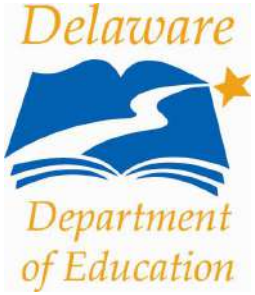
Delaware Science Coalition

Grade 10 Science Unit Template
Unit I:
The Nature of Science and Evolution



Delaware Recommended Curriculum Unit Template

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

Grade Level(s): 10

Subject/Topic Area: Biology

Searchable Key Words:

Time Frame: Approximately 7 weeks (year-long course)

Designed By:

Reviewed by: **Date: 12-8-08**

Brief Summary of Unit

This unit explores the nature of science and the theory of evolution by natural selection. Students investigate how science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments, and healthy skepticism. Students also investigate how evolution explains the unity and diversity of species found on Earth and why evolution is important now as it is applied to current medical, agricultural, environmental, and other societal issues.

This unit is intended to be used at the beginning of the Grade 10 science course and be followed by *Unit II: The Chemical and Cellular Basis of Life* and *Unit III: Genetics/Biotechnology.*

Stage 1: Desired Results
(Determine What Students Will Know, Do and Understand)

DE Content Standards

Standard 1: Understandings and Abilities of Scientific Inquiry

1. Scientists conduct investigations for a variety of reasons including to explore new phenomena, to replicate other's results, to test how well a theory predicts, to develop new products, and to compare theories.
2. Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments and healthy skepticism.
3. Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses. The application of theories allows people to make reasonable predictions. Theories may be amended to become more complete with the introduction of new evidence.
4. Investigating most real-world problems requires building upon previous scientific findings and cooperation among individuals with knowledge and expertise from a variety of scientific fields. The results of scientific studies are considered valid when subjected to critical review where contradictions are resolved and the explanation is confirmed.
5. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. (American Association for the Advancement of Science, 2001)
6. Knowledge and skill from sources other than science are essential to scientific inquiry. These include mathematics, reading, writing, and technology.

Standard 7: Diversity and Evolution

1. Evolution is a change in allelic frequencies of a population over time. The theory of evolution is supported by extensive biochemical, structural, embryological, and fossil evidence.
2. The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled available niches with life forms. The millions of different species of plants, animals, and microorganisms that live on Earth today are related by descent with modification from common ancestors.
3. The process of natural selection occurs when some heritable variations that arise from random mutation and recombination give individuals within a species some survival advantages over others. These offspring with advantageous adaptations are more likely to survive and reproduce than individuals without these adaptations, thus increasing the proportion of individuals within a population with these advantageous characteristics. When populations become isolated, these changes may accumulate in each subpopulation eventually resulting in new species.

4. Evolution does not proceed at the same rate in all populations; nor does it progress in a linear or set direction. Environmental changes have a strong influence on the evolutionary process. Other factors that influence evolution include sexual selection, mutation, genetic drift, and genetic modification.
5. Organisms are classified into a hierarchy of groups and subgroups based on similarities in structure, comparisons in DNA and protein and evolutionary relationships.
6. Genetically diverse populations are more likely than genetically homogeneous populations to survive changing environments.
7. Biological evolution is the foundation for modern biology and is used to make predictions for medical, environmental, agricultural and other societal purposes.

Big Ideas

"Big Ideas" in Grade 10

• **Science As Inquiry**	Science is a way of knowing about the natural world by the use of empirical observations, experimental evidence, logical arguments, and healthy skepticism.
• **Evolution**	The theory of evolution explains the unity and diversity found among living things and is the foundation of modern biology.
• **Matter and Energy**	Living things transform and transfer matter and energy from one form to another to build their structures and conduct their life processes.
• **Structure and Function**	Living things organize matter into a variety of forms whose structure and function are complementary.
• **Regulation and Homeostasis**	Living things have mechanisms and behaviors that regulate their internal environments and respond to changes in their surroundings.
• **Genetic Continuity**	Living things reproduce, develop, and transmit heritable traits to their offspring.
• **Interdependence in Nature**	Living things and their environments are interconnected.
• **Science Technology Society**	The dynamic interaction of science and technology affects and is affected by society.

"Big Idea" Emphasis in Grade 10 Units

Unit I Nature of Science and Evolution	Unit II	Unit III Genetics/Biotechnology
Major Emphasis	***Major Emphasis***	***Major Emphasis***
Science As Inquiry	Science As Inquiry	Science As Inquiry
Evolution	Matter and Energy	Structure and Function
	Structure and Function	Genetic Continuity
	Regulation and Homeostasis	Science Technology Society
Minor Emphasis	***Minor Emphasis***	***Minor Emphasis***
Genetic Continuity	Evolution	Evolution
Interdependence in Nature	Interdependence in Nature	Interdependence in Nature
Science Technology Society	Science Technology Society	

Unit Enduring Understandings

Students will understand that…

Enduring Understandings from Standard 1: Understandings and Abilities of Scientific Inquiry

1. Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.
   a. Science uses facts, inferences, hypotheses, laws, and theories to explain natural phenomena.
   b. Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses.
   c. Scientific knowledge is simultaneously reliable and tentative. Having confidence in scientific knowledge is reasonable while realizing that such knowledge may be abandoned or modified in light of new evidence … *NSTA Position Statement "The Nature of Science" July 2000*

Enduring Understandings from Standard 7: Diversity and Evolution

1. The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.
   a. All living things are related by descent with modification from common ancestors.
   b. The theory of evolution is well supported by extensive biochemical, anatomical, embryological, and fossil evidence.

c. Evolution is the underlying and unifying theme for biological concepts.
d. Evolution is used to understand ourselves and the world around us, and to develop solutions for many medical, environmental, agricultural and other societal issues.

Unit Essential Questions

Essential Questions from Standard 1: Understandings and Abilities of Scientific Inquiry

1. What makes a question scientific?
2. What constitutes evidence?
3. When do you know you have enough evidence?
4. Why is it necessary to justify and communicate an explanation?

Essential Questions from Standard 7: Diversity and Evolution

1. How does diversity of species result from evolution?
   a. What are the sources of hereditary variation in evolution by natural selection?
   b. How do the inherited traits in a population change over time?
   c. How do new species arise?
   d. What is the evidence for evolution?
   e. Why is the theory of evolution the foundation of modern biology?
2. How does the understanding of evolution affect the quality of human life?
   a. How does an understanding of evolution inform us about ourselves and the world around us?
   b. How is an understanding of evolution being used to develop solutions for societal issues in medicine, agriculture and the environment?

Knowledge & Skills

Students will know…

Standard 1: Understandings and Abilities of Scientific Inquiry

1. Scientists conduct investigations for a variety of reasons including to explore new phenomena, to replicate other's results, to test how well a theory predicts, to develop new products, and to compare theories.
2. Science is distinguished from other ways of knowing by the use of empirical observations, experimental evidence, logical arguments and healthy skepticism.
   a. Science is limited to seeking explanations about the natural world.
   b. Facts in science are empirical observations of natural phenomena that have been repeatedly confirmed and can change with new technologies and better ways of looking at data.

c. Inferences derived from evidence and reasoning are used in science to construct explanations.
d. Hypotheses in science are testable statements about natural phenomena that can be used to build more accurate explanations.
e. Laws in science describe but do not explain natural phenomena.

3. Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses. The application of theories allows people to make reasonable predictions. Theories may be amended to become more complete with the introduction of new evidence.
4. Investigating most real-world problems requires building upon previous scientific findings and cooperation among individuals with knowledge and expertise from a variety of scientific fields. The results of scientific studies are considered valid when subjected to critical review where contradictions are resolved and the explanation is confirmed.
5. In communicating and defending the results of scientific inquiry, arguments must be logical and demonstrate connections between natural phenomena, investigations, and the historical body of scientific knowledge. (American Association for the Advancement of Science, 2001)
6. Knowledge and skill from sources other than science are essential to scientific inquiry. These include mathematics, reading, writing, and technology.

Standard 7: Diversity and Evolution

1. Evolution is a change in allelic frequencies of a population over time. The theory of evolution is supported by extensive biochemical, structural, embryological, and fossil evidence. Note: In Unit I evolution should be defined as a change in the hereditary characteristics of a population over the course of generations. Allele frequencies and biochemical evidence are addressed in Unit III.
   a. Populations, not individual organisms, undergo evolutionary change.
2. The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled available niches with life forms. The millions of different species of plants, animals, and microorganisms that live on Earth today are related by descent with modification from common ancestors.
3. The process of natural selection occurs when some heritable variations that arise from random mutation and recombination give individuals within a species some survival advantages over others. These offspring with advantageous adaptations are more likely to survive and reproduce than individuals without these adaptations, thus increasing the proportion of these individuals within a population with advantageous characteristics. When populations become isolated, these changes may accumulate in each subpopulation eventually resulting in new species. Note: In Unit I mutations should be defined as changes in hereditary characteristics of a population over time. Mutation as a change in the nucleotide sequence of DNA is addressed in Unit III. Genetic recombination is addressed in Unit III.
   a. Natural selection is a non-random process driven by environmental conditions.
   b. The tendency of populations to overproduce offspring is a factor in natural selection because it results in competition for food and other resources necessary for survival.

4. Evolution does not proceed at the same rate in all populations; nor does it progress in a linear or set direction. Environmental changes have a strong influence on the evolutionary process. Other factors that influence evolution include sexual selection, mutation, genetic drift, and genetic modification.
5. Organisms are classified into a hierarchy of groups and subgroups based on similarities in structure, comparisons in DNA and protein and evolutionary relationships. Note: DNA and protein comparisons are assigned to Unit III.
6. Genetically diverse populations are more likely than genetically homogeneous populations to survive changing environments.
7. Biological evolution is the foundation for modern biology and is used to make predictions for medical, environmental, agricultural and other societal purposes.

Students will be able to…

Grade-Level Expectations from Standard 1: Understandings and Abilities of Scientific Inquiry

Enduring Understanding

- Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.
  a. Science uses facts, inferences, hypotheses, laws, and theories to explain natural phenomena.
  b. Theories in science are well-established explanations of natural phenomena that are supported by many confirmed observations and verified hypotheses.
  c. Scientific knowledge is simultaneously reliable and tentative. Having confidence in scientific knowledge is reasonable while realizing that such knowledge may be abandoned or modified in light of new evidence. *NSTA Position Statement "The Nature of Science" July 2000*

1. Identify and form questions that generate a specific testable hypothesis that guides the design and breadth of the scientific investigation.
2. Design and conduct valid scientific investigations to control all but the testable variable in order to test a specific hypothesis.
3. Collect accurate and precise data through the selection and use of tools and technologies appropriate to the investigations. Display and organize data through the use of tables, diagrams, graphs, and other organizers that allow analysis and comparison with known information and allow for replication of results.
4. Construct logical scientific explanations and present arguments which defend proposed explanations through the use of closely examined evidence.
5. Communicate and defend the results of scientific investigations using logical arguments and connections with the known body of scientific information.
6. Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Grade-Level Expectations from Standard 7: Diversity and Evolution

Enduring Understanding

- The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring.
  a. All living things are related by descent with modification from common ancestors.
  b. The theory of evolution is well supported by extensive biochemical, anatomical, embryological, and fossil evidence.
  c. Evolution is the underlying and unifying theme for biological concepts.
  d. Evolution is used to understand ourselves and the world around us, and to develop solutions for many medical, environmental, agricultural and other societal issues.

1. Recognize random mutation (changes in DNA) and recombination within gametes as the sources of heritable variations that give individuals within a species survival and reproductive advantage or disadvantage over others in the species. *Note: A full understanding of the role DNA mutation and genetic recombination as sources of variation are assigned to Unit III.*
2. Conduct and analyze a natural selection simulations and use data generated from it to describe how environmentally favored traits are perpetuated over generations resulting in species survival, while less favorable traits decrease in frequency or may lead to extinction. *Note: Student explanations should include reference to heritable variation, overproduction of offspring, struggle for survival, and differential survival and reproduction.*
3. Explain how biochemical evidence, homologous structures, embryological development and fossil evidence support or refute prior hypotheses of common ancestry. *Note: The biochemical evidence part of this GLE is assigned to Unit III.*
4. Describe that evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organism.
5. Explain how species evolve through descent with modification, thus allowing them to adapt to different environments.
6. Discuss how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process. Recognize that a change in a species over time does not follow a set pattern or timeline.
7. Compare and contrast the role of sexual selection to the role of natural selection on the evolutionary process.
8. Relate a population's survival to the reproductive success of adapted individuals in that population.
9. Explain the roles of geographical isolation and natural selection on the evolution of new species.
10. Predict possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, and industrial pollution).
11. Explain why homogeneous populations may be more vulnerable to environmental changes than heterogeneous populations.
12. Explain how evolutionary relationships between species are used to group organisms together.
13. Explain how antibiotic resistant populations evolve from common bacterial populations.

14. Research an evolution related issue (e.g. invasive species, pesticide-resistant insects, artificial selection in plant and animal breeding, bioengineered food) and explain the connection between the issue and evolution.
15. Explain how DNA evidence can be used to determine evolutionary relationships. *Note: This GLE is assigned to Unit III.*
16. Observe and analyze evidence of human evolution.
17. Explain the scientific use of the term theory when applied to evolution.

Stage 2: Assessment Evidence
(Design Assessments to Guide Instruction)

Suggested Performance Task(s)

Assessments

Note: The Nature of Science and Evolution Unit is divided into the subunits listed below. A summative assessment is appropriate at the completion of each subunit. Summative assessments have been developed for the Mechanisms of Evolution and the Application of Evolution subunits.

1. **Nature of Science** (Formerly "How Does Science Differ From Other Ways of Knowing?") Assessment not developed.

   Topics: Science as a way of knowing about the natural world; facts, hypotheses, inferences, laws and theories; evolution as theory; sexual selection.

   Knowledge:
   - Standard 1: Understandings and Abilities of Scientific Inquiry 1, 2 a-e, 3, 4, 5, 6
   - Standard 7: Diversity and Evolution 1 (In part: definition of evolution), 4 (In part: sexual selection), 7 (In part: biological evolution as foundation of biology)

   Skills:
   - Standard 1: Understandings and Abilities of Scientific Inquiry 4-6
   - Standard 7: Diversity and Evolution 17

2. **Mechanisms of Evolution** (Formerly "What Is Evolution and How Does It Occur?") Assessment developed. Refer to Natural Selection and Why Evolution Matters Now at the following web address: www.scienceassessment.org

   Topics: Natural selection, mutation, genetic drift

   Knowledge:
   - Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
   - Standard 7: Diversity and Evolution 1 (In Part: Change in hereditary characteristics over generations) 1a, 3, 3a-b, 4, 6

   Skills:
   - Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
   - Standard 7: Diversity and Evolution 1, 2, 4, 5, 6 (environmental pressure, genetic drift and mutation and competition), 7, 8, 9,10,11

3. **Evidence and Explanation** (Formerly "What Is the Evidence for Evolution and What Does It Explain?") Assessment not developed.

   Topics: Anatomical and embryological homologies, fossil evidence, classification, descent from common ancestor, speciation.

   Knowledge:

   - Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
   - Standard 7: Diversity and Evolution 1 (structural, embryological, and fossil evidence), 2, 4 (rate of evolution), 5, 7 (evolution as foundation of biology)

   Skills:

   - Standard 1: Understandings and Abilities of Scientific 3-6
   - Standard 7: Diversity and Evolution 3, 5, 6 (evolution follows no set pattern), 9, 12, 16

4. **Relevance of Evolution** (Formerly "Why Does Evolution Matter Now?") Assessment developed. Refer to Natural Selection and Why Evolution Matters Now at the following web address: www.scienceassessment.org

   Topics: Antibiotic and pesticide resistance, invasive species, artificial selection, and other societal issues.

   Knowledge:

   - Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
   - Standard 7: Diversity and Evolution 3, 4, 6, 7

   Skills:

   - Standard 1: Understandings and Abilities of Scientific Inquiry 3-6
   - Standard 7: Diversity and Evolution 10, 11, 13, 14

Rubrics/Checklists for Performance Tasks

Refer to Natural Selection and Why Evolution Matters Now assessment rubrics (diagnostic double digit rubric) found at the following web address: **www.scienceassessment.org**

Other Evidence

Student Self-Assessment and Reflection

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

Key Learning Events Needed to Achieve Unit Goals

Note: Most of the lessons listed below are from the current (Spring 2007) Nature of Science and Evolution Unit and should to be reviewed and modified as necessary to address knowledge and skill goals. For details and an in-depth discussion of the lessons please refer the teacher guides that accompany the lessons. The following lessons are new and have not been developed: 2d. "Genetic Drift", 3b. "Origin of New Species", and 4b. "Agricultural and Environmental Issues and Evolution".

1. Nature of Science

Topics: Science as a way of knowing about the natural world; facts, hypotheses, inferences, laws and theories; evolution as theory; sexual selection

Knowledge:

- Standard 1: Understandings and Abilities of Scientific Inquiry 1, 2 a-e, 3, 4, 5, 6
- Standard 7: Diversity and Evolution 1 (In part: definition of evolution), 4 (In part: sexual selection), 7 (In part: biological evolution as foundation of biology)

Skills:

- Standard 1: Understandings and Abilities of Scientific Inquiry 4-6
- Standard 7: Diversity and Evolution 17

Lesson 1a: Science As a Way of Knowing

Review and modify "What Do You Know – AIDS" from the 2007 unit.

Students learn that science is a particular way of knowing about the world that is different from other ways of knowing about the world.

Lesson 1b: Using Inferences in Science

Review and modify "Solving the Puzzle" from the 2007 unit.

From information on a few pieces of a jigsaw puzzle, students make inferences about the content of the whole puzzle.

Lesson 1c: Case Studies of Scientists in Action

Review and modify "Scientists in Action" from the 2007 unit.

Students investigate the processes of science using information in two PBS *Evolution* video clips: "Leaf Cutters of the Amazon" and "Tale of the Peacock." *Note: Sexual selection is described in "The Tale of the Peacock."*

Lesson 1d: Facts, Hypotheses, Laws and Theories in Science

Review and modify "Isn't Evolution Just a Theory?" and "Who Was Charles Darwin?" from the 2007 unit.

Students define the scientific use of the terms facts, hypotheses, laws and theories and relate this terminology to evolution after viewing PBS *Teaching and Evolution* video clips: "Isn't Evolution Just a Theory", and "Who Was Darwin?".

2. Mechanisms of Evolution

Topics: Natural selection, mutation, genetic drift

Knowledge:

- Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
- Standard 7: Diversity and Evolution 1 (In Part: Change in hereditary characteristics over generations) 1a, 3, 3a-b, 4, 6

Skills:

- Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
- Standard 7: Diversity and Evolution 1, 2, 4, 5, 6 (environmental pressure, genetic drift and mutation and competition), 7, 8, 9,10,11

Lesson 2a: Variation and Natural Selection

Review and modify "Observing Variation in Wolves" from the 2007 unit.

Students analyze data on variation in three geographically separated North American wolf populations.

Students identify genetic mutations as a source variation.

Lesson 2b: Overproduction of Offspring and Natural Selection

Review and modify "Pepper Explosion" from the 2007 unit.

Students count the number of seeds in a bell pepper fruit (or other fruit) and make inferences about how over production of offspring that could lead to a struggle for survival.

Lesson 2c: Natural Selection Simulation

Review and modify "Survival in the Bean Patch" from the 2007 unit.

In this lab or field activity, students model how the process of natural selection, occurring over several generations, might change the frequencies of color variants in bean seeds.

Lesson 2d: Genetic Drift

This lesson has not been developed.

Students analyze data from a genetic drift simulation activity.

3. Evidence and Explanation

Topics: Anatomical and embryological homologies, fossil evidence, classification, descent from common ancestor, speciation.

Knowledge:

- Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
- Standard 7: Diversity and Evolution 1 (structural, embryological, and fossil evidence), 2, 4 (rate of evolution), 5, 7 (evolution as foundation of biology)

Skills:

- Standard 1: Understandings and Abilities of Scientific 3-6
- Standard 7: Diversity and Evolution 3, 5, 6 (evolution follows no set pattern), 9, 12, 16

Lesson 3a: Structural Homologies

Review and modify "Chicken Wings and Batters' Arms," the PBS Web Library video "Common Past, Different Paths," Evidence for Evolution, and the PBS Teaching and Learning video "How Do We Know Evolution Really Happens?"

Students examine bones in a cooked chicken wing and compare them to bones in their own arms and forelimbs of other vertebrates. Students also analyze embryo homology evidence and discuss a PBS video on evidence for evolution.

Lesson 3b: Origin of New Species

This lesson has not been developed.

Students investigate extinction how speciation can result from geographical isolation and natural selection.

Lesson 3c: Whale Evolution

Note: Review and modify "The Whale's Tale", "Classification and Homologies, Part 1," and the PowerPoint "Evolution of Whales" from the 2007 unit.

Students learn that structural homologies are used to group species according to related ancestry. Part 1 of this CD PowerPoint/ worksheet lesson prepares students for the "The Whale's Tale." In "the Whale's Tale," students use evidence from the anatomy of modern whales and fossil discoveries to draw tentative explanations about whale ancestry. Students view the CD PowerPoint "Evolution of Whales."

Lesson 3d: Human Evolution

Review and modify "Hominoid Skull Comparison" and "Classification and Homologies, Part 2."

Students learn about primate structural homologies and classification and make inferences about human evolution after collecting and analyzing data on skull characteristics of seven modern and extinct hominoids.

4. Relevance of Evolution

Topics: Antibiotic and pesticide resistance, invasive species, artificial selection, and other medical, agricultural, and environmental issues.

Knowledge:

- Standard 1: Understandings and Abilities of Scientific Inquiry 1-6
- Standard 7: Diversity and Evolution 3, 4, 6, 7

Skills:

- Standard 1: Understandings and Abilities of Scientific Inquiry 3-6
- Standard 7: Diversity and Evolution 10, 11, 13, 14

Lesson 4a: Medicine and Evolution: Antibiotic Resistant Bacteria

This lesson has not been developed. It is suggested that the following lessons from the 2007 unit be reviewed for possible modification to make a single, shorter lesson in which students explore the evolution of antibiotic resistant bacteria:

"What Can You Learn From This?" – In this engagement activity, students read a description of a girl's (Susan) illness, summarize her symptoms, and develop a hypothesis about the cause of her illness.

"Did You Know?" – Students identify Susan's illness utilizing the internet.

"Learning About Microbes" – Students use a web resource to learn more about TB. www.microbe.org/microbes/bacterium1.asp

"Antibiotic Resistance" – Using PowerPoint slides, students learn about antibiotics and the evolution of antibiotic resistance.

"Why Does Evolution Matter Now?" – By watching a PBS *Teaching and Learning* video segment, students investigate the treatment and spread of multi-drug resistant TB.

"It's a Small World" – Students investigate the relationship between increasing speeds of human transportation and the spread of disease.

"Debi's Story" – Students analyze Debi's diagnosis and treatment for TB. Reference: NIH CD "Debi's Story," *Emerging and Remerging Infectious Diseases*, Superbugs: An Evolving Concern.

Lesson 4b: Agricultural and Environmental Issues and Evolution

This lesson has not been developed.

Students analyze evolution-related agricultural and environmental issues (e.g., pesticide resistance, invasive species, and hybridization of wild and farmed salmon) and prepare reports that explain the connection between the issues and evolution.

Resources & Teaching Tips

- What text/print/media/kit/web resources best support this unit?

Web Resources

Note: The following resources apply to the current (Spring 2007) Nature of Science and Evolution Unit.

PBS Evolution

- http://www.pbs.org/wgbh/evolution/ (also available in DVD/VHS format)
- "Leaf Cutters of the Amazon", Show 4, Segment 8
- "Tale of the Peacock", Show 5, Segment 4
- "Toxic Newts", Show 4, Segment 2

PBS Teaching and Evolution

- http://www.pbs.org/wgbh/evolution/ (also available in VHS format)
- Segment 1 "Isn't Evolution Just a Theory?"
- Segment 2 "Who Was Darwin?"
- Segment 3 "How Do We Know Evolution Really Happens?"
- Segment 4 "How Does Evolution Really Work?"
- Segment 5 "Did Humans Evolve?"
- Segment 6 "Why Does Evolution Matter Now?"

PBS Evolution Web Library

- http://www.pbs.org/wgbh/evolution/
- "Evolution of Camouflage"
- "Evolution of the Eye"
- "An Origin of Species"
- "Sex and the Single Guppy"
- "The Mating Game"
- "Laetoli Footprints"
- "Walking Tall"
- "Origin of Humankind"
- "All in the Family"
- "Riddle of the Bones"

Becoming Human, The Institute of Human Origins

- www.becominghuman.org

Smithsonian Institution Human Origins Program

- www.mnh.si.edu/anthro/humanorigins/index.htm

The Skeletons Project

- www.eskeletons.org

The Microbe World

- http://www.microbeworld.org/

National Institutes of Health Curriculum Supplements

- http://science.education.nih.gov/supplements/nih1/diseases/default.htm (also available on CD)
- *Emerging and Remerging Infectious Diseases*

National Academy of Sciences

- http://nationalacademies.org/evolution/ (also available in print)
- *Teaching About Evolution and the Nature of Science* "Proposing Explanations for Fossil Footprints", Activity 5
- *Science and Creationism: A View from the National Academy of Sciences*, Second Edition

American Geological Institute

- http://www.agiweb.org/news/evolution/ (also available in print)
- *Evolution and the Fossil Record*

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

Accommodation/Differentiation Ideas and Tips