Grades 9-12 Science
HN Anatomy & Physiology

The Human Body: An Orientation

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

Life in Christ

Students will be able to

7. Assume personal responsibility (CCC 1914).

11. Respect all human life (CCC 2318).

12. Respect the integrity of all creation, including animals, plants, and all nature (CCC 2415).

The Celebration of the Christian Mystery

Students will be able to

2. Understand that God blessed all living beings (CCC 1080).

Targeted Standards

NGSS Grade 9-12 NGSS: Science and Engineering Practices

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 912 builds on K8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 912 builds on K8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Construct and revise 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.

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 912 builds on K8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 912 builds on K8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

Evaluate a question to determine if it is testable and relevant.

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 912 builds on K8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

OH Grade 9-12 OH: Science (2011)

HS Biology

Science Inquiry and Application During the years of grades 9 through 12 all students must use the following scientific processes to construct their knowledge and understanding in all science content areas:

Identify questions and concepts that guide scientific investigations;

Design and conduct scientific investigations;

Use technology and mathematics to improve investigations and communications;

Formulate and revise explanations and models using logic and evidence (critical thinking);

Recognize and analyze explanations and models

Communicate and defend a scientific argument.

Course Content:Cells

Cell structure and function: Structure, function and interrelatedness of cell organelles

Cell structure and function: Eukaryotic cells and prokaryotic cells

Cellular processes: Characteristics of life regulated by cellular processes

Cellular processes: Photosynthesis, chemosynthesis, cellular respiration

OH Grades 9-10 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Text Types and Purposes 1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

WHST.9-10.1. Write arguments focused on discipline-specific content.

WHST.9-10.1b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audiences knowledge level and concerns.

WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Draw evidence from literary or informational texts to support analysis, reflection, and research.

WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.9-10.2. Determine the central ideas or conclusions of a text; trace the texts explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Integration of Knowledge and Ideas 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. 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.

Read and comprehend complex literary and informational texts independently and proficiently.

RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 910 text complexity band independently and proficiently.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the concepts of anatomy and physiology, the basic organs and functions of the 11 body organ systems, structure and function of cell parts in eukaryotic cells, and anatomical terminology. Students are expected to be able to identify, distinguish, and describe the functions of cell parts. As stated by the Ohio Department of Education, focus should be on the concept of the cell as a functioning, interconnected living system rather than on memorization of cell parts. In addition, students should be able to distinguish characteristics which help students to compare and contrast eukaryotic and prokaryotic cells.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells and homeostasis.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Compare the studies of anatomy and physiology.
2. Contrast the studies of anatomy and physiology.
3. identify the 11 organ systems of a human.
4. Describe the major organs and functions of each organ system.
5. Identify the basic necessities and life functions of a human.
6. Apply proper anatomical vocabulary to describe various body regions.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback. Multicellular organisms perform functions which may not exist in other unicellular organisms.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. Anatomy is the study of the structure of an organism, and physiology is the study of the functioning of an organism.
5. Humans are composed of 11 organ systems which work together to maintain a homeostatic balance.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
3. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
4. Anatomy and physiology, though differing in focus, work together to describe how the "form" of a structure affects its "function."
5. The 11 organ systems of a human must work together to maintain the homeostatic balance of an individual person.

Content

**cell types**

1. eukaryotes

**cell organelles**

1. nucleus

**cellular processes**

1. cellular respiration
2. ATP

**anatomy**

**physiology**

**organ systems**

1. integumentary
2. skeletal
3. muscular
4. nervous
5. cardiovascular
6. respiratory
7. digestive
8. urinary
9. endocrine
10. lymphatic
11. reproductive

**anatomical vocabulary**

**homeostasis**

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Describe anatomy.

Describe physiology.

Draw visual diagrams to represent various concepts presented in class.

Identify the reactants and products in a chemical equation.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the 11 organ systems of the human body.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish between anatomy and physiology.
2. Compare the similarities between: anatomy and physiology; the 11 organ systems.
3. Contrast the differences between: anatomy and physiology; the 11 organ systmes.

**Apply (DOK Level 2)**

1. Show where the 11 organ systems are found in the body.

**Analyze (DOK Level 3)**

1. Outline the major organs and functions of the 11 organ systems.

**Evaluate (DOK Level 3 and Level 4)**

1. Assess the impact of changes in a body's environment on its ability to function and respond to maintain homeostasis.

**Create (DOK Level 4)**

1. Generate solutions to deal with situation when the body is not at homeostasis.

Essential Questions

1. What cell parts are common to all humans?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?
6. How do the studies of anatomy and physiology give scientists an understanding of how living organisms function?
7. How do the 11 organ systems interact to maintain homeostasis in an individual?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

The Human Body: An Orientation review packet p. 1-15

Quizzes

Summative: Quiz

Organ systemsAnatomical vocabulary

Unit Exam

Summative: Unit Exam

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.

Grades 9-12 Science
HN Anatomy & Physiology

Cells and Tissues

Stage 1: Desired Results

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Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the structure and function of cell parts in eukaryotic cells. Students are expected to be able to identify, distinguish, and describe the functions of cell parts. As stated by the Ohio Department of Education, focus should be on the concept of the cell as a functioning, interconnected living system rather than on memorization of cell parts.

In this unit, students should be able to explain how matter and energy are conserved during the process of cellular respiration. In addition, students need to be able to connect content presented in this unit with information presented in previous units, including macromolecules and chemical behavior of elements and molecules.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells (e.g., change in carbon dioxide levels in a pond affects the rate of photosynthesis in phytoplankton) and homeostasis.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Identify and describe cell parts in eukaryotic cells.
2. Describe the cell theory.
3. Describe how cell parts work together to create a complex living system which helps the cell carry out various processes.
4. Describe how cells obtain and transform energy through cellular respiration.
5. Connect content from previous units to current concepts presented in this unit to describe how the molecular level affects the cellular level of an organism.
6. Compare the 4 main tissue types.
7. Contrast the 4 main tissue types.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. Through cell specialization, cells are organized into 4 tissue types, each with unique characteristics.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. Cellular processes can be understood in terms of transformation of matter and energy through cellular respiration.
3. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
4. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
5. In multicellular organisms, cells are specialized to perform certain functions.
6. Groups of cells work together, forming tissues.

Content

**cell types**

1. eukaryotes

**cell organelles**

1. nucleus
2. nucleolus
3. mitochondria
4. golgi apparatus
5. endoplasmic reticulum
6. cytoskeleton
7. centriole
8. lysosome
9. ribosome
10. cell membrane
11. cell wall
12. vacuole
13. chloroplast
14. peroxisomes

**cellular processes**

1. cellular respiration
2. ATP

**tissues**

1. epithelial
2. connective
3. muscular
4. nervous

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Identify the reactants and products in a chemical equation.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the 4 tissue types.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish among the 4 tissue types through a microscope.
2. Compare the similarities among the 4 tissue types.
3. Contrast the differences among the 4 tissue types.

**Apply (DOK Level 2)**

1. Show where in the cell various organelles are located.

**Analyze (DOK Level 3)**

1. Outline the major parts of each cellular process.
2. Investigate the effects of changes in the external environment on the internal environment of a cell.

**Evaluate (DOK Level 3 and Level 4)**

1. Recommend suggestions for further investigation based on results from current investigations.

**Create (DOK Level 4)**

1. Formulate a hypothesis to test the effects of changes on the external environment on a cell.
2. Compose a thoughtful and detailed analysis to describe the relationship between cellular processes and proper functioning of the cell.

Essential Questions

1. What cell parts are common to all living organisms?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. How are cellular parts utilized to produce various macromolecules in the cell?
6. What role do macromolecules play in cellular processes occurring within the cell?
7. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

Cells and Tissues review packet p. 33-50

Quizzes

Summative: Quiz

Organelles

Identifying Tissue Types

Summative: Lab Assignment

Students were to use a microscope to observe slides with various types of tissue and identify what they are observing.

Unit Exams

Summative: Unit Exam

Exam Part 1 (given midway through unit): cellsExam Part 2 (given at end of unit): tissues

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.

Technology Integration

**iPad Apps (Free):**

1. iCell (Hudson Alpha iCell)

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.

Grades 9-12 Science
HN Anatomy & Physiology

The Skeletal System

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

Life in Christ

Students will be able to

7. Assume personal responsibility (CCC 1914).

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The Celebration of the Christian Mystery

Students will be able to

2. Understand that God blessed all living beings (CCC 1080).

Targeted Standards

NGSS Grade 9-12 NGSS: Science and Engineering Practices

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 912 builds on K8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 912 builds on K8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Construct and revise 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.

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 912 builds on K8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 912 builds on K8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

Evaluate a question to determine if it is testable and relevant.

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 912 builds on K8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

OH Grade 9-12 OH: Science (2011)

HS Biology

Science Inquiry and Application During the years of grades 9 through 12 all students must use the following scientific processes to construct their knowledge and understanding in all science content areas:

Identify questions and concepts that guide scientific investigations;

Design and conduct scientific investigations;

Use technology and mathematics to improve investigations and communications;

Formulate and revise explanations and models using logic and evidence (critical thinking);

Recognize and analyze explanations and models

Communicate and defend a scientific argument.

Course Content:Cells

Cell structure and function: Structure, function and interrelatedness of cell organelles

Cell structure and function: Eukaryotic cells and prokaryotic cells

Cellular processes: Characteristics of life regulated by cellular processes

Cellular processes: Photosynthesis, chemosynthesis, cellular respiration

OH Grades 9-10 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Text Types and Purposes 1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

WHST.9-10.1. Write arguments focused on discipline-specific content.

WHST.9-10.1b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audiences knowledge level and concerns.

WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Draw evidence from literary or informational texts to support analysis, reflection, and research.

WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.9-10.2. Determine the central ideas or conclusions of a text; trace the texts explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Integration of Knowledge and Ideas 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. 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.

Read and comprehend complex literary and informational texts independently and proficiently.

RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 910 text complexity band independently and proficiently.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the structures skeletal (connective tissue). Students are expected to be able to identify, distinguish, and describe the functions of the skeletal system.

In this unit, students should be able to explain the gross and microscopic anatomy of long bone, the bones of the skeletal system, the joints between bones, developmental aspects of bone, and homeostatic imbalances involving the skeletal system.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Identify and describe cell parts in eukaryotic cells.
2. Describe the cell theory.
3. Describe how cell parts work together to create a complex living system which helps the cell carry out various processes.
4. Describe how cells obtain and transform energy through cellular respiration.
5. Connect content from previous units to current concepts presented in this unit to describe how the molecular level affects the cellular level of an organism.
6. Describe the microscopic and gross anatomy of a long bone.
7. Identify the bones of the human body.
8. Describe the physiology of a long bone.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. The skeletal system provides support and protection for the body.
5. The physiology of a bone is related to its anatomy.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. Cellular processes can be understood in terms of transformation of matter and energy through cellular respiration.
3. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
4. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
5. In multicellular organisms, cells are specialized to perform certain functions.
6. Groups of cells work together, forming tissues.
7. The skeletal system is essential for structure, movement, and protection of the human body.

Content

**cell types**

1. eukaryotes

**cell structures**

1. nucleus
2. extracellular matrix
3. collagen fibers

**cellular processes**

1. cellular respiration
2. ATP

**tissues**

1. connective

**bones of the human body**

**fractures**

**joints**

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Identify the reactants and products in a chemical equation.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the bones of the human body.

Identify the joints of the human body.

Identify various fractures which can affect bones.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish among the 4 types of bones.
2. Compare the similarities among the 4 types of bones.
3. Contrast the differences among the 4 types of bones.
4. Compare and contrast the different types of fractures.
5. Compare and contrast the different types of joints.

**Apply (DOK Level 2)**

1. Show where in the various bones of the body are located.

**Analyze (DOK Level 3)**

1. Outline how each part of the microscopic anatomy of long bone contributes to the overall physiology of the bone.

**Evaluate (DOK Level 3 and Level 4)**

1. Recommend suggestions for dealing with various types of fractures.
2. Recommend suggestions for dealing with joint disorders, such as arthritis.

**Create (DOK Level 4)**

1. Formulate a hypothesis to test the effects of changes on the external environment on a long bone.
2. Formulate a hoypothesis to test the effects of changes on the external environmnet on a joint.

Essential Questions

1. What cell parts are common to all living organisms?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. How are cellular parts utilized to produce various macromolecules in the cell?
6. What role do macromolecules play in cellular processes occurring within the cell?
7. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?
8. How is the anatomy of a long bone related to its function?
9. How is the arrangement of the skeleton allow it to perform its functions?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

The Skeletal System review packet p. 73-98

Quizzes

Summative: Quiz

Labeling the bones of the skullLabeling the bones of the pectoral girdle and armsLabeling the bones of the pelvic girdle and leg

Unit Exams

Summative: Unit Exam

Exam Part 1 (given midway through unit): microscopic and gross anatomy oof long bone, axial skeleton, fracturesExam Part 2 (given at end of unit): appendicular skeleton, joints, homeostatic imbalances

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.

Technology Integration

**iPad Apps (Free):**

1. iCell (Hudson Alpha iCell)
2. Essential Skeleton 2 (Skeleton)

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.

Grades 9-12 Science
HN Anatomy & Physiology

The Muscular System

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

Life in Christ

Students will be able to

7. Assume personal responsibility (CCC 1914).

11. Respect all human life (CCC 2318).

12. Respect the integrity of all creation, including animals, plants, and all nature (CCC 2415).

The Celebration of the Christian Mystery

Students will be able to

2. Understand that God blessed all living beings (CCC 1080).

Targeted Standards

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Practice 4. Analyzing and interpreting data

Analyzing data in 912 builds on K8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

OH Grade 9-12 OH: Science (2011)

HS Biology

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Communicate and defend a scientific argument.

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Cell structure and function: Eukaryotic cells and prokaryotic cells

Cellular processes: Characteristics of life regulated by cellular processes

Cellular processes: Photosynthesis, chemosynthesis, cellular respiration

OH Grades 9-10 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Text Types and Purposes 1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

WHST.9-10.1. Write arguments focused on discipline-specific content.

WHST.9-10.1b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audiences knowledge level and concerns.

WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Draw evidence from literary or informational texts to support analysis, reflection, and research.

WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

Capacities of the Literate Individual

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They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.9-10.2. Determine the central ideas or conclusions of a text; trace the texts explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Integration of Knowledge and Ideas 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. 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.

Read and comprehend complex literary and informational texts independently and proficiently.

RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 910 text complexity band independently and proficiently.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the cell parts, structure, and function of muscular tissue. Students are expected to be able to identify, distinguish, and describe the functions of the muscular system.

In this unit, students should be able to explain the gross and microscopic anatomy of skeletal muscle, the muscles of the muscular system, the movements of muscle at joints, developmental aspects of muscle, and homeostatic imbalances involving the muscular system.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Identify and describe cell parts in eukaryotic cells.
2. Describe the cell theory.
3. Describe how cell parts work together to create a complex living system which helps the cell carry out various processes.
4. Describe how cells obtain and transform energy through cellular respiration.
5. Connect content from previous units to current concepts presented in this unit to describe how the molecular level affects the cellular level of an organism.
6. Describe the microscopic and gross anatomy of a muscle.
7. Identify the muscles of the human body.
8. Describe the physiology of a muscle.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. The muscular system allows motion of the body and protection for visceral organs..
5. The physiology of a muscle is related to its anatomy.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. Cellular processes can be understood in terms of transformation of matter and energy through cellular respiration.
3. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
4. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
5. In multicellular organisms, cells are specialized to perform certain functions.
6. Groups of cells work together, forming tissues.
7. The muscular system is essential for movement, protection, and the production of heat in the human body.

Content

**cell types**

1. eukaryotes

**muscle fibers**

**cell structures**

1. nucleus
2. myofibrils
3. sarcomeres
4. fascilces
5. myofilaments
6. actin
7. myosin

**cellular processes**

1. cellular respiration
2. ATP

**tissues**

1. muscular

**muscle contraction**

1. action potential
2. all-or-nothing
3. sliding filament theory

**muscles of the human body**

**body movements**

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Identify the reactants and products in a chemical equation.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the muscles of the human body.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish among the 3 types of muscles: skeletal, smooth, and cardiac.
2. Compare the similarities among the 3 types of muscles.
3. Contrast the differences among the 3 types of muscles..
4. Compare and contrast the different ways muscles get energy.

**Apply (DOK Level 2)**

1. Show where in the various muscles of the body are located.

**Analyze (DOK Level 3)**

1. Outline how an action potential causes a muscle contraction.

**Evaluate (DOK Level 3 and Level 4)**

1. Recommend suggestions for dealing with muscle fatigue.

**Create (DOK Level 4)**

1. Formulate a hypothesis to test the effects of changes on the external environment on a muscle.

Essential Questions

1. What cell parts are common to all living organisms?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. How are cellular parts utilized to produce various macromolecules in the cell?
6. What role do macromolecules play in cellular processes occurring within the cell?
7. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?
8. How is the anatomy of a muscle related to its function?
9. How is the arrangement of the muscular allow it to perform its functions?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

The Muscular System review packet p. 103-126

Quizzes

Summative: Quiz

Labeling the muscles of the body

Unit Exams

Summative: Unit Exam

Exam Part 1 (given midway through unit): microscopic and gross anatomy of skeletal muscle and the muscle contractionsExam Part 2 (given at end of unit): muscles of the body, body movements, homeostatic imbalances, and developmental aspects of the muscular system

Lab exercises

Summative: Lab Assignment

Microscopic Anatomy and Organization of Skeletal MuscleGross Anatomy of the Muscular System

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.

Technology Integration

**iPad Apps (Free):**

1. Essential Skeleton 2 (Skeleton)

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.

Grades 9-12 Science
HN Anatomy & Physiology

The Nervous System

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

Life in Christ

Students will be able to

7. Assume personal responsibility (CCC 1914).

11. Respect all human life (CCC 2318).

12. Respect the integrity of all creation, including animals, plants, and all nature (CCC 2415).

The Celebration of the Christian Mystery

Students will be able to

2. Understand that God blessed all living beings (CCC 1080).

Targeted Standards

NGSS Grade 9-12 NGSS: Science and Engineering Practices

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 912 builds on K8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 912 builds on K8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

Construct and revise 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.

Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Practice 7. Engaging in argument from evidence

Engaging in argument from evidence in 912 builds on K8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 912 builds on K8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.

Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.

Evaluate a question to determine if it is testable and relevant.

Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 912 builds on K8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

OH Grade 9-12 OH: Science (2011)

HS Biology

Science Inquiry and Application During the years of grades 9 through 12 all students must use the following scientific processes to construct their knowledge and understanding in all science content areas:

Identify questions and concepts that guide scientific investigations;

Design and conduct scientific investigations;

Use technology and mathematics to improve investigations and communications;

Formulate and revise explanations and models using logic and evidence (critical thinking);

Recognize and analyze explanations and models

Communicate and defend a scientific argument.

Course Content:Cells

Cell structure and function: Structure, function and interrelatedness of cell organelles

Cell structure and function: Eukaryotic cells and prokaryotic cells

Cellular processes: Characteristics of life regulated by cellular processes

Cellular processes: Photosynthesis, chemosynthesis, cellular respiration

OH Grades 9-10 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Text Types and Purposes 1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

WHST.9-10.1. Write arguments focused on discipline-specific content.

WHST.9-10.1b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audiences knowledge level and concerns.

WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Draw evidence from literary or informational texts to support analysis, reflection, and research.

WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.9-10.2. Determine the central ideas or conclusions of a text; trace the texts explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Integration of Knowledge and Ideas 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. 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.

Read and comprehend complex literary and informational texts independently and proficiently.

RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 910 text complexity band independently and proficiently.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the cell parts, structure, and function of neurons. Students are expected to be able to identify, distinguish, and describe the functions of the nervous system.

In this unit, students should be able to explain the gross and microscopic anatomy of a neuron , the various types of nerve cells, the movements of muscle at joints, the physiology of a neuron, and the process of a reflex arc.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Identify and describe cell parts in eukaryotic cells.
2. Describe the cell theory.
3. Describe how cell parts work together to create a complex living system which helps the cell carry out various processes.
4. Describe how cells obtain and transform energy through cellular respiration.
5. Connect content from previous units to current concepts presented in this unit to describe how the molecular level affects the cellular level of an organism.
6. Describe the microscopic and gross anatomy of a neuron..
7. Identify the types of nerve cells of the human body.
8. Describe the physiology of a muscle.
9. Describe the components of a reflex arc.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. The nervous system receives information from stimuli, processes the information, and sends signals to effect a response.
5. A neuron transmits signals through action potentials.
6. The physiology of a neuron is related to its anatomy.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. Cellular processes can be understood in terms of transformation of matter and energy through cellular respiration.
3. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
4. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
5. In multicellular organisms, cells are specialized to perform certain functions.
6. Groups of cells work together, forming tissues.
7. The nervous system is responsible for responding to stimuli and short-term regulation of the human body.

Content

**cell types**

1. eukaryotes

**neurons (nerve cells)**

**cell structures**

1. nucleus
2. head
3. dendrites
4. axon
5. axon terminals
6. neurotransmitters
7. myelin sheaths

**cellular processes**

1. action potential

**tissues**

1. nervous

**muscle contraction**

1. action potential
2. all-or-nothing
3. sliding filament theory

**reflex arcs**

**feedback mechanisms**

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the various nerve cells of the human body.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish among the 3 types of nerve cells.
2. Compare the similarities among the types of nerve cells.
3. Contrast the differences among the nerve cells.

**Apply (DOK Level 2)**

1. Show where in the various nerve cells of the body are located.

**Analyze (DOK Level 3)**

1. Outline the process of an action potential.
2. Outline the process of a reflex arc.

**Evaluate (DOK Level 3 and Level 4)**

**Create (DOK Level 4)**

1. Formulate a hypothesis on how future research could regenerate damaged nervous tissue.

Essential Questions

1. What cell parts are common to all living organisms?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. How are cellular parts utilized to produce various macromolecules in the cell?
6. What role do macromolecules play in cellular processes occurring within the cell?
7. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?
8. How is the anatomy of a neuron related to its function?
9. How do neurons transmit information throughout the body?
10. What are the pathways that signals are sent through the body?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

The Nervous System review packet p. 131-138

Quizzes

Summative: Quiz

Labeling the structures of a neuron

Unit Exam

Summative: Unit Exam

Students will be assessed on the anatomy and physiology of a neuron, the events of an action potential, and processes involved in a reflex arc.

Lab exercises

Summative: Lab Assignment

Neuron anatomy and physiology

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.

Technology Integration

**YouTube:**

1. Video of the sodium-potassium pump

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.

Grades 9-12 Science
HN Anatomy & Physiology

The Cardiovascular System/Fetal Pig Dissection

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

8. Understand that the world was made for the glory of God, the Creator of all things (CCC 290; 293).

9. Know that we are created in God's image to serve Him and to rule over all creatures (CCC 380).

Life in Christ

Students will be able to

7. Assume personal responsibility (CCC 1914).

11. Respect all human life (CCC 2318).

12. Respect the integrity of all creation, including animals, plants, and all nature (CCC 2415).

The Celebration of the Christian Mystery

Students will be able to

2. Understand that God blessed all living beings (CCC 1080).

Targeted Standards

NGSS Grade 9-12 NGSS: Science and Engineering Practices

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Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

Practice 4. Analyzing and interpreting data

Analyzing data in 912 builds on K8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

OH Grade 9-12 OH: Science (2011)

HS Biology

Science Inquiry and Application During the years of grades 9 through 12 all students must use the following scientific processes to construct their knowledge and understanding in all science content areas:

Identify questions and concepts that guide scientific investigations;

Design and conduct scientific investigations;

Use technology and mathematics to improve investigations and communications;

Formulate and revise explanations and models using logic and evidence (critical thinking);

Recognize and analyze explanations and models

Communicate and defend a scientific argument.

Course Content:Cells

Cell structure and function: Structure, function and interrelatedness of cell organelles

Cell structure and function: Eukaryotic cells and prokaryotic cells

Cellular processes: Characteristics of life regulated by cellular processes

Cellular processes: Photosynthesis, chemosynthesis, cellular respiration

OH Grades 9-10 OH: Literacy in History/Social Studies, Science, & Technical Subjects 6-12

Writing

Text Types and Purposes 1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.

WHST.9-10.1. Write arguments focused on discipline-specific content.

WHST.9-10.1b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form and in a manner that anticipates the audiences knowledge level and concerns.

WHST.9-10.1d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.1e. Provide a concluding statement or section that follows from or supports the argument presented.

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-10.2e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

WHST.9-10.2f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

Production and Distribution of Writing 4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

WHST.9-10.6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Draw evidence from literary or informational texts to support analysis, reflection, and research.

WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.

Capacities of the Literate Individual

Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

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They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

Reading: Science & Technical Subjects

Key Ideas and Details 1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

RST.9-10.1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.9-10.2. Determine the central ideas or conclusions of a text; trace the texts explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.

Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.

RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Integration of Knowledge and Ideas 7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. 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.

Read and comprehend complex literary and informational texts independently and proficiently.

RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 910 text complexity band independently and proficiently.

Catholic Identity

DOC All Grades Catholic Identity

Catholic Social Justice Teachings

Rights and Responsibilities

Care for God's Creation

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit focuses on the cell parts, structure, and function of cardiovascular system, focusing on the heart. Students are expected to be able to identify and describe the parts and function of the heart. The unit and course culminates in the dissection of a fetal pig, identifying organ systems and organs studied throughout the course.

In this unit, students should be able to explain the gross anatomy of the heart and the path of blood through the heart. Students should be able to explain what they observing in their dissected fetal pigs.

Students should be able to describe and evaluate how cell processes are regulated. In addition, they should be able to recognize the influence of external changes on the internal functioning of cells.

Unit Goals

**Once students have completed this unit, they will be able to:**

1. Identify and describe cell parts in eukaryotic cells.
2. Describe the cell theory.
3. Describe how cell parts work together to create a complex living system which helps the cell carry out various processes.
4. Describe how cells obtain and transform energy through cellular respiration.
5. Connect content from previous units to current concepts presented in this unit to describe how the molecular level affects the cellular level of an organism.
6. Describe the organs of the cardiovascular system.
7. Describe the gross anatomy of the heart.
8. Describe the path of blood through the heart.
9. Identify various organ systems in a dissected fetal pig.

Big Ideas

1. Cells contain specialized parts for the purposes of transportation, energy processing, metabolism, movement, reproduction, and feedback.
2. The cell theory can be used to describe the basic structure and function of all cells.
3. Cell functions are regulated by complex interactions among different types of molecules relating to growth, metabolism, reproduction, response, and energy transformations.
4. The cardiovascular system is responsible for transporting nutrients and gases throughout the body.
5. The heart is an organ that is responsible for pumping blood throughout the body.
6. The anatomy of a fetal pig is similar to the anatomy of a human and, therefore, can be used to study the anatomy of a human.

Enduring Understandings

1. While the structure, function, and complexity of cells vary among living things, commonalities exist among all living things in terms of types of molecules and cell parts.
2. Cellular processes can be understood in terms of transformation of matter and energy through cellular respiration.
3. To fulfill the requirement for life, cells must be able to process energy in order to respond and adapt to their environment to maintain homeostasis.
4. Cell organelles work together to form a complex living system that helps all cells carry out the basic functions of life (growth, development, reproduction, metabolism, etc.).
5. In multicellular organisms, cells are specialized to perform certain functions.
6. Groups of cells work together, forming tissues.
7. The cardiovascular system is responsible for transporting nutrients and gasses throughout the body.
8. The heart is essential to pump blood throughout the body.
9. Fetal pigs have an anatomical organization similar to that of humans.

Content

**cell types**

1. eukaryotes

**cardiac muscle cells**

**cell structures**

1. nucleus
2. intercalated discs

**structures of the heart**

1. right atrium
2. right ventricle
3. left atrium
4. left ventricle

**blood vessels**

1. superior and inferior vena cava
2. pulmonary artieries
3. aorta

**valves of the heart**

**anatomical and directional terminiology**

**dissection techniques**

Skills

**Remember (DOK Level 1)**

Define vocabulary pertinent to the unit to increase content knowledge.

Recognize the organelles and macromolecules involved in cellular processes.

Identify the various organs of the cardiovascular system.

Identify the various chambers and valves of the heart.

Identify the major organ systems of a fetal pig.

**Understand (DOK Level 1 and Level 2)**

1. Distinguish between veins and arteries..
2. Distinguish among the various chambers of the heart..
3. Contrast the valves of the heart.
4. Contrast the various blood vessels entering and leaving the heart.

**Apply (DOK Level 2)**

1. Trace the path of blood through the heart..

**Analyze (DOK Level 3)**

1. Outline the process of a pumping heart.

**Evaluate (DOK Level 3 and Level 4)**

1. Evaluate the symptoms of various homeostatic imbalances of the heart.

**Create (DOK Level 4)**

1. Dissect a fetal pig.

Essential Questions

1. What cell parts are common to all living organisms?
2. How do changes in the external environment influence the internal environment of an organism?
3. How do changes in a cell's environment affect its ability to maintain homeostasis?
4. How does a cell utilize cellular parts to respond and adapt to changes in the internal and external environment of the living system?
5. How are cellular parts utilized to produce various macromolecules in the cell?
6. What role do macromolecules play in cellular processes occurring within the cell?
7. What mechanisms are involved in allowing cells to organize to create complex living systems such as tissues, organs, organ systems, and organisms?
8. How does the organization of the muscular system allow substances to travel throughout the body?
9. What is the pathway of blood through the heart?

Stage 2: Assessment Evidence

Various Formative Assessments

Formative: Class Discussion

Bell work

Various Formative Assessments

Formative: Homework

The Cardiovascular System review packet p. 203-207

Unit Exam

Summative: Unit Exam

Students will be assessed on the anatomy of the cardiovascular system and the anatomy and physiology of the heart.

Lab exercises

Summative: Lab Assignment

Fetal Pig Dissection

Stage 3: Learning Plan

Learning Experiences

1. Cooperative Learning Groups: Students will use the Jigsaw approach to explore concepts.
2. Graphic Organizer: Students will use Thinking Maps to review concepts.
3. Fetal pig dissection in groups of two

Resources

**Books:**

1. Essentials of Human Anatomy and Physiology. (2012). Pearson.
2. Fetal Pig Lab Dissection Manual.