *Balancing Act*. Students learn to read nutrition labels and use elements of problem solving as they design an energy bar meeting specific requirements. Comparison and contrast of scientific investigation and experimental design is emphasized.
17. Activity 17: *Gas Exchange*. Students are challenged to determine, quantitatively, how much carbon dioxide is in their exhaled breath. Using an indicator, students follow titration procedures to calculate the carbon dioxide amount.
18. Activity 18: *The Circulation Game*. Students are challenged to trace the flow of blood as it travels around the body. They do this through a large model of the circulatory system and play a game called the circulation game.
19. Activity 19: *Heart-ily Fit*. Students collect heart rate data before and after exercising and use this data to create and analyze a graph.
20. Activity 20: *Great Aunt Lily's Will*. The class watches students role play "Great Aunt Lily's Will" and decide on the best use of limited funds to fight heart disease and promote public health.
21. Activity 21: *Inside a Pump*. Mechanical pumps serve as potential models for the human heart as students experiment with the pumps.
22. Activity 22: *The Heart-A Muscle*. Students evaluate the strength of the heart muscle by attempting to pump water at the same rate as their resting pulse (in beats per minute). They then compare the volume of water they pumped to the volume of blood the heart pumped in the same amount of time.
23. Activity 23: *Heart Parts*. Students investigate the functions of the blood vessels and the major structures of the heart
24. Activity 24: *Round and Round*. Students use their understanding of the circulatory system to model how the heart pumps blood to the lungs and the rest of the body. They use pressure bulbs to model the double-pump circulatory system of mammals.
25. Activity 25: *Healing the Heart*. Students watch video segments on heart surgery and organ transplants. The class discusses the trade-offs in developing new treatments for heart disease.
26. Activity 26: *Heart Sounds*. An audiotape of normal and abnormal heart sounds introduces the use of heart sounds and their relationship to the heart cycle to diagnose heart problems.
27. Activity 27: *The Pressure's On*. Students investigate the effects of high blood pressure by using clamps on the tubing of the circulatory system simulation.
28. Activity 28: *Heart Problems*. Students read about high blood pressure, heart disease, and heart attacks. "Stopping to Think" sections encourage them to think about and apply the information they are reading.
29. Activity 29: *Helping Hearts*. A heart risk quiz helps evaluate their voluntary and involuntary risk factors for heart disease. After considering the reasons many adolescents do not reduce their voluntary risks, students produce brochures designed to convince their peers to reduce their risk of heart disease.

Resources & Teaching Tips

SEPUP Science Education For Public Understanding Program My Body and Me
Science and Life Issues

○ **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

Students have many misconceptions about the sizes and locations of human organs. Activities in this unit help to address these misconceptions.

Research indicates that elementary students may believe that a system of objects must be doing something (interacting) in order to be a system. Research shows that student misconceptions about systems arise from their difficulty in recognizing that a natural phenomenon (e.g., the human body) occurs by systems working independently and together (e.g., circulatory, respiratory, nervous, digestive). Studies of student thinking show that, at all ages, they tend to interpret phenomena by noting the qualities of separate objects rather than by seeing the interactions between the parts of a system.

For upper elementary-school students, research specific to the human body indicates that, in terms of *internal bodily organs*, upper elementary students are able to list a large number of organs. In terms of the *nervous system*, they know the brain helps the body parts but do not always realize the converse (that the body helps the brain). They do know, however, that nerves conduct messages, control activity, and stabilize the body. Upper elementary students do not understand the brain's role in controlling involuntary behavior. In terms of the *digestive system*, once students reach the fifth grade, they know that food undergoes a transformation process in the body. In terms of the *respiratory system*, they associate the lungs' activities with breathing. Further, they may have some knowledge about the exchange of gases in the lungs and understand that air goes to all parts of the body. In terms of the *circulatory system*, upper elementary-school students realize that the heart is a pump, but they do not realize that the blood returns to the heart

Accommodation/Differentiation ideas and tips

Multisensory presentation of new information – (visual overhead, auditory lecture, kinesthetic note taking and model)

Visual aids around the room which demonstrate concepts.

Weekly lab activities that allow for kinesthetic, visual, and experimental validation of concepts.

Varied instruction through a single class period.

Handout materials for retention in binder or notebook.

Outside materials for enrichment.