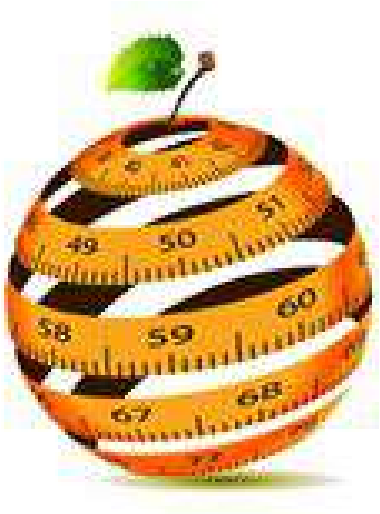
Biology Curriculum Guide



UNIT: 1 STRUCTURE AND FUNCTION
DURATION: 8 weeks

Orange Public School

Topic: Structure and Function

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Next Generation Science Standards Alignment

Life Science

Overview:

NGSS Storyline: The performance expectations in the topic Structure and Function help students formulate an answer to the question: “How do the structures of organisms enable life’s functions?” High school students are able to investigate explanations for the structure and function of cells as the basic units of life, the hierarchical systems of organisms, and the role of specialized cells for maintenance and growth. Students demonstrate understanding of how systems of cells function together to support the life processes. Students demonstrate their understanding through critical reading, using models, and conducting investigations. The crosscutting concepts of **structure and function, matter and energy, and systems and system models in organisms** are highlighted as organizing concepts.

PACING GUIDE

UNIT 1: STRUCTURE AND FUNCTION	8 WEEKS
UNIT 2: MATTER AND ENERGY	8 WEEKS
UNIT 3: HEREDITY	6 WEEKS
UNIT 4: EVOLUTION	6 WEEKS
UNIT 5: INTERDEPENDENCE	6 WEEKS

Table 1: The table uses the information in the NGSS foundation boxes to connect the high school NGSS performance expectations to the component ideas from the *Framework*.

Biology

LS1.A	HS-LS1-1.
	HS-LS1-2.
	HS-LS1-3.
LS1.B	HS-LS1-4.
LS1.C*	HS-LS1-5.
	HS-LS1-6.
	HS-LS1-7.
LS2.A	HS-LS2-1.
	HS-LS2-2.
LS2.B	HS-LS2-3.
	HS-LS2-4.
	HS-LS2-5.
LS2.C	HS-LS2-6.
	HS-LS2-7.
LS2.D	HS-LS2-8.
LS3.A	HS-LS3-1.
LS3.B	HS-LS3-2.
	HS-LS3-3.
LS4.A	HS-LS4-1.
LS4.B	HS-LS4-2.
	HS-LS4-3.
LS4.C	HS-LS4-4.
	HS-LS4-5.
	HS-LS4-6.
ETS1.A	HS-ETS1-1.
ETS1.B	HS-ETS1-3.
	HS-ETS1-4.
ETS1.C	HS-ETS1-2.

Biology Repeats

LS2.C	HS-LS2-2.
LS4.C	HS-LS4-2.
	HS-LS4-3.
LS4.D	HS-LS4-6.

Chemistry

PS1.A	HS-PS1-1.
	HS-PS1-2.
	HS-PS1-3.
	HS-PS1-4.
PS1.B	HS-PS1-5.
	HS-PS1-6.
	HS-PS1-7.
PS3.B	HS-PS3-1.
	HS-PS3-4.
PS3.D	HS-PS3-3.

LS1.C moved from Biology	
LS1.C*	HS-LS1-5.
	HS-LS1-6.
	HS-LS1-7.

Chemistry Repeats

PS1.B	HS-PS1-2.
	HS-PS1-4.
PS3.D	*HS-PS4-5.*
	HS-LS2-5.
	HS-ESS1-1.
	HS-PS3-4.
ETS1.A	HS-ETS1-1.
ETS1.B	HS-ETS1-3.
	HS-ETS1-4.
ETS1.C	HS-ETS1-2.

Key to Highlighting

PE appears in two DCIs within the same course

PE is identified in NGSS as a secondary connection to this

PE connected to two component ideas between two courses

Physics

PS2.A	HS-PS2-1.
	HS-PS2-2.
	HS-PS2-3.
PS2.B	HS-PS2-4.
	HS-PS2-5.
	HS-PS2-6.
PS1.C	HS-PS1-8.
PS3.A	HS-PS3-2.
PS3.C	HS-PS3-5.
PS4.A	HS-PS4-1.
	HS-PS4-2.
	HS-PS4-3.
	HS-PS4-5.
PS4.B	HS-PS4-4.

Physics Repeats

PS2.B	*HS-PS1-1.*
	HS-PS1-3.
PS3.A	HS-PS3-1.
	HS-PS3-3.
	HS-PS2-5.
PS3.B	HS-PS3-1.
	HS-PS3-4.
PS4.A	*HS-ESS2-3.*
PS4.B	HS-PS4-3.
	HS-PS4-5.
	HS-ESS1-2.
ETS1.A	HS-ETS1-1.
ETS1.B	HS-ETS1-3.
	HS-ETS1-4.
ETS1.C	HS-ETS1-2.

Earth & Space

ESS1.A	HS-ESS1-1.
	HS-ESS1-2.
	HS-ESS1-3.
ESS1.B	HS-ESS1-4.
ESS1.C	HS-ESS1-5.
	HS-ESS1-6.
ESS2.A	HS-ESS2-1.
	HS-ESS2-2.
	HS-ESS2-3.
	HS-ESS2-4.
ESS2.C	HS-ESS2-5.
ESS2.D	HS-ESS2-6.
	HS-ESS2-7.
ESS3.A	HS-ESS3-1.
	HS-ESS3-2.
ESS3.C	HS-ESS3-3.
	HS-ESS3-4.
ESS3.D	HS-ESS3-5.
	HS-ESS3-6.

Earth & Space Repeats

ESS1.B	*HS-ESS2-4*
ESS2.B	*HS-ESS1-5.*
	HS-ESS2-1.
	HS-ESS2-3.
ESS2.D	HS-ESS2-4.
	HS-ESS3-6.
ESS2.E	HS-ESS2-7.
ESS3.B	HS-ESS3-1.
ETS1.A	HS-ETS1-1.
ETS1.B	HS-ETS1-3.
	HS-ETS1-4.
ETS1.C	HS-ETS1-2.

UNIT 1: STRUCTURE AND FUNCTION

In this unit students will…

-contrast and compare prokaryotic and eukaryotic cells

-contrast and compare animal and plant cells

-describe structure and function of select cellular organelles

-investigate and describe the effects of osmosis in plant/animal cells

-explain the structure and function of DNA

-recognize and order the hierarchy of living things – cells, tissues, organs, organ systems

-explain a negative and positive feedback mechanism

Enduring Understandings

-systems of specialized cells within organisms help them perform life processes

-cells contain genetic information in the form of DNA molecules which code for the formation of proteins

-multicellular organisms have a hierarchical structural organization

-feedback mechanisms maintain dynamic equilibrium within organisms.

NGSS Unit 1: Structure and Function

Performance Expectations
Performance Expectation:
HS-LS1-1. **Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.** [*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]
HS-LS1-2. **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]
HS-LS1-3. **Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*]
HS-LS1-4. **Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) • Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4),(HS-LS1-5),(HS-LS1-7) **Planning and Carrying Out Investigations** Planning and carrying out 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. (HS-LS1-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 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. • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the	**LS1.A: Structure and Function** • Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) *(Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)* • Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) • Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** • In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4) **LS1.C: Organization for Matter and**	**Systems and System Models** • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2),(HS-LS1-4) **Energy and Matter** • Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) • Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS1-7) **Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1) **Stability and Change** • Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3) *Connections to other DCIs in this grade-band:* **HS.PS1.B** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **HS.PS2.B** (HS-LS1-7); **HS.LS3.A** (HS-LS1-1); **HS.PS3.B** (HS-LS1-5),(HS-LS1-7) *Articulation of DCIs across grade-bands:* **MS.PS1.A** (HS-LS1-6); **MS.PS1.B** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **MS.PS3.D** (HS-LS1-5),(HS-LS1-6),(HS-LS1-7); **MS.LS1.A** (HS-LS1-1),(HS-LS1-2),(HS-LS1-3),(HS-LS1-4); **MS.LS1.B** (HS-LS1-4); **MS.LS1.C** (HS-LS1-5),(HS-LS1-

assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1) • 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. (HS-LS1-6) ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)	**Energy Flow in Organisms** • The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5) • The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6) • As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6),(HS-LS1-7) • As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)	6),(HS-LS1-7); **MS.LS2.B** (HS-LS1-5),(HS-LS1-7); **MS.ESS2.E** (HS-LS1-6); **MS.LS3.A** (HS-LS1-1),(HS-LS1-4); **MS.LS3.B** (HS-LS1-1)

Common Core State Standards

CCSS: English Language Arts	
Reading Informational Text	
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1-1),(HS-LS1-6)
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. *(HS-LS1-3)*
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS1-1),(HS-LS1-6)
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. *(HS-LS1-2),(HS-LS1-4),(HS-LS1-5),(HS-LS1-7)*
CCSS: Mathematics	
MP.4	Model with mathematics. *(HS-LS1-4)*
HSF-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*(HS-LS1-4)*
HSF-BF.A.1	Write a function that describes a relationship between two quantities. *(HS-LS1-4)*

CONCEPTUAL FLOW CHART/MAP

Prerequisite concepts: Living things are made of cells that work together to form tissues and organs that are specialized for particular body functions (growth, survival, behavior and reproduction)

The structure of DNA determines the structure of proteins which carry out the essential functions of life (HS-LS1-1)

Success Criteria: I can construct an explanation based on evidence for how DNA determines the structure of proteins that carry out life's processes

Formative Assessment:

Students will compare types of mutations and whether they have an effect on an organism.

The hierarchical organization of interacting systems provide specific functions within multicellular organisms (HS-LS1)

Success Criteria: I can develop and use a model to show the hierarchical organization of interacting systems that provide specific functions within a multicellular organism

Formative Assessment:

Students will construct a model to illustrate the organization of a system such as nutrient uptake, water delivery, or organism response to stimuli

Feedback mechanisms maintain homeostasis (HS-LS1-3)

Success Criteria: can plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Formative Assessment:

Students will investigate and illustrate a feedback mechanism.

Unit 1 Structure and Function

NGSS Storyline: The performance expectations in the topic Structure and Function help students formulate an answer to the question: "How do the structures of organisms enable life's functions?" High school students are able to investigate explanations for the structure and function of cells as the basic units of life, the hierarchical systems of organisms, and the role of specialized cells for maintenance and growth. Students demonstrate understanding of how systems of cells function together to support the life processes. Students demonstrate their understanding through critical reading, using models, and conducting investigations. The crosscutting concepts of **structure and function, matter and energy, and systems and system models in organisms** are called out as organizing concepts.

Structure and Function
Duration: 8 weeks

Unit Overview

Provide a concise summary of what students will learn in the UNIT. It explains the unit's focus, big ideas, connection to content, and real world connection.

Students are expected to observe the structure of living things from the role of DNA to the structure of organ systems to infer that structure dictates function. Students will gain an understanding that components of a system interact, but systems also interact with each other. Students will research how cells and organ systems maintain dynamic equilibrium. Through the study of biomimicry, students will use their observation skills to solve a technology problem.

*** Biology. Chapters 3, 5, 8, 21, 22.5, Fig 5.1, Holt McDougal**

Essential Questions	***Resources***
• Are prokaryotic and eukaryotic cells different? • How do select cellular organelles work within a system? • What processes enable active/passive transport across a semi-permeable membrane? • What is the effect of osmosis in plant/animal cells? • What interaction is there between the skeletal and muscular systems? • How does the structure of the cellular membrane enable what enters and leaves the cell? • How does the structure of DNA allow it to fulfil its function? • How are human body systems organized? • How do negative and positive feedback mechanisms maintain homeostasis?	**Textbook:** Nowicki, Stephen (2012). • Chapter 3 pp. 68 • Chapter 3 pp. 70-75 • Chapter 3 pp. 77-80 • Chapter 3 pp. 81 - 83 • Chapter 33 pp 936- 946 • Chapter 3 pp. 77-80 • Chap 8 pp. 216 -219 • Chap 28 pp. 798- 800 • Chap 28 pp. 804 – 807

Additional Resources

NGSS Implementation of activities by Disciplinary Core Idea & Crosscutting Concepts:
http://serendip.brynmawr.edu/exchange/bioactivities/NGSS

Access www.bozemanscience.com and ALL other websites listed below and search by topic/DCI
Bozeman Science, Unit 1, 3, 4, 11 at http://www.bozemanscience.com/biology-main-page/

Understanding proteins, DNA and enzymes
http://serendip.brynmawr.edu/exchange/bioactivities/proteins

Human body systems simplified, http://www.arvindguptatoys.com/arvindgupta/humanbody-english.pdf

Understanding proteins, DNA and enzymes
http://serendip.brynmawr.edu/exchange/bioactivities/proteins

Biomimicry: Cool Science Examples in nature through readings and video
http://ben.biomimicry.net/category/coolbio/

Biomimicry Introduction Video with sustainability focus
http://biomimicry.org/what-is-biomimicry/

Biomimicry Design Challenge downloadable PDF
http://ben.biomimicry.net/curricula-and-resources/youth-curricula/biomimicry-design-approaches-k-12/

Possible PD: Biomimicry 8 hr online course
http://ben.biomimicry.net/online-course/

5 minute field trips downloadable PDF (observation, biomimicry and ecosystems)
http://ben.biomimicry.net/curricula-and-resources/youth-curricula/5-minute-field-trips/

http://www.sciencenetlinks.com

www.biology.com

http://strandmaps.nsdl.org/

www.thinkquest.com

http://www.ngsslifescience.com/

http://www.haspi.org/

Enduring Understandings	***Essential Questions: Overarching***	***Cross Cutting Concepts***
Identify discrete facts or skills to focus on larger concepts, principles, or processes. They are transferable - applicable to new situations within or beyond the subject. (DCI'S) **LS1.A: Structure and Function** • Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) *(Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)* • Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) • Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) **LS1.B: Growth and Development of Organisms** • In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)	Identify several open-ended questions to provoke inquiry about the core ideas for the lesson. They are grade-level appropriate questions that prompt intellectual exploration of a topic. **How do organisms live and grow?** Questions: • How does a cell perform its functions? • How do prokaryotic organisms live? • How do eukaryotic organisms live? • How does a cellular system work? • How does an organ system or vascular system work? • How do organ systems or vascular systems work together? • How do organisms grow and transmit information? • What is life? • How does the natural world operate? • Why is homeostasis important to living things? • How do scientists think and act? • What is a system? • What is a model? What are the limitations of a model? • What is valid and reliable evidence? • What can nature teach us about finding solutions to problems in our man-made world?	**Systems and System Models** • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2),(HS-LS1-4) **Structure and Function** • Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1) **Stability and Change** • Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

STUDENT OUTCOMES

Identify the transferable knowledge and skills that students should understand and be able to do when the lesson is completed. Outcomes must align with but not limited to the Next Generation Science Standards. (PE'S)

HS-LS1-1. **Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.** [*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]

HS-LS1-2. **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*]

HS-LS1-3. **Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.** [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*]

HS-LS1-4. **Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.** [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]

Key Vocabulary

List key vocabulary important to the conceptual understanding.

DNA, bases, replication, transcription, translation, amino acids, proteins

Mitosis, chromosomes, genes

Organ system, organ, tissue, cells, feedback loop, positive feedback loop, negative feedback loop, homeostasis

System, model

Preconception /Misconceptions

All organisms are multicellular

Prokaryotes contain organelles

DNA not found in plant cells

Organelles are the same in BOTH plant and animal cells

Prokaryotes are not clones and divide by mitosis

All feedback loops are negative

Homeostasis is static

DNA structure is always a double helix and chromosomes always look like an "X"

Investigation Sequence

Investigation	***Links/Resources***
• Investigation 1 Engagement and Exploration of System Structures	Part 1- Why study Biology? What can we learn from studying nature? Phenomena of biomimicry introduction: http://ben.biomimicry.net/category/coolbio/ Part 2 – Examine structures and infer function. **What is the relationship between the structure and the function you infer from the structure?** Examine unknown objects and write at least 3 observations. Then make at least three inferences about their function from the structure and clues you infer. Part 3 – Examine a simple system. Dissect its parts. ***Explanation***: How do the parts relate to its function? What other systems could this one you examine interact with? Present your system and a graphic organizer. Extension of Systems may be Mystery Tubes investigation. Part 4: What do you observe in natural structures? ***Explanation***: How does your natural system work? What are its parts? What other systems could this one you examine interact with? Present your system and a graphic organizer
• Investigation 2 Homeostasis - semi-permeable membrane	Part 1 - How does a system maintain homeostasis? How does a semi-permeable membrane work? Investigate a positive feedback loop. Investigate a negative feedback loop. Part 2 – Homeostasis - nature has designed solutions to maintaining equilibrium in systems (negative and positive feedback loops). Create a model of a feedback system in nature. What are the limitations of your model?
• Investigation 3a - Improvement of structures	Part 1 – What challenges do we face on Earth? Part 2 – What would nature do? How does nature…. - Create lightweight structures with large surface area? - Create a strong but light scaffolding system? - Prevent traffic jams? - Make “photocopies of DNA” to reproduce in cells? - Prevent trees from breaking in high winds? - Part 3 - What can scientists learns from studying nature? Reading & Web quest on biomimicry. Fill in Graphic organizer and write about one system and the challenge it solves
• Investigation 3b - Tackle a challenge and design a solution	Part 1 – ***Elaboration***: Create a solution to a problem using the materials provided and inspiration from nature Part 2 – ***Evaluation***: Analyze your creation, peer review, and improve your model Part 3 – Communication of ideas: Present your biomimicry model providing an analysis of the process and parallels between the design and inspiration from the natural world.

Accommodations:

1. Input – Adapt the way instruction is delivered to the learner.

For example: Use multimedia presentations to deliver content; provide hands-on activities; provide audio books; preferentially seat students; provide graphic organizers.

2. Output – Adapt how the learner can respond to instruction.

For example: Allow oral responses to tests; allow students to use multiple intelligences to express their understanding of material (verbal vs. written response; offer hands-on demonstration to show knowledge); use assistive technology for communication.

3. Time – Adapt the time allotted and allowed for learning, task completion or testing.

For example: Increase the wait time to increase the number of student responses; provide a sequential timeline that visually displays the pacing of tasks and their expected completion dates.

4. Difficulty – Adapt the skill level, problem type, or the rules on how the learner may approach the work.

For example: Use an assistive technology device (e.g. a calculator, spell checker, tape recorder, etc.); modify instructions to allow the learner to successfully complete the activity or homework assignment.

5. Level of Support – Increase the amount of personal assistance for the specific learner.

For example: Work with paraprofessionals to assist child-specific needs in the classroom; preferentially seat a student in a group or next to a peer buddy; assign peer tutors or one-on-one tutors.

6. Size – Adapt the number of items that a student is expected to learn or complete.

For example: Decrease the homework load (e.g. complete only the odd math problems; reduce the number of pages a child is required to read; reduce the number of vocabulary terms a child must learn.

7. Degree of Participation – Adapt the extent to which a learner is actively involved in the task.

For example: Assign group activities where the student will have a specific role/task that he/she is responsible for carrying out.

8. Alternate Goals – Adapt the goals or outcome expectations while using the same materials.

For example: Expect one student to be able to name all the major parts of an animal cell while others learn the parts and functions of an animal and a plant cell.

9. Substitute Curriculum – Provide the different instruction and materials to meet a learner's individual goals.

Example: Have an alternate textbook available for students who read below their grade level; assess the student on effort and completion rather than accuracy; pace learning differently to accommodate the student's needs.

Reference for Adaptations: (These adaptations were taken directly from the source with no modifications)

Ebeling, D.G. ,Ed.D., Deschenes, C.,M.Ed., & Sprague, J.,Ph.D.(1994). *Adapting curriculum and instruction*. The Center for School and Community Integration, Institute for the Study of Developmental Disabilities