Learning Assessment Model Project (LAMP)

Muncie Central High School
Muncie, Indiana
Grade 9 Biology
Topic: Darwin's Descent with Modification
Duration: 2 weeks

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Purpose of Unit:

The purpose of this unit is to educate students about Charles Darwin's theory of descent with modification, commonly known as evolution. Evolution is the process of change over time, and it is the eighth and final Indiana state standard. Everything the students have learned thus far in biology has been building to this integral foundational principle: evolution in the basis for all biology. Theodosius Dobzhansky wrote in 1973 that "Nothing in Biology Makes Sense Except in the Light of Evolution" and this rings true. This unit seeks to explore Darwin, his ideas, how they developed, historic people who influenced his thinking, and the incredible amount and array of evidence which all supports the theory of evolution.

Specific Skill Objectives Keyed to the Academic Standards and Indicators

- Content objective: Students will describe the conditions under which natural selection occurs, explain the principle of common descent, and explain the results of the Grants' investigation of adaptation in Galapagos finches.
  IN State standard: Students will describe how modern evolutionary theory provides an explanation of the history of life on earth and the similarities among organisms that exist today.
    Standard 8: Evolution
    Indicator:B.8.5 Describe how organisms with beneficial traits are more likely to survive, reproduce, and pass on their genetic information due to genetic variations, environmental forces and reproductive pressures.
  Interdisciplinary and curricular connections: History and Math
  How this objective will be assessed: Post-test, Evidence Project

- Content objective: Students will describe what homologous structures and embryology suggest about the process of evolutionary change, and students will be able to explain how molecular evidence can be used to trace the process of evolution.
  IN State standard: Students will describe how biochemical, fossil, anatomical, developmental, and genetic findings are used to determine relationships among organisms and how those relationships are then used to produce modern classification systems.
    Standard 8: Evolution
    Indicators:B.8.3 Use anatomical and molecular evidence to establish evolutionary relationships among organisms.
    B.8.4 Understand that molecular evidence supports the anatomical evidence for these evolutionary relationships and provides additional information about the order in which different lines of descent branched.
  Interdisciplinary and curricular connections: History and Math
  How this objective will be assessed: Post-test, Evidence Project

Vocabulary:

- Scientific fact – an objective and verifiable observation, in contrast with a hypothesis or theory, which is intended to explain or interpret facts.
- Belief – trust, faith, or confidence in someone or something

- Evidence – evidence which serves to either support or counter a scientific theory or hypothesis. Such evidence is expected to be empirical evidence and interpretation in accordance with scientific method.
- Science – the study of the natural world
- Evolution – the process of change over time
- Fossil – remains or traces of ancient organisms
- Artificial selection – nature provides the variation and humans select traits they view as beneficial
- Adaptation – any heritable characteristic that increases an organism's ability to survive and reproduce in its environment
- Natural selection – the process by which organisms with variations most suited in their environment survive and leave more offspring
- Fitness – how well an organism can survive and reproduce
- Biogeography – the study of where organisms live now compared to where their ancestors lived in the past
- Analogous structure – structures with similar functions, but different structure
- Homologous structure – structures shared by related species and have inherited from a common ancestor
- Vestigial Structure – structures inherited from ancestors that no longer serve their original function

Timeline of Day-to-day Plans:

Monday	Tuesday	Wednesday	Thursday	Friday
3-28	3-29	3-30	3-31	4-1
Who is Charles Darwin? Intro day & Vocab Assignment	Nature of Science Vocab discussion (R/C) Mystery Item Inquiry	16.1 Darwin's Voyage Video and Notes	16.2 Ideas that shaped Darwin (R/C) Historic influences Notes (1/2 page) Artificial Selection notes & card game: "Go Milk!"	16.3 Natural Selection (Darwin presents his case) Notes (R/C) Natural selection birds and butterflies activity
4-4	4-5	4-6	4-7	4-8
Distinguishing artificial selection from natural selection (R/C) Natural selection review video clip (R/C) Finish natural selection lab analysis (R/C)	16.4 Evidence for Evolution: Notes **Introduce individual project on presenting one part of evidence	Evidence for Evolution Stations: Practice mini packets for each area of evidence (R/C) **Evidence Project Day 1: research and create	Evidence for Evolution Stations: Finish (R/C) Test review sheet (R/C) **Evidence Project Day 2: finish and share with class	LAMP Post-assessment

(R/C = Review time and connections to previous lesson content)

** = initially planned in lesson, but not executed because of time constraints with state testing

Resources:

Teacher Resources:

B. (2014). The Making of a Theory: Darwin, Wallace, and Natural Selection – HHMI BioInteractive Video. Retrieved April 19, 2016, from https://www.youtube.com/watch?v=XOiUZ3ycZwU

ENSI/SENSI: Evolution/Nat.of Sci.Home Page. (n.d.). Retrieved April 19, 2016, from http://www.indiana.edu/~ensiweb/

Jensen, J. E. (2008). *NSTA tool kit for teaching evolution*.

Miller, K. R., & Levine, J. S. (2012). *Miller & Levine biology*. Boston, MA: Pearson.

PBS Evolution. (n.d.). Retrieved April 19, 2016, from http://www.pbs.org/wgbh/evolution/

S. (2013). What is Natural Selection? Retrieved April 19, 2016, from https://www.youtube.com/watch?v=0SCjhI86grU

Student Resources:

B. (2014). The Making of a Theory: Darwin, Wallace, and Natural Selection – HHMI BioInteractive Video. Retrieved April 19, 2016, from https://www.youtube.com/watch?v=XOiUZ3ycZwU

Jensen, J. E. (2008). *NSTA tool kit for teaching evolution*.

Miller, K. R., & Levine, J. S. (2012). *Miller & Levine biology*. Boston, MA: Pearson.

S. (2013). What is Natural Selection? Retrieved April 19, 2016, from https://www.youtube.com/watch?v=0SCjhI86grU

Letter to Parents:

Dear amazing biology student and parent and/or guardian,

Next week we will begin the final unit for Biology 1, which is evolution. I really enjoy this topic because it explores many different kinds of plant and animal species! The purpose of the unit is to introduce the topic of evolution by studying the development of the theory which focuses largely on Charles Darwin's collection of evidence in support for descent with modification via natural selection. Everything we have been learning about all year has been building to evolution because everything in biology is connected to evolution.

The content to be covered will start with the nature of science, mainly focusing on what science can and cannot study. Next, we will learn about Darwin's five year journey around the world and the evidence found. Then we will look at other people who were influencing the ideas of that time. Finally we will explore the process of natural selection and look at examples in nature.

Students will have the chance to observe bug collections and fossils, but my selection is a little limited. If you (or someone you know) has any bug collections or fossils that you (or they) would be comfortable letting us use for this unit, please let me know. Also, if you would like to come in and share about your collection we would greatly appreciate your time. It is always more fun and educational when we can do hands on activities with passionate people!

Near the end of the first unit, students will be partaking in a project evaluating a source for evolution and creating a poster portraying their piece of evidence to be shared with the class. We will look at evidence from geology, biogeography, archeology, physics, comparative anatomy, embryology, heredity, and genetics. We will have one and a half days in class for research, and one day to present. Because of this short time period, I would like to ask for your help in guiding the poster at home. I have supplies at school which can be used for the project, but because of state testing our schedule is limited.

Next week, I will send out the rubric with the students for their project. If you would like to have the rubric ahead of time please let me know, and I can send one either through email, or with your student.

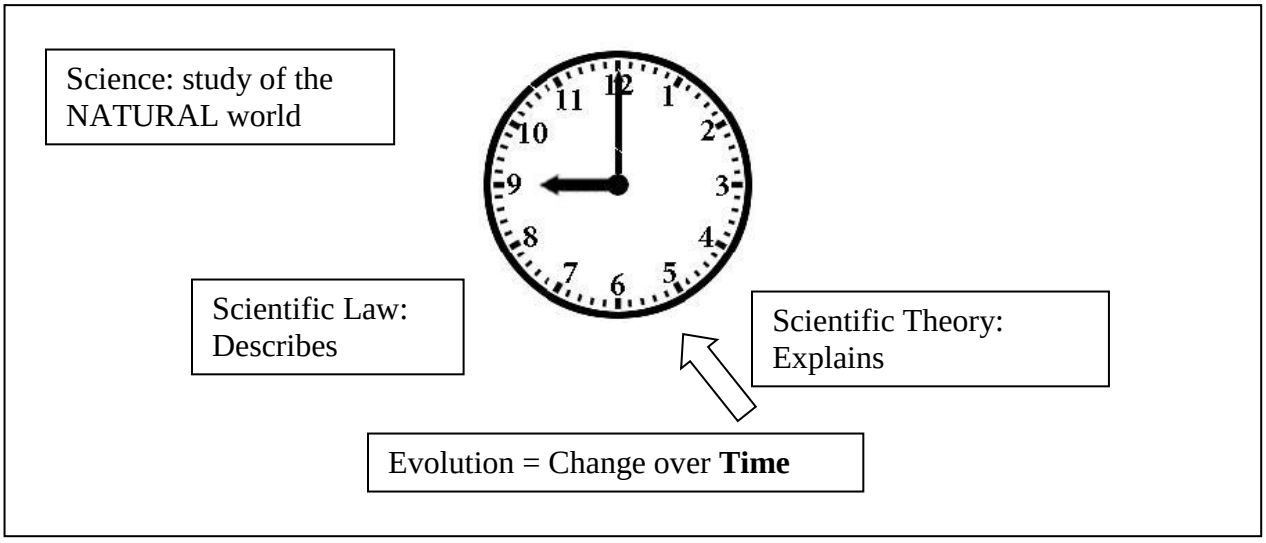
As always, if you have any questions or concerns please do not hesitate to call, email, set up a time to meet, or stop in to see me. We are almost there!

Sincerely,

Jessica E. Ulrich Flessner

Display Area:

Diagram of evolution display:



Narrative of display: This display is one of my more simple designs compared to previous displays. I purposefully made the display simple and located by the real clock in the room. This set up has a twofold benefit: first, students can become acquainted with the Nature of Science vocabulary, and secondly the students frequently look at the clock, therefore they are looking in the area where the display is at. I am testing to see if this location and simplicity will help students to have the foundational knowledge in the nature of science, therefore will be better suited to study evolution.

Student Project and Rubric:

This project idea is from Cresta Hancock. Due to time restrictions for state testing, we were not able to conduct this project.

Why does Evolution Matter Now?

Evolution and Antibiotic Resistance

When people go to the doctor's office, they expect to be cured. They don't like to be told, "Go home, drink lots of fluids and rest, and you will get better." They want a more proactive approach. Often, doctors prescribe antibiotics just to make their patients happy, even if the antibiotics cannot treat the illness at hand. As a result, antibiotics become more prevalent, the microbes they attack are more likely to develop resistance, and over time the antibiotics become ineffective. Learn about why some diseases have become antibiotic-resistant and how you can help address the problem.

1. Your team has been hired to develop a public relations campaign to help inform the general public about the threat of antibiotic resistance. You will gather information and produce an educational piece (pamphlet, brochure, PowerPoint presentation, poster board, or video commercial) to inform the general population.

2. The following Web sites might be helpful in your search:

- Center for Disease Control: A Public Health Action Plan to Combat Antimicrobial Resistance
  The introduction to this extensive action plan provides a good overview of the state of antibiotic resistance and some information about what federal agencies are doing to address the problem.
- Alliance for the Prudent Use of Antibiotics
  This nonprofit, international organization provides information for consumers about what antibiotics are and how the public can help limit the development of antibiotic resistance.
- The Rise of Antibiotic-Resistant Infection
  This article for the U.S. Food and Drug Administration's consumer newsletter describes the threats and mechanisms of antibiotic resistance.
- The Challenge of Antibiotic Resistance
  This feature article discusses strains of a staph infection that have emerged that are resistant to their accustomed antidote.

4. Your research team needs to process the information you collect and design an informational product for presentation to the class or distribution to a general audience. It should include:

- An explanation of antibiotic resistance;
- An explanation of how natural selection influences the effectiveness of antibiotics and the virulence of infectious agents;
- Information about how national and international agencies combat antibiotic resistance; and
- Tips for how the public can help combat increased antibiotic resistance.

Public Awareness Campaign : Evolution and Antibiotic Resistance

Student Name: _____

CATEGORY	4	3	2	1
Brainstorming - Solutions	Students identify more than 4 reasonable, insightful possible solutions/strategies to encourage change.	Students identify at least 4 reasonable, insightful possible solutions/strategies to encourage change.	Students identify at least 3 reasonable, insightful possible solutions/strategies to encourage change.	Students identify fewer than 3 reasonable, insightful possible solutions/strategies to encourage change.
Research/Statistical Data	Students include 4 or more high-quality examples or pieces of data to support their campaign.	Students include at least 3 high-quality examples or pieces of data to support their campaign.	Students include at least 2 high-quality examples or pieces of data to support their campaign.	Students include fewer than 2 high-quality examples or pieces of data to support their campaign.
Campaign/Product	Students create an original, accurate and interesting product that adequately addresses the issue.	Students create an accurate product that adequately addresses the issue.	Students create an accurate product but it does not adequately address the issue.	The product is not accurate.
Explanation of antibiotic resistance and the influcance of natrual selection	Students create a complete and accurate explanation of antibiotic resistance and the influence of natural selection.	Students create an explanation of antibiotic reseistance and the influence of natural selection.	Students create an explanation of antibiotic resistance and the influence of natural selection but it does not adequately explain.	No explanation is included.
Lab behavior	Student worked the entire time in computer lab and was on task.	Student worked most of the time on task in the compter lab.	Student work ethic in compter lab was lacking.	No work done.

Technology:

Technology in the classroom can help advance the comprehension of complex topics, like evolution. I have not used technology in this unit as a means of an end, rather to advance and better describe natural phenomena. The following list includes technology used during this unit.

- EPSON Projector – allows for projection of computer screen
- Microsoft Power Point – allows for easy projection of notes, diagrams, and images for lecture-discussion notes

- Student devices – allows for access to classroom webpage for information and the ability to research online databases for information for their student research project
- Videos from a variety of different sources (Crash Course, Stated Clearly, National Geographic) – allows for a different explanation and visual for classroom information and for student access later for them to review for the end of chapter test.

In the future, I would like to incorporate more use of formative response programs, such as Kahoot, Socrative, or clicker technology.

Detailed Lesson Plans:

The following pages are the detailed lesson plans for each day along with samples of the student work pages. (Duration of unit: 2 weeks)

Lesson Plan Day 1: Monday 3-28

Overview

Students participated in an introduction to the vocabulary and an introduction to the first part of the unit by creating flash cards with the word, definition, and a picture. Then students read through the first section and made an outline for the key topics.

Standards: B.8.3, B.8.4, and B.8.5

** I would change this lesson to be more engaging the next time I teach this unit. I would write the word "Evolution" on the board and ask students to do the same in their notebook. Then I would ask them to individually write down at least 10 things they have heard about evolution or have learned about evolution. This would allow me to assess their prior knowledge and potential misconceptions (like the most common "humans came from monkeys" statement) in a way that allows them to feel like they can express their thoughts.

Secondly, I would write the words: science, belief, fact, theory, law, and hypothesis on the board and have the students write the words in their notebook and on their own come up with their definition for each word.

Finally I would ask the students to volunteer their definitions for each word and talk about what science can and cannot study. Then I would transition into asking students to volunteer things they have heard or learned about evolution and write them on the board. After at least 10 different things are shared, I would have students work with their partner to pick 3 words/ideas/questions on the board and come up with a question, an answer, or a definition.

Then I would assign the flashcards vocab assignment to the students.

Objectives

- Students will be able to…
  - Define science (as the study of the natural world)
  - Define evolution (as change over time)
  - Recognize specified vocab words, their definitions, and provide an example

Co-Teaching Strategy

One teach, one assist

Procedures

1. Introduction: Writing evolution on the board and having students come up with at least 10 things. (10 minutes)
2. Writing vocab words on board and explaining to students to come up with their own definition. (10 minutes)
3. Go over definitions as a class. (10 minutes)
4. Transition into evolution and list students' list on board. (10 minutes)
5. Students pick three with their table partner and come up with a response. (5 minutes)
6. Assign vocab words and lesson wrap-up. (5 minutes)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)

Assessment/Evaluation

Formative assessment: of what was heard during discussion

This is assessed to understand students' incoming information

Paper assessment: of definitions, 10 things about evolution & 3 responses, and vocab assignment

Graded work for participation (except for vocab assignment at the end. This will be graded for correctness). This allows me to gage students' understanding and participation in class lecture-discussions.

Accommodations for:

Special Needs

Student can make electronic or paper flashcards
Student can fill out a checklist of what they think science can and cannot study
Student can relay information via explaining to teacher or assistant
Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.
Student can read ahead into next section
Student can depict lesson information in an infographic

Lesson Plan Day 2: Tuesday 4-29

Overview

Review/scaffolding: review vocab words as a class when discussing what science can and cannot study.
Students receive a "mystery object" and through observations and prior knowledge will hypothesize what the object is made of and what it is used for.

Objectives

- Students will be able to…
    - Define science (as the study of the natural world)
    - Define evolution (as change over time) and other vocabulary
    - Use the scientific method to determine what a mystery item is used for
    - Explain how scientists studying evolution use their observations, prior knowledge, and technology to support the theory of evolution

Co-Teaching Strategy

One teach, one assist

Procedures

1. Vocab check for grade while students work on bell work which is a review question (5 min)
2. Ask students what is science (bell work) and review vocab from prior day in quick class discussion (5 min)
3. Introduce mystery item activity and pass out mystery items. Students make observations and write them in their notebook (10 minutes)
4. Review hypothesis format and model how to write a hypothesis (5 min)
5. Students use their observations to write a hypothesis for their object (5 min)
6. Students discuss their hypothesis with a partner and see if they can work together to figure out the items (10 min)
7. Class discussion about mystery items and connection to evolution evidence (5 min)
8. Lesson wrap-up and review (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Mystery items (different one for every student)

Assessment/Evaluation

(How will you assess your students' progress toward meeting the lesson's objective(s)? What will be graded and why?)

Formative assessment: of what was heard during discussion

This is assessed to understand students' comprehension

Paper assessment: mystery item observations and hypothesis in journal

Assessed to see if student knows how to use the correct format for a hypothesis

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 3: Wednesday 3-30

Overview

Review/scaffolding: review bell work, "Can science study supernatural things?" – no, only the natural world.

Students will watch a video about Darwin's journey and work with Wallace while answering follow along questions.

Standards: B.8.3 and B.8.5

Objectives

- Students will be able to…
  - State Darwin's contribution to science
  - Describe the three patterns of biodiversity noted by Darwin

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work reviewing Monday and Tuesday's lesson (5 min)
2. Intro of Darwin's journey (5 min)
3. Video exploring Darwin and Wallace's study of evolution (35 min)
4. Class wrap-up of lesson (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Computer
- Projector
- Video: The Origin of Species: The Making of a Theory: Darwin, Wallace, and Natural Selection — HHMI BioInteractive Vide
  - https://www.youtube.com/watch?v=XOiUZ3ycZwU
- Follow along questions:

The Origin of Species: The Making of a Theory
Darwin, Wallace, and Natural Selection — HHMI BioInteractive Video
https://www.youtube.com/watch?v=XOiUZ3ycZwU

Directions: Read questions before watching the video to listen and watch for the answers. Watch the video (31:02) and answer all questions. Be specific with your answers.

1. In 1852 Alfred Russel _____spent 4 years collecting thousands of specimens in the Amazon Jungle. A _____ on the ship caused the loss of all of his specimens and notes about the life of various species.
2. _____ only shared his idea of a common origin with only a few trusted friends.
3. _____ was planning to become a clergyman in the Church of England until he was offered the chance to sail around the world on the British Ship: the _____. He was a passionate amateur naturalist and wanted to collect specimens.

4. He examined _____ by microscope. He questioned "Why were these forms created for so little apparent _____?"
5. In Argentina, roasted _____is a delicacy which Darwin tried and thought it tasted like duck. Close by, Darwin discovered a fossil of an ancient species: glyptodon and noticed that the hard _____covering provided protection for the fossil, just like for the armadillo.
6. In 1835 Darwin visited the Galapagos Islands, a remote Spanish colony. Darwin was a 26 year old collector. He did not know the _____of what he was collecting until much later.
7. Darwin rode a _____. The Spaniards gave Darwin an important clue: they could tell what island a _____came from based on the shape of the shell.
8. Darwin also observed _____ which had different colorations on different islands.
9. Darwin puzzled how similar but distinct creatures lived on nearby . Darwin thought that one species traveled from the mainland and in different ways on different islands.
10. The radical idea of Darwin's time: Species might _____.
11. In 1837 London, England: Darwin reflected on his journey. When reviewing the evidence collected from the voyage, he hypothesized that today's are descended from older extinct types. If so then all species are connected together in a _____.
12. Any species can give rise to any new and slightly different species, and as _____pass grand species arise. Species can give rise to new _____.
13. Darwin is England's most prominent naturalist when _____and Darwin meet for the first time. _____is single and must collect for the living and travels to the Malay Archipelago where he collected specimens for the next 8 years. He is captivated by _____, especially those called "bird wings" because of their shape and size.
14. Wallace identifies new species: some which are slightly different from others on nearby islands. Wallace's butterfly observations spark a similar thought that Darwin had: species _____.
15. Around the globe, the more _____ two species are, the _____ they tend to live. Based on the evidence collected, Wallace theorizes that species to not arise in random locations. They arise near similar species. Species are connected to one another like the _____ of a tree.
16. Wallace finds more evidence that all species are related by considering some intriguing creatures:

a. _____ are mammals which live entirely in the sea, but inside their flippers are _____bones.
b. Similar yet apparently useless bones are in _____flippers too.
c. Vestigial structures are supporting evidence that every species is a modified form of an _____ species.
d. Borneo Island: monkeys and orangutans: Western islands
e. New Guinea: tree kangaroos (marsupials): Eastern islands
f. Mammals of the eastern islands resemble those of _____. Mammals of the west resemble those of _____. The _____ line separates the mammals of the Archipelago. Special creation could not explain the line, but Wallace's earlier law could: species come from preexisting _____ species.
g. Wallace theorized that land bridges at one point connected the eastern islands to New Guinea and Australia which allowed for the movement of _____ through the area. The western islands were never _____ to the eastern islands, but the western islands were connected to Asia, so the west had different mammals: ones with placentas instead of _____.

17. Natural Processes, such as volcanism and erosion, could change the _____ of islands and continents, but what about species? How do they change?
18. Individuals among a species usually _____in small ways.
19. 1858 Molucca Islands: Wallace thought about the English economist Thomas Malthus who noted that human _____are held in place by famine, disease, and death. Wallace related this concept to other populations. Without _____, any species could quickly overrun earth, but animal populations tend to hold steady.
20. Wallace determines that species could change through massive death plus variation. Those individuals with _____ that give even a slight edge will survive, reproduce, and in time _____ those without the advantage.
21. Wallace thinks he might have an important new idea, but he wants a second opinion before publishing. In June 1858, Wallace asks _____to review his theories. _____was shocked that Wallace arrived at the same conclusion without sharing any of his _____.
22. Both men…
    a. …Observed slightly different species on nearby _____, and concluded that species could _____ over time.
    b. …Collected huge numbers of specimens and realized that _____ vary within species.

c. …Witnessed nature up close, and realized it was a _____ with major casualties.

23. Darwin feared he would lose all the _____ for his work, but collaborated with Wallace and agreed to read aloud parts from both Darwin and Wallace in the same day in England.

Assessment/Evaluation

Formative assessment: of what was heard during discussion

This is assessed to understand students' incoming information

Paper assessment: video follow along notes

Assessed to see how students were able to follow along with the video.

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Student can have an alternative assignment if they cannot watch video and write at same time.

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 4: Thursday 3-31

Overview

Review/scaffolding: bell work about Darwin's voyage and vocab: "biogeography was used by Darwin when he observed which two animals and where?" – Armadillo and Glyptodon.

Students will take a short set of notes about four people who had ideas which shaped Darwin's thinking about descent with modification. Then students will explore artificial selection (one of the ideas which shaped Darwin's thinking towards natural selection) through a game called "Go Milk" which involves students selecting cows with higher quantity of milk production to win the game (similar to Go Fish).

Standards: B.8.3 and B.8.5

Objectives

- Students will be able to…
  - Identify the conclusions drawn by Hutton and Lyell about Earth's history
  - Describe Lamarck's hypothesis of evolution
  - Describe Malthus' view of population growth
  - Explain the role of inherited variation in artificial selection

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work review (5 min)

2. Notes (15 min)
3. Go Milk (25 min)
4. Review and exit slip evaluation (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Projector screen
- Power point notes
- Go Milk cards and game rules:

Artificial Selection: Milk Market GO MILK!

Dairy cows have been artificially selected by humans for the cows who produce the best quality milk. This game (similar to "go fish") will emulate the directional and purposeful selection that humans caused to artificially select beneficial variations in a species which eventually resulted in the development of new species.

Goal: get to 11 points or more (as indicated on the cows) BUT! You must get there with only 2 cow cards… kind of (see special rules below!)

Number of cards	Type of cards
9	#1
3	#2
2	#3
1	#4
1	#7
16 Total	

1. Each individual person starts with
2. All players mix their cards into one large and central pile, the "farm." All players draw three cards.
3. If you have any two cows that have matching numbers, you may choose to place them down on the table during your turn ONLY.
4. You cannot have more than 3 cards in your hand.
5. The person with the most colorful shoes will start the game by asking ONE other person if they have a specific numbered cow. If that person has that numbered cow, they must give their cow to the player who asked. If the player does not have the card, they must say "Go Milk!" at which the asking player will draw ONE card from the center farm.
6. If you have more than 3 cards in your hand, you must pick one card to discard into the center pile.
7. A player can only lay down paired numbered cows when it is their turn.
8. A player can only lay down ONE pair per turn. If you have no cards after pairing, you can draw ONE card.
9. A player can only win the game when it is their turn. If you win, you have to say "Moo!" ☺

BUT WAIT! THERE'S MORE WAYS TO EARN YOUR POINTS! Special Rules below!

Paired Card Combinations

These card combinations can produce higher quality milk, but all of the cards in the card combinations must be paired on the table for a certain amount of turns. This time allows for the breeding on the cows and the maturation of their young who might have higher quality milk.

For Example:

If you have 2 pairs of Cow #3 cards (4 cards total) and you have both pairs down on the table, AND they mature on the table for 1 turn, your #3 Cows can breed you a level #6 Cow.

	#1 pair	#2 pair	#3 pair	#4 pair

#1 pair	#1	#3 (w/2 turns)	#4 (w/3 turns)	#5 (w/4 turns)
#2 pair		#4 (w/2 turns)	#5 (w/2 turns)	#6 (w/2 turns)
#3 pair			#6 (w/1 turn)	#7 (w/1 turn)
#4 pair				

Assessment/Evaluation

Formative assessment: of what was heard during game

This is assessed to understand students' understanding of artificial selection. I made a point to talk with each group and assess students' understanding of artificial selection.

Paper assessment: none

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 5: Friday 4-1

Overview

Review/scaffolding: bell work review and connection to today's topic: natural selection.

"How is artificial selection different from natural selection?" – The force selecting

Students will participate in a lecture-discussion for notetaking for the first part of the class. In the second part, students will participate in a natural selection simulation activity where they will pretend to be birds and select butterflies in order to survive.

Standards: B.8.5

Objectives

- Students will be able to…
  - Describe the conditions under which natural selection occurs
  - Explain the principle of common descent

Co-Teaching Strategy

One teach, one assist

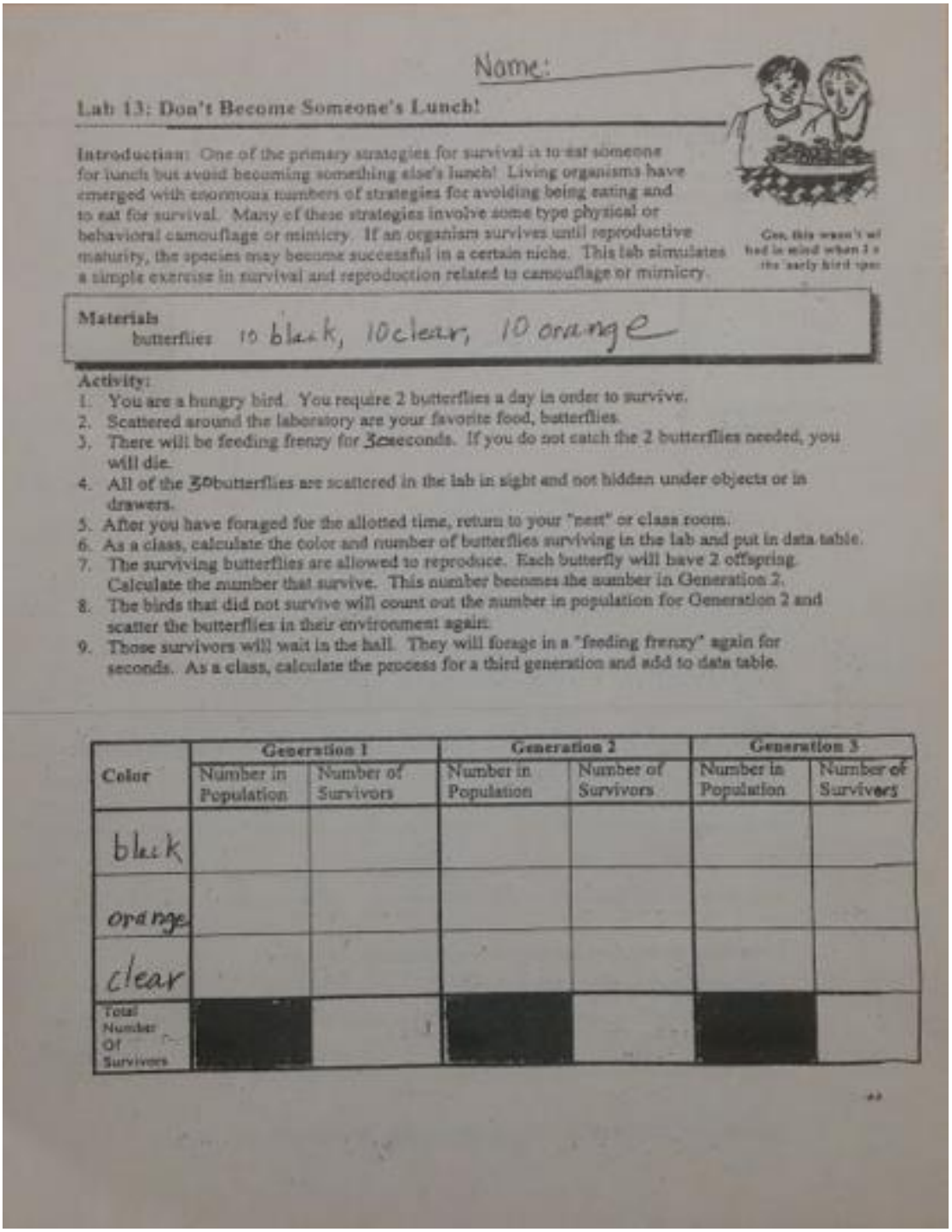
Procedures

1. Bell work review (5 min)
2. Natural Selection Notes (20 min)
3. Natural selection activity (25 min) – activity not finished, requires part of next class.

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Computer

- Projector
- Power point
- Excel file for data log during activity
- Orange, black, and clear butterflies (30 of each color)
- Student lab handout:



Name:

Lab 13: Don't Become Someone's Lunch!

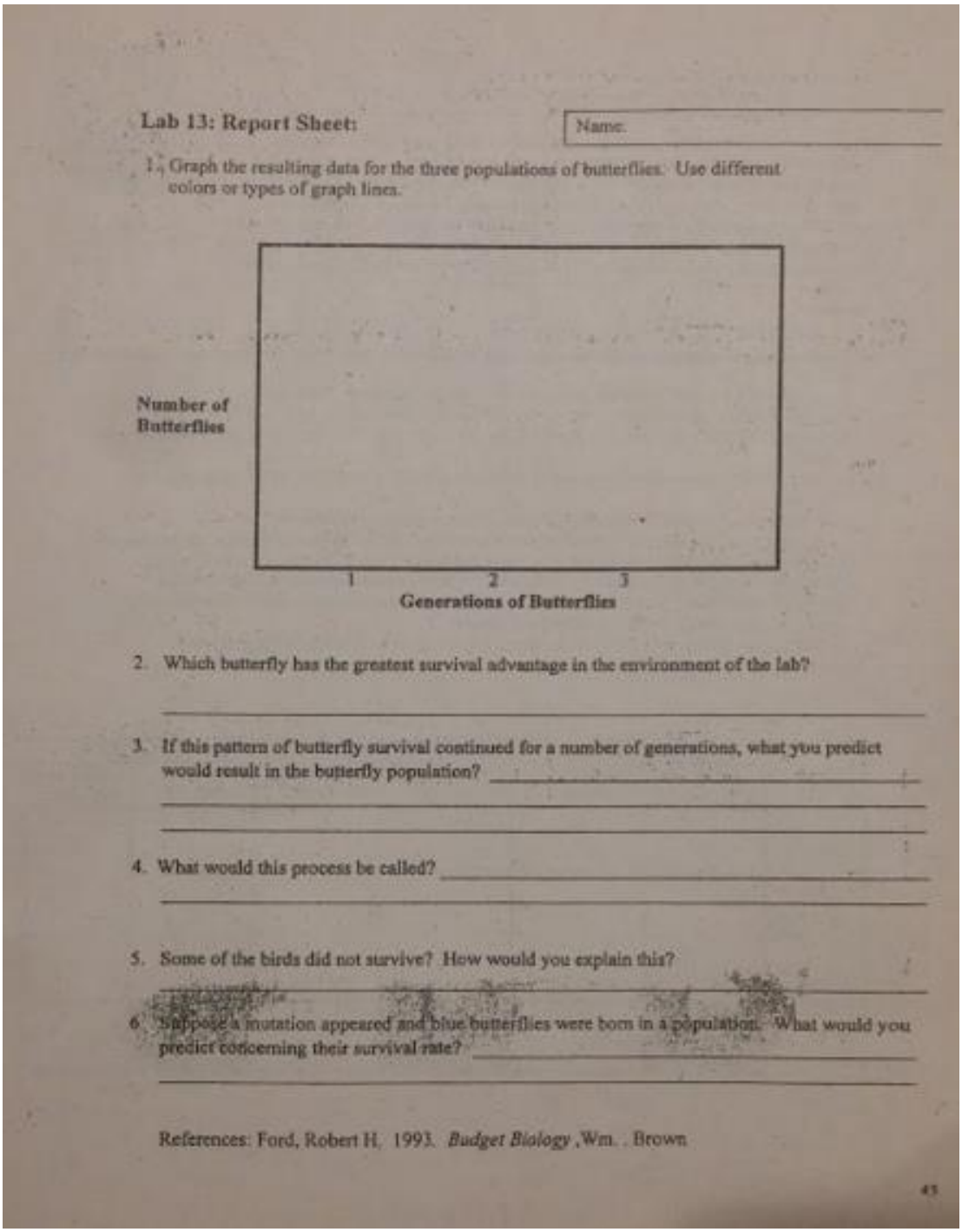
Introduction: One of the primary strategies for survival is to eat someone for lunch but avoid becoming something else's lunch! Living organisms have emerged with enormous numbers of strategies for avoiding being eating and to eat for survival. Many of these strategies involve some type physical or behavioral camouflage or mimicry. If an organism survives until reproductive maturity, the species may become successful in a certain niche. This lab simulates a simple exercise in survival and reproduction related to camouflage or mimicry.

Gee, this wasn't what I had in mind when I s the 'early bird spec

Materials
butterflies 10 black, 10 clear, 10 orange

Activity:
1. You are a hungry bird. You require 2 butterflies a day in order to survive.
2. Scattered around the laboratory are your favorite food, butterflies.
3. There will be feeding frenzy for 30seconds. If you do not catch the 2 butterflies needed, you will die.
4. All of the 30butterflies are scattered in the lab in sight and not hidden under objects or in drawers.
5. After you have foraged for the allotted time, return to your "nest" or class room.
6. As a class, calculate the color and number of butterflies surviving in the lab and put in data table.
7. The surviving butterflies are allowed to reproduce. Each butterfly will have 2 offspring. Calculate the number that survive. This number becomes the number in Generation 2.
8. The birds that did not survive will count out the number in population for Generation 2 and scatter the butterflies in their environment again.
9. Those survivors will wait in the hall. They will forage in a "feeding frenzy" again for seconds. As a class, calculate the process for a third generation and add to data table.

Color	Generation 1		Generation 2		Generation 3	
	Number in Population	Number of Survivors	Number in Population	Number of Survivors	Number in Population	Number of Survivers
black						
orange						
clear						
Total Number Of Survivors						



Lab 13: Report Sheet:

Name:

1. Graph the resulting data for the three populations of butterflies. Use different colors or types of graph lines.

Number of Butterflies

1 2 3

Generations of Butterflies

2. Which butterfly has the greatest survival advantage in the environment of the lab?

3. If this pattern of butterfly survival continued for a number of generations, what you predict would result in the butterfly population?

4. What would this process be called?

5. Some of the birds did not survive? How would you explain this?

6. Suppose a mutation appeared and blue butterflies were born in a population. What would you predict concerning their survival rate?

References: Ford, Robert H. 1993. *Budget Biology* ,Wm. . Brown

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Assessment/Evaluation

Formative assessment: of what was heard during discussion and lab

This is assessed to understand students' incoming information and comprehension

Paper assessment: lab worksheet (turned in next class)

Allows me to evaluate who understood the lab and the process of natural selection

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment
Alternative assignment if necessary

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.
Student can read ahead into next section
Student can depict lesson information in an infographic

Lesson Plan Day 6: Monday 4-4

Overview

Review/scaffolding: Bell work review of lab activity: "which butterfly has the highest fitness and why?" - The clear butterfly because it is not as easily seen.
Students will review natural selection by watching a video by stated clearly about the process of natural selection. We will have a brief discussion about the lab and then students will finish the data analysis and questions to the lab.
Standards: B.8.5

Objectives

(Bulleted list of what students will know, be able to do, or believe at the end of this lesson; include applicable standards.)

- Students will be able to…
  - Describe the conditions under which natural selection occurs
  - Explain the principle of common descent

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work review (5 min)
2. Natural selection video review (10 min)
3. Lab review discussion (5 min)
4. Lab analysis and questions (25 min)
5. Lesson wrap-up (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Projector
- Stated Clearly Video: https://www.youtube.com/watch?v=0SCjhI86grU
- Excel file

Assessment/Evaluation

Formative assessment: of what was heard during discussion and lab analysis
This is assessed to understand students' incoming information and comprehension
Paper assessment: lab worksheet
Allows me to evaluate who understood the lab and the process of natural selection

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 7: Tuesday 4-5

Overview

Review/scaffolding: bell work review of vocabulary: "Are bird wings and bee wings homologous or analogous structures? Explain." – They are analogous structures because they have the same function, but different structures.

Students will participate in a lecture-discussion about the evidence for evolution.

Standards: B.8.3, B.8.4, and B.8.5

Objectives

- Students will be able to…
  - Explain how geologic distribution of species relates to their evolutionary history
  - Explain how fossils and the fossil record document the descent of modern species from ancient ancestors
  - Describe what homologous structures and embryology suggest about the process of evolutionary change
  - Explain how molecular evidence can be used to trace the process of evolution
  - Explain the results of the Grants' investigation of adaptation in the Galapagos finches

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work review (5 min)
2. Evidence for evolution notes (19 min)
3. Brain break: students stand up and touch any 3 walls
   a. This is designed to break up the long set of notes and keep students engaged
4. Finish evidence notes (19 min)
5. Class wrap-up (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Power point
- Projector
- Computer
- Clicker to advance slides from around the room

Assessment/Evaluation

Formative assessment: of what was heard during lecture-discussion notes

This is assessed to understand students' incoming information and comprehension

Accommodations for:

Special Needs

Student can have a printed off version of notes to follow along and add additional notes in margins

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 8: Wednesday 4-6

Overview

Review/scaffolding: bell work review of vestigial structures: "What is the function of the femur bone in whales? Explain."

Students will be counted off and grouped into small groups. Each group will start at a different station which will have a different source of evidence and a practice worksheet. Students will complete the activity and record their responses on the worksheet. At the end of 10 minutes, students will rotate stations. Any work not finished will be homework.

Standards: B.8.3, B.8.4, and B.8.5

Objectives

- Students will be able to…
  - Explain how geologic distribution of species relates to their evolutionary history
  - Explain how fossils and the fossil record document the descent of modern species from ancient ancestors
  - Describe what homologous structures and embryology suggest about the process of evolutionary change
  - Explain how molecular evidence can be used to trace the process of evolution
  - Explain the results of the Grants' investigation of adaptation in the Galapagos finches

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work review & Stations explanation and fielding questions (5 min)
2. Station 1 (10 min)
3. Station 2 (10 min)
4. Station 3 (10 min)
5. Class wrap-up (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Station 1

Name _____ Class Period _____

Embryo/Fully Developed Organisms Observations Worksheet

Directions:

1. In groups, make observations about similarities and differences between the four embryos provided. Note your observations in the chart below.
2. Once your groups' observations are complete, set aside the embryos and observe the fully developed organisms. Note similarities and differences between the four organisms in the chart below.
3. Answer the conclusion questions provided.

Embryo Observations:

Similarities	Differences

Fully Developed Organisms Observations:

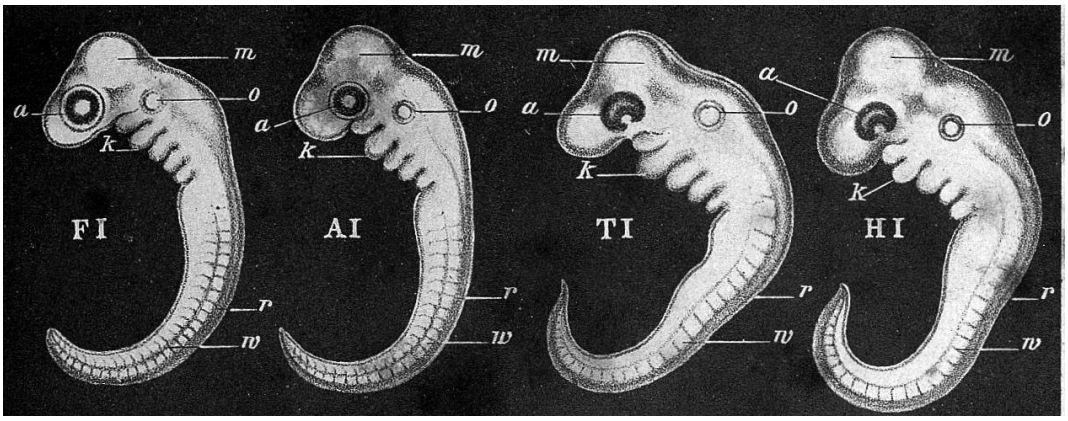
Similarities	Differences

Conclusion Questions:

1. What is an embryo?
2. What is comparative embryology?

3. Did you have more similarities or differences in your embryo observations chart? Use evidence from your observation chart to explain your answer.
4. Did you have more similarities or differences in your fully developed organisms observations chart? Use evidence from your observation chart to explain your answer.
5. How do you think comparative embryology shows support for evolution?

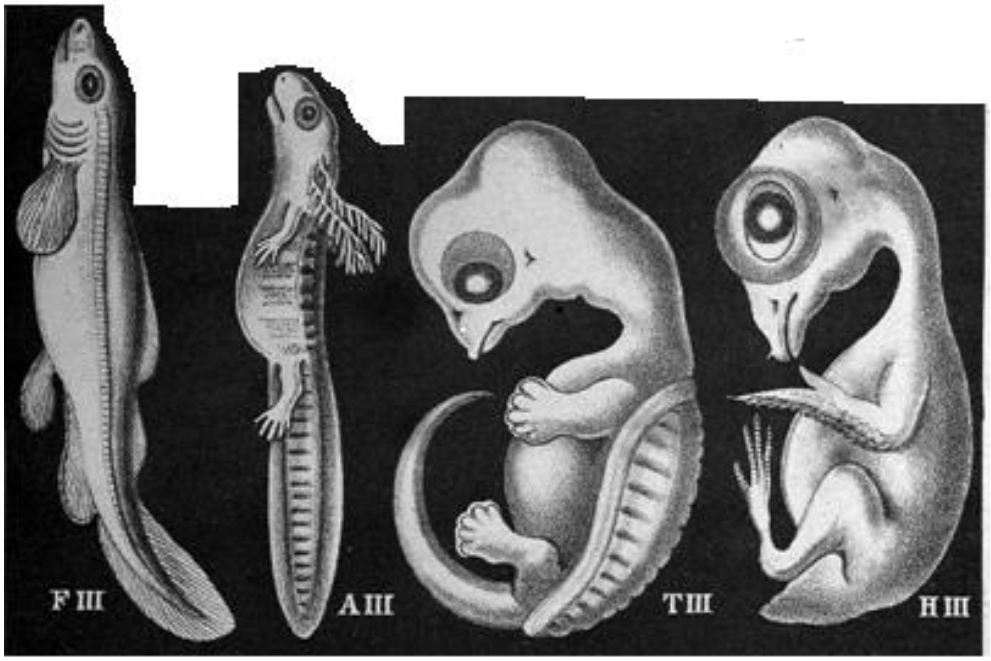
Embryos Set A



A B C D

https://commons.wikimedia.org/wiki/File:Ernst_Haeckel,_Anthropogenie._Wellcome_L0027291.jpg, (CC BY 4.0)

Fully Developed Organisms Set B



A B C D

https://commons.wikimedia.org/wiki/File:Ernst_Haeckel,_Anthropogenie._Wellcome_L0027292.jpg (CC BY 4.0)

- Station 2

Name _____ Class _____ Period _____

29-2 How Do Fossils Show Change?

Most organisms live, die, and decompose. They leave no traces of having lived. Under certain conditions, an organism's remains or tracks may be preserved as a fossil. Fossils give clues about how an organism looked and where it lived. They are often used by scientists as evidence of change.

A fossil is any remains of a once-living thing. Fossils may only be the outline of some plant, animal, or other organism that is preserved in rock. Sometimes, entire skeletons of animals that lived millions of years ago are found.

INTERPRETATIO

OBJECTIVES

In this activity, you will:

a. examine diagrams of fossil horses and present-day horses shown in their surroundings.
b. examine diagrams of the structure of the front foot of fossil horses and present-day horses.
c. note the changes in horses that have taken place over time.

KEYWORDS

Define the following keywords:

adaptation _____

Equus _____

fossil _____

Hyracotherium _____

natural selection _____

MATERIALS

metric ruler
colored pencils: red, blue, green, and yellow

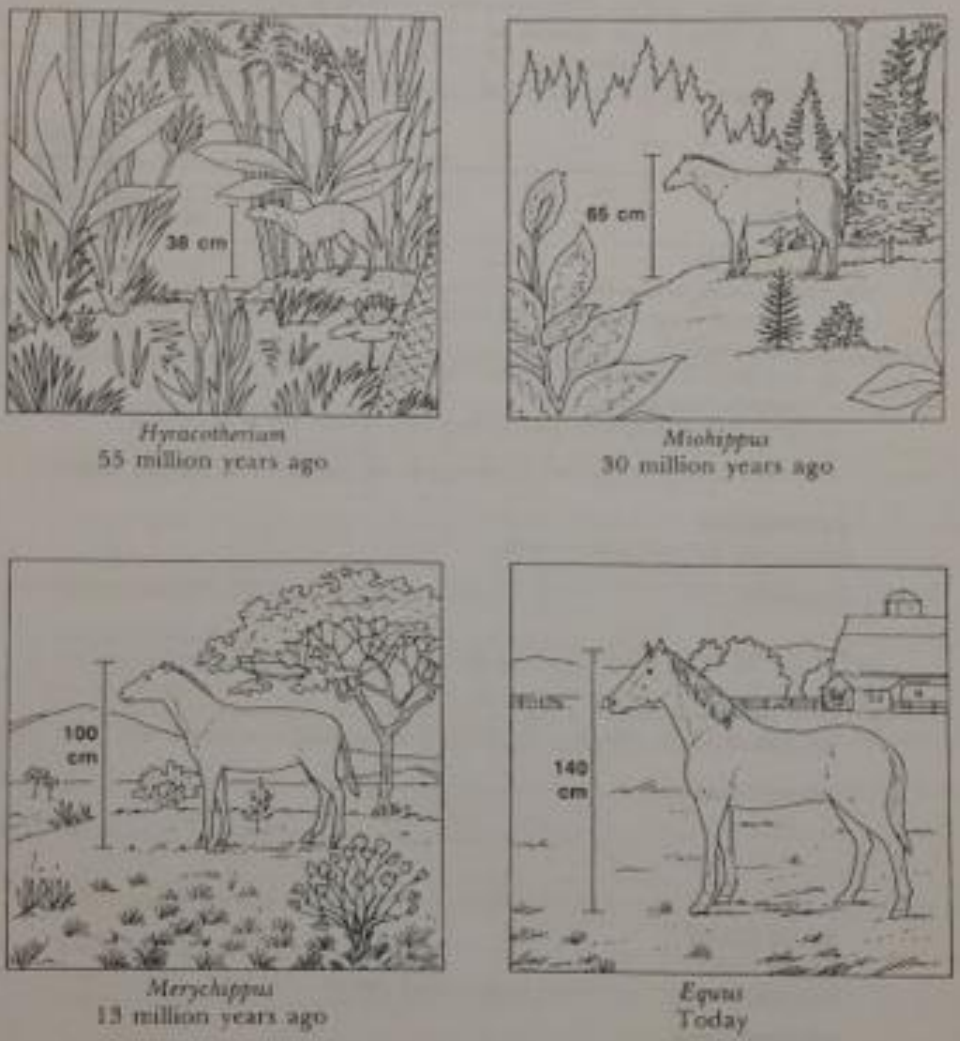
PROCEDURE

Part A. Change in Size With Time

1. Examine the diagrams in Figure 1 of *Hyracotherium*, *Merychippus*, *Equus*.
2. Use the diagrams to fill in Table 1.

Table 1. Evolution in the Horse

Horse	*Hyracotherium*	*Miohippus*	*Merychippus*	*Equus*
Size				
Type of surroundings				



Hyracotherium
55 million years ago

Miohippus
30 million years ago

Merychippus
13 million years ago

Equus
Today

FIGURE 1. Evolution of the horse

Name _____ Class _____ Period _____

Part B. Changes in Bone Structures With Time

The changes in horses over the last 55 million years have been shown by studies of large numbers of fossils. The earliest kind of horse was small and had teeth that were adapted to browsing on young shoots of trees and shrubs. The present-day horse is much larger and has larger teeth that are adapted to grazing on the tough leaves of grasses. Early horses were adapted to living in wooded, swampy areas where more toes were an advantage. The single-hoofed toes of the present-day horse allow it to travel fast in the plains.

1. Examine the diagrams in Figure 2. They show fossils of the front foot bones and the teeth of horses. The foot bones at the upper right of each diagram indicate the relative bone sizes of each kind of horse.

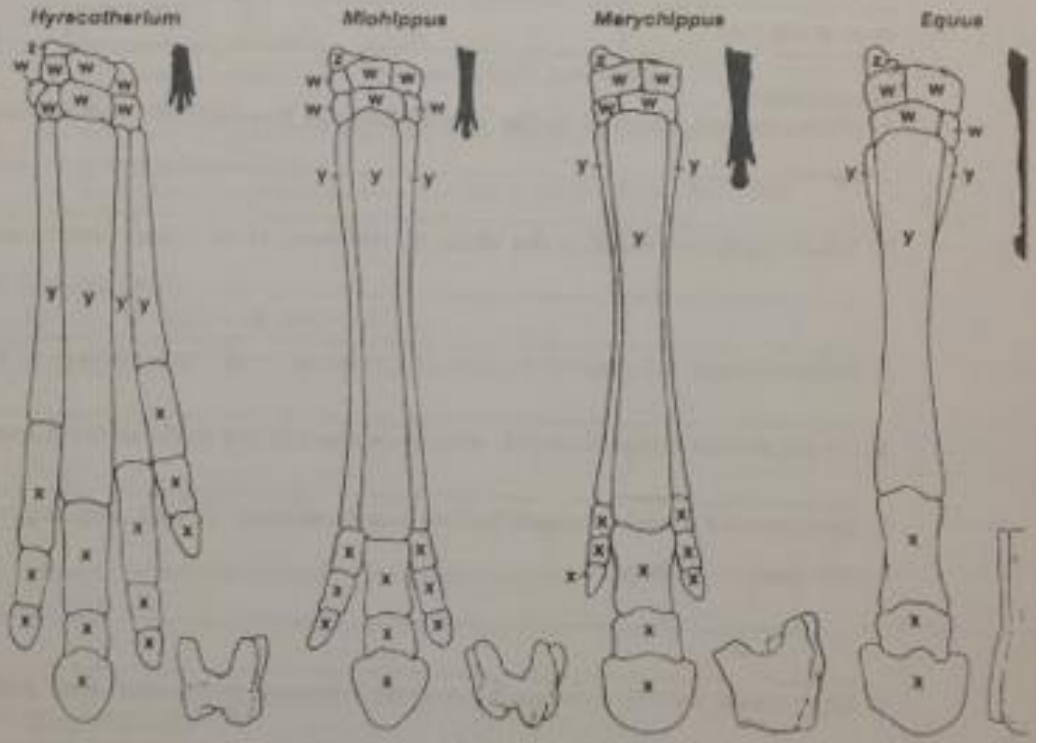


FIGURE 2. Forefoot bones and teeth of horses

2. Look for and color the following kinds of bones for each fossil horse.
   a. Color the toe bones red. These are marked for you with an *x*.
   b. Color the foot bones blue. These are marked with a *y*.
   c. Color the ankle bones green. These are marked with a *w*.
   d. Color the heel bones yellow. These are marked with a *z*.
3. Using the diagrams in Figure 2, make measurements to fill in Table 2.

Table 2. Evolution of the Horse

Kind of horse	*Hyracotherium*	*Mohippus*	*Merychippus*	*Equus*
Number of toes				
Number of toe bones				
Number of foot bones				
Number of ankle bones				
Number of heel bones				
Total number of foot bones				
Length of foot (measure inset diagrams) (mm)				
Height of teeth (mm)				

QUESTIONS

1. What changes occurred in the surroundings of horses from *Hyracotherium* to *Equus*?

2. What change occurred in the shape of the horse from *Hyracotherium* to *Equus*?

3. What changes occurred in the size of the horse from *Hyracotherium* to *Equus*?

4. As the surroundings changed, what happened to the teeth of the horse?

5. Describe the overall changes in foot length, number of toes, and size of toes in the horse over time.

6. How would natural selection have caused changes in the size, feet, and teeth of the horse?

- Station 3

The Molecular Connection

1. Find the human, rhesus monkey, kangaroo, snapping turtle, bullfrog, and tuna on the "Amino Acid Sequences in Cytochrome-C Proteins from 20 Different Species" chart provided and underline their names.

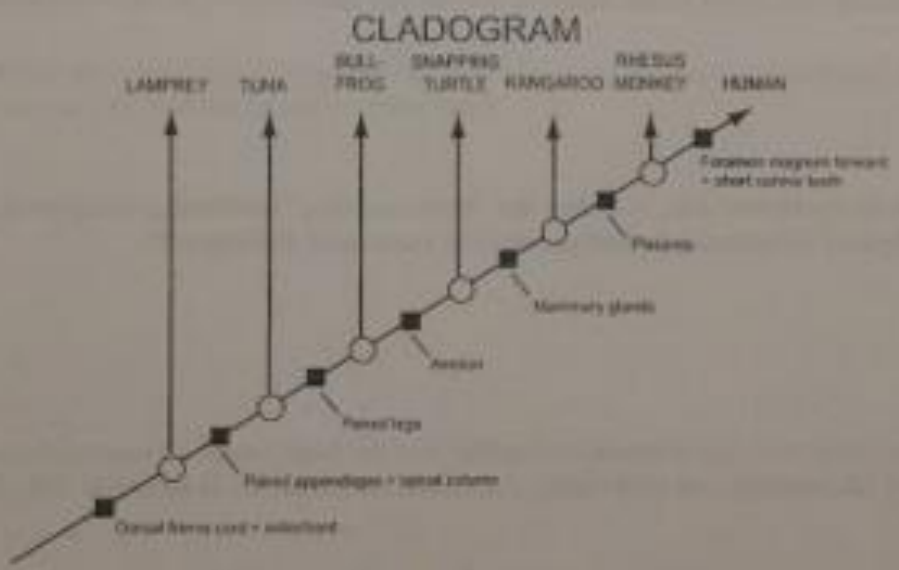
2. Compare the human amino acid sequence with each of these five animals by counting the number of times an amino acid in that animal's cytochrome c is different from the amino acid in that same position of the human sequence. For example, the number of differences between human and dog=10.

Write that information below:

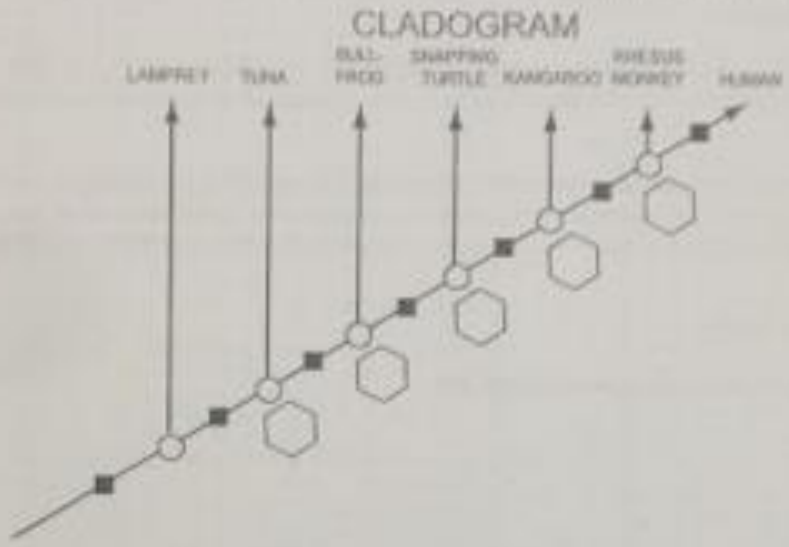
Number of amino acid differences between human and

- Rhesus monkey=
- Kangaroo=
- Snapping turtle=
- Bullfrog=
- Tuna=

3. The cladogram diagram below shows the relationship of selected animals based on their shared anatomical features. For example, out of seven key traits, all of these animals have a dorsal nerve cord, but only humans, monkeys and kangaroos have mammary glands.



Record the total number of amino acid differences between humans and each animal shown below. Write your answer in the hexagon below the arrow pointing to the name of that animal.



4. Does the data from the amino acid sequence generally agree with the anatomical data that was used to make the cladogram?

5. Do organisms with fewer shared anatomical traits also have more amino acid differences?

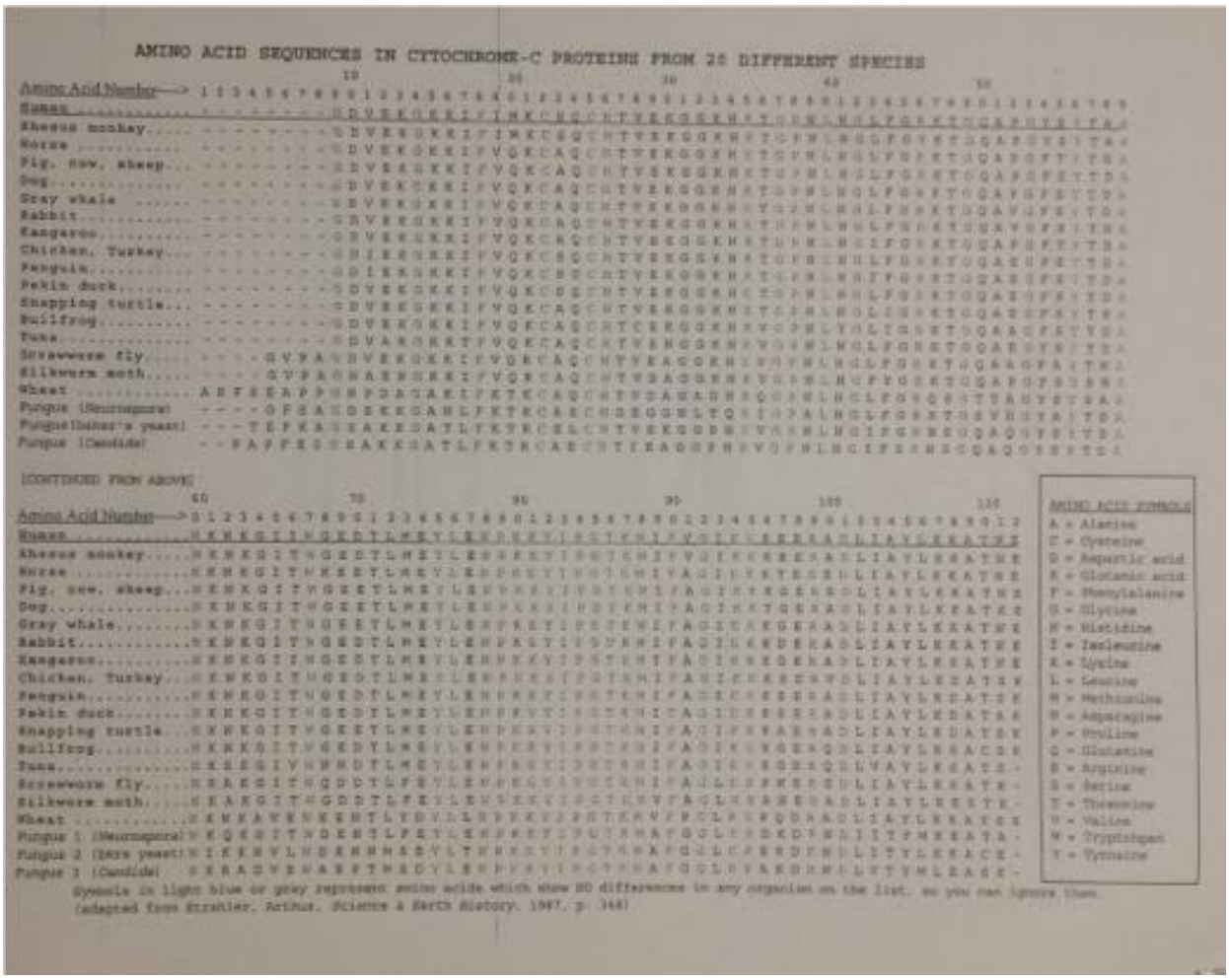
6. Based on the molecular data, how does the "human-monkey" relationship compare to the "duck-chicken" relationship (which shows three amino acid differences)?

7. If the molecular data, the structural similarities, and the fossil record all support the same pattern of relationships, can we be fairly confident that the pattern is accurate? Why or why not?

8. Chickens and turkeys are both birds and have the same sequence of amino acids in their cytochrome-c protein. Explain how two species can have identical cytochrome-c and still be different species.

9. Neurospora (bread mold) and Saccharomycetes (bakers yeast) are both fungi. Chickens and turkeys are both birds. What can you say about the inferred evolutionary relationships between the two birds compared to the relationship between the two fungi? Explain your reasoning.

10. Write a short paragraph summarizing the important information that can be obtained from cladograms (not the information used to make them).


AMINO ACID SEQUENCES IN CYTOCHROME-C PROTEINS FROM 25 DIFFERENT SPECIES

Amino Acid Number—>

Human

Rhesus monkey

Horse

Pig, cow, sheep

Dog

Gray whale

Rabbit

Kangaroo

Chicken, Turkey

Penguin

Pekin duck

Snapping turtle

Bullfrog

Tuna

Screwworm fly

Silkworm moth

Wheat

Fungus (Neurospora)

Fungus (Baker's yeast)

Fungus (Candida)

(CONTINUED FROM ABOVE)

Amino Acid Number—>

Human

Rhesus monkey

Horse

Pig, cow, sheep

Dog

Gray whale

Rabbit

Kangaroo

Chicken, Turkey

Penguin

Pekin duck

Snapping turtle

Bullfrog

Tuna

Screwworm fly

Silkworm moth

Wheat

Fungus 1 (Neurospora)

Fungus 2 (Baker's yeast)

Fungus 3 (Candida)

AMINO ACID SYMBOLS

A = Alanine

C = Cysteine

D = Aspartic acid

E = Glutamic acid

F = Phenylalanine

G = Glycine

H = Histidine

I = Isoleucine

K = Lysine

L = Leucine

M = Methionine

N = Asparagine

P = Proline

Q = Glutamine

R = Arginine

S = Serine

T = Threonine

V = Valine

W = Tryptophan

Y = Tyrosine

Symbols in light blue or gray represent amino acids which show NO differences in any organism on the list, so you can ignore them.

(adapted from Strahler, Arthur. Science & Earth History. 1987, p. 348)

Assessment/Evaluation

Formative assessment: of student comments and questions during stations

This is assessed to understand students' incoming information and comprehension

Paper assessment: stations worksheets

The worksheets allow me to assess the level of understanding of the evidence for evolution

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Student can have all stations and work individually if desired

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 9: Thursday 4-7

Overview

Review/scaffolding: bell work review: "what source of evidence did scientists use to study the evolution of the horse leg?" – Fossils and bone structures of modern day horses. Students will receive a review packet for the exam tomorrow. They will have the class to work on the review and ask any last minute questions.
Standards: B.8.3, B.8.4, and B.8.5

Objectives

- Students will be able to…
  - Define science (as the study of the natural world)
  - Define evolution (as change over time)
  - Recognize specified vocab words, their definitions, and provide an example
  - Define science (as the study of the natural world)
  - Define evolution (as change over time) and other vocabulary
  - Use the scientific method to determine what a mystery item is used for
  - Explain how scientists studying evolution use their observations, prior knowledge, and technology to support the theory of evolution
  - State Darwin's contribution to science
  - Describe the three patterns of biodiversity noted by Darwin
  - Identify the conclusions drawn by Hutton and Lyell about Earth's history
  - Describe Lamarck's hypothesis of evolution
  - Describe Malthus' view of population growth
  - Explain the role of inherited variation in artificial selection
  - Describe the conditions under which natural selection occurs
  - Explain the principle of common descent
  - Explain how geologic distribution of species relates to their evolutionary history
  - Explain how fossils and the fossil record document the descent of modern species from ancient ancestors
  - Describe what homologous structures and embryology suggest about the process of evolutionary change
  - Explain how molecular evidence can be used to trace the process of evolution
  - Explain the results of the Grants' investigation of adaptation in the Galapagos finches

Co-Teaching Strategy

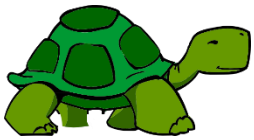
One teach, one assist

Procedures

1. Bell work review (5 min)
2. Study guide work (40 min)
3. Class wrap-up (5 min)

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- Study guide:



Biology – Chapter 16 Darwin & Evolution Exam Study Guide

Textbook: Chapter 16 – pages 449-479

1. 16.1 Where did Darwin travel? Did Darwin think similar looking island species could have been related?

2. 16.1 What animals did Darwin observe in his travels? What fossils did he find? What comparison did Darwin make between the living species and the fossils found nearby?

3. 16.1 What main ideas and evidence did Darwin contribute to science?

4. 16.2 Explain the difference between artificial selection and natural selection?

5. 16.2 What are a few examples of artificial selection? Pick one example and explain how artificial selection affected the organism.

6. 16.2 For the following people, list what they studied, an example of what they studied, and their main contribution.
    a. James Hutton
        i.
        ii.
        iii.
    b. Charles Lyell
        i.
        ii.
        iii.
    c. Lamarck
        i.
        ii.
        iii.
    d. Malthus
        i.
        ii.
        iii.
7. 16.3 Explain how natural selection works. Explain using a real world example.

8. 16.3 Are all mutations harmful? What are helpful or beneficial mutations called? (aka heritable characteristic) What does it increase for the organism?

9. 16.3 What does Darwin's mechanism for evolution suggest about living and extinct species? What did Darwin draw to show his idea?

10. 16.3 How about how long does it take for new species to develop, according to Darwin?

11. 16.4 List the fields of study which have evidence to support evolution: Circle the two that Darwin and the scientific community did NOT know about. Define each field of study.
    a.
    b.
    c.
    d.
    e.
    f.
    g.
12. 16.4 Define homologous structures and explain an example of homologous structures in nature.

13. 16.4 Define analogous structures and explain an example of analogous structures in nature.

14. 16.4 Define vestigial structures and explain an example of vestigial structures in nature.

15. 16.4 What are larvae? What field of study would examine and compare developing larvae of different species?

16. 16.4 Who are Peter and Rosemary Grant? What did they study?

17. 16.4 Did all animals become larger over time, or did some animals remain small in size? Provide examples in nature to support your hypothesis.

Assessment/Evaluation

Formative assessment: of student questions and comments during study guide review

This is assessed to understand students' comprehension of the unit

Paper assessment: completion of study guide

Allows me to see who has taken the time to review by filling out the study guide

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

Lesson Plan Day 10: Friday 4-8

Overview

Assessment of unit completed via post-test (paper and pencil)

Standards: B.8.3, B.8.4, and B.8.5

Objectives

- Students will be able to express their understanding of…
  - Define science (as the study of the natural world)
  - Define evolution (as change over time)
  - Recognize specified vocab words, their definitions, and provide an example
  - Define science (as the study of the natural world)
  - Define evolution (as change over time) and other vocabulary
  - Use the scientific method to determine what a mystery item is used for
  - Explain how scientists studying evolution use their observations, prior knowledge, and technology to support the theory of evolution
  - State Darwin's contribution to science
  - Describe the three patterns of biodiversity noted by Darwin
  - Identify the conclusions drawn by Hutton and Lyell about Earth's history
  - Describe Lamarck's hypothesis of evolution
  - Describe Malthus' view of population growth
  - Explain the role of inherited variation in artificial selection
  - Describe the conditions under which natural selection occurs
  - Explain the principle of common descent
  - Explain how geologic distribution of species relates to their evolutionary history
  - Explain how fossils and the fossil record document the descent of modern species from ancient ancestors
  - Describe what homologous structures and embryology suggest about the process of evolutionary change
  - Explain how molecular evidence can be used to trace the process of evolution
  - Explain the results of the Grants' investigation of adaptation in the Galapagos finches

Co-Teaching Strategy

One teach, one assist

Procedures

1. Bell work review/assessment: "What did you do to prepare for the exam in addition to the class work?"

Resources/Materials

- White board (or chalkboard)
- Markers (or chalk)
- See post-assessment for the test

Assessment/Evaluation

Formative assessment: of their bell work – how much did the student do to prepare

Allows me to see how the different preparation might affect the post-test grade

Paper assessment: post-test

Allows me to have a summative assessment of the unit

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt test

Student can take test in resource room

Enrichment

None

<u>Differentiation and Accommodations:</u>

Present throughout my lesson plans are the basic accommodations and differentiations for students as follows:

Accommodations for:

Special Needs

Student can relay information via explaining to teacher or assistant

Student can have extended time with assignment and can reattempt assignment

Enrichment

Student can find recent article about subject online and write down the main points and how it relates to what we are studying.

Student can read ahead into next section

Student can depict lesson information in an infographic

For special needs students, I always follow the directions in their IEP. This can include extended time with assignments and assessments, or allowing verbal answers. I only have a few special needs students and they do not have many accommodations listed in their IEP other than those previously mentioned.

For enrichment activities for students who finish their work ahead of others, they can either move ahead into the next section, or they can dive deeper into the current section by looking up current articles and sharing the information with the class. This one is my favorite because it brings in current topics and relevant issues/stories.

As for differentiation, I always try to cover a specific topic in at least three ways. For example, natural selection was first covered in the vocabulary assignment, followed by a brief discussion leading into notes, notes, lab activity using manipulatives and kinesthetic, video review and finally a group and class discussion. In this I am able to teach the topic using different modalities of learning in attempt to reach all students.

Authentic Real-life Applications:

In all lessons, I try to address relevant topics to the students and ones which will help them think critically. The mystery item lesson requires the student to think critically in order to figure out the mystery item. In class I make sure to state the connection to their lives because they should obtain all evidence before drawing conclusions. That skill can help students in all areas of life because it can help them evaluate the situation before making decisions or assumptions.

One other real life example I like to present is antibiotic resistance, virus evolution, and personalized medicine. I had a student ask "when will we ever need to know this stuff?" – in reference to evolution of populations, and we were able to have a discussion about antibiotic resistance, the treatments for HIV, and personalized medicine to treat genetic disorders.

Pre and Post-tests:

Student Pre-assessment:

Name: _____ Class: _____ Date: _____ ID: A

Chapter 16: Darwin's Descent with Modification Pre-assessment

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Darwin noticed that many organisms seemed well suited to
a. being preserved as fossils.
b. providing humans with food.
c. surviving in the environments in which they lived.
d. swimming from South America to the Galápagos Islands.

____ 2. When farmers select animals or plants to use for breeding, they look for
a. species that are perfect and unchanging.
b. homologous structures.
c. characteristics acquired during the lifetime of the organism.
d. natural variations that are present in a species.

____ 3. The principle of common descent helps explain why
a. well-adapted species have many offspring.
b. conditions in an organism's environment ensures the organism's survival.
c. birds and reptiles share a number of inherited characteristics.
d. tigers are so different from cheetahs.

____ 4. Similar patterns of embryological development in different but related organisms are responsible for the formation of
a. homologous structures.
b. analogous structures.
c. Hox genes.
d. intermediate fossil forms.

____ 5. According to the Grants' investigation of Galápagos finches, what happened to the beaks of finches?
a. Beaks became larger through artificial selection.
b. Beaks became smaller when they migrated.
c. Beaks became smaller during the finches' lifespan.
d. Beaks became larger over many generations.

____ 6. Biogeography is the study of
a. where species and their ancestors live.
b. how extinct species can be related to living species.
c. how different species can interbreed.
d. how animals that live in the same area are closely related.

Name: _____

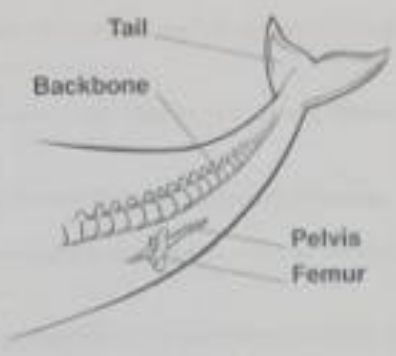


Figure 16–1

____ 7. In humans, the pelvis and femur, or thigh bone, are involved in walking. In whales, the pelvis and femur shown in Figure 16–1 are
   a. examples of fossils.
   b. vestigial structures.
   c. acquired traits.
   d. examples of natural variation.

Completion
Complete each statement.

8. The geologist _____ proposed that past changes in Earth must be explained in terms of events and processes observable today.

9. According to Lamarck, evolution resulted from the inheritance of _____ traits.

10. Charles Darwin applied Thomas Malthus's thoughts about human population growth to all _____.

Modified True/False
Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

____ 11. After his voyage on the *Beagle*, Charles Darwin wondered whether similar species from the Galápagos Islands could once have been members of the same species. _____

____ 12. In Charles Darwin's time, many people thought that Earth and its living things were formed about a few thousand years ago. _____

____ 13. Evidence that the surface of a mountain was once under the sea includes the presence of marine fossils on the mountain. _____

____ 14. According to Lamarck's hypothesis, an organism could change parts of its genotype and pass these changes to its offspring. _____

____ 15. Lyell hypothesized that human populations are kept in check by war, famine or starvation, and disease. _____

____ 16. Artificial selection as practiced by farmers is also called selective breeding. _____

____ 17. In natural selection, humans, rather than the environment, select the variations of traits to be passed to offspring. _____

____ 18. According to the concept of natural variation, living and extinct species evolved from the same ancestors. _____

____ 19. Darwin observed that birds in the Galápagos were closely related to species found in South America, but were not exactly the same. These observations of the patterns in the distribution of living things would be considered today to be in the field of embryology.

____ 20. The wings of birds and the flippers of dolphins are vestigial structures. _____

____ 21. When comparing the genomes of two species, the number of differences in their genetic codes can be used to estimate the time since their lineages split. _____

____ 22. In their studies of Galápagos finches, the Grants studied the molecular characteristics of finches from different islands. _____

Science Skills

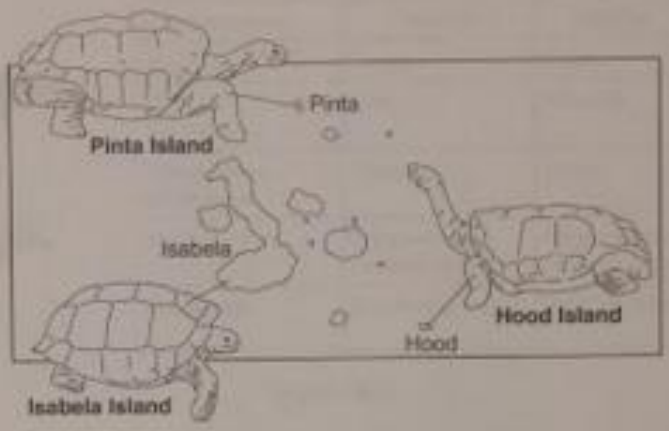


Figure 16–2

23. **Interpret Visuals** What adaptation is apparent in the bodies of the three tortoise species shown in Figure 16–2?

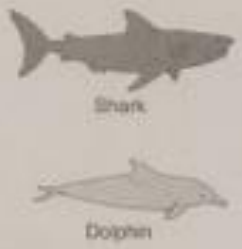
24. **Interpret Visuals** Which of the tortoises shown in Figure 16–2 has the longest neck?

25. **Infer** Vegetation on Hood Island is sparse and sometimes hard to reach. How might the vegetation have affected the evolution of the Hood Island tortoise shown in Figure 16–2?

26. **Form a Hypothesis** Considering the body structure of the tortoises shown in Figure 16–2, which tortoises—a population from Pinta Island or a population from Isabela Island—might survive more successfully on Hood Island? Why?

27. **Apply Concepts** Can you tell from Figure 16–2 how closely the three tortoise species resemble the ancestral species? Why or why not?

Name: _____



Comparison of Two Vertebrates		
Characteristics	**Shark**	**Dolphin**
Habitat	Ocean	Ocean
Type of Vertebrate	Fish	Mammal
Composition of Skeleton	Cartilage	Bone
Type of Teeth	Large numbers of sharp teeth	Large numbers of sharp teeth
Respiration	Breathes in water	Breathes in air

Figure 16–3

28. **Compare and Contrast** In Figure 16–3, sharks and dolphins belong to different vertebrate groups and are not closely related. How can Darwin's ideas about evolution help explain their similar appearance?

29. **Apply Concepts** Charles Darwin would say that sharks like the one in Figure 16–3 exhibit fitness. Explain what that means, and discuss two specific adaptations as part of your explanation.

30. **Apply Concepts** Fossil evidence indicates that dolphins evolved from ancestors that walked on land. How can the concept of natural selection be used to explain the evolution of the present-day dolphin body, as seen in Figure 16–3?

31. **Predict** Suppose a dolphin population, like those in Figure 16–3, becomes trapped in a harbor that is growing smaller and more shallow because of climate changes. Is it likely that the dolphins would evolve into a land-dwelling species in a few thousand years? Explain your answer.

32. **Infer** Based on Figure 16–3, if you wanted to find out whether sharks and dolphins share homologous structures, what structures would you examine? Explain.

Figure 16–4

33. **Infer** Scientists have never seen the ancient horses shown in Figure 16–4. What do you think was the main type of evidence scientists used to prepare these diagrams?

34. **Interpret Visuals** According to Figure 16–4, how did overall body size of the horse change during its evolution?

35. **Observe** In Figure 16–4, how does the size of the head change as the horse evolves?

36. **Compare and Contrast** According to Figure 16–4, how did the number of toes of *Mesohippus* compare with that of *Equus*, the modern horse?

37. **Infer** Does Figure 16–4 show that all species get much larger as they evolve?

Essay

Bird wing

Human arm

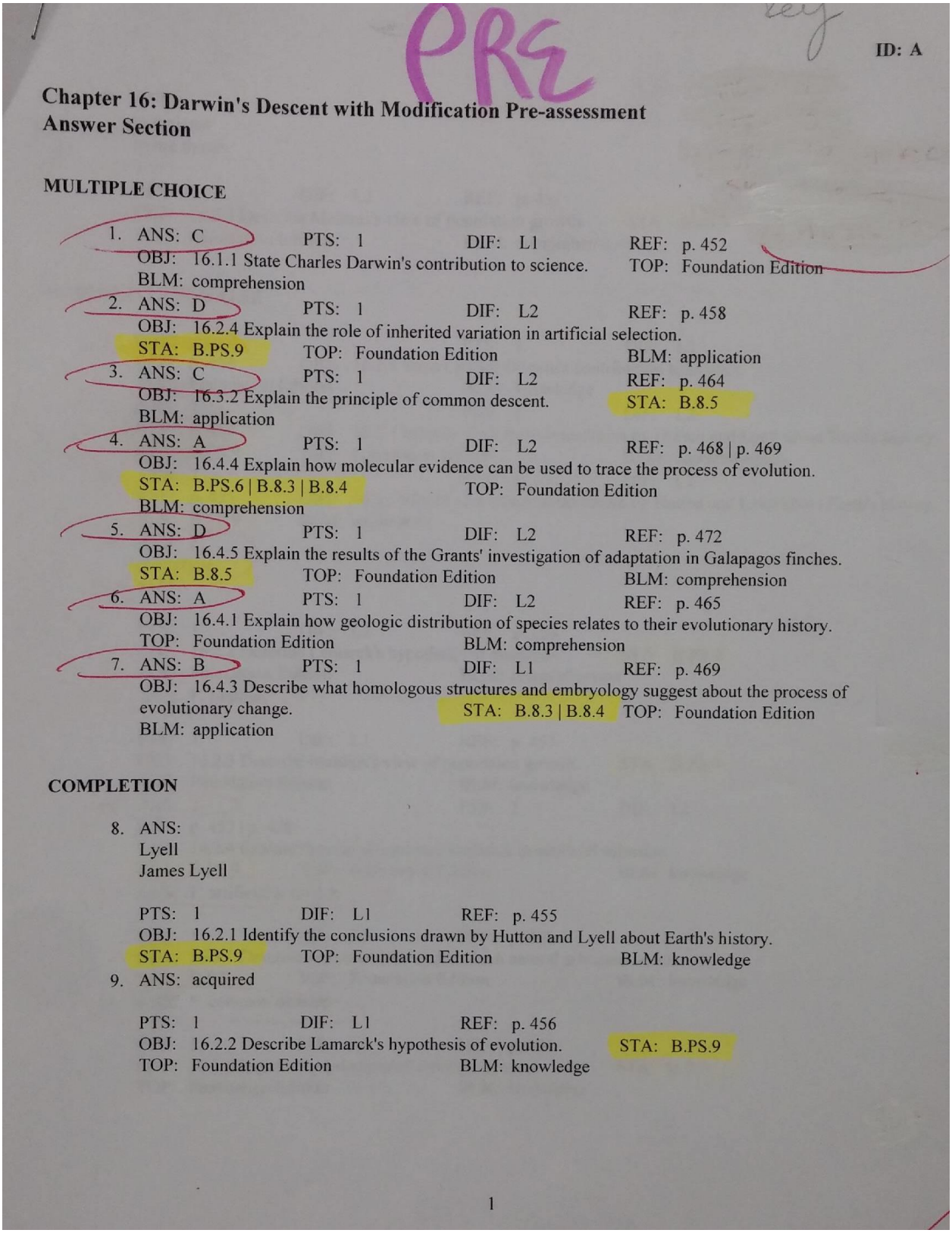
Figure 16-5

38. How is the idea of common descent supported by examples of homologous structures as shown in Figure 16-5?

39. What sources of evidence contributed to Charles Darwin's presentation of his concept of evolution by natural selection?

40. Darwin observed that different animals that lived in similar habitats existed around the world. Give an example of animals that Darwin observed that supported this observation.

Teacher Pre-assessment:



PRE

ID: A

Chapter 16: Darwin's Descent with Modification Pre-assessment
Answer Section

MULTIPLE CHOICE

1. ANS: C PTS: 1 DIF: L1 REF: p. 452
   OBJ: 16.1.1 State Charles Darwin's contribution to science. TOP: Foundation Edition
   BLM: comprehension
2. ANS: D PTS: 1 DIF: L2 REF: p. 458
   OBJ: 16.2.4 Explain the role of inherited variation in artificial selection.
   STA: B.PS.9 TOP: Foundation Edition BLM: application
3. ANS: C PTS: 1 DIF: L2 REF: p. 464
   OBJ: 16.3.2 Explain the principle of common descent. STA: B.8.5
   BLM: application
4. ANS: A PTS: 1 DIF: L2 REF: p. 468 | p. 469
   OBJ: 16.4.4 Explain how molecular evidence can be used to trace the process of evolution.
   STA: B.PS.6 | B.8.3 | B.8.4 TOP: Foundation Edition
   BLM: comprehension
5. ANS: D PTS: 1 DIF: L2 REF: p. 472
   OBJ: 16.4.5 Explain the results of the Grants' investigation of adaptation in Galapagos finches.
   STA: B.8.5 TOP: Foundation Edition BLM: comprehension
6. ANS: A PTS: 1 DIF: L2 REF: p. 465
   OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
   TOP: Foundation Edition BLM: comprehension
7. ANS: B PTS: 1 DIF: L1 REF: p. 469
   OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
   BLM: application

COMPLETION

8. ANS:
   Lyell
   James Lyell

   PTS: 1 DIF: L1 REF: p. 455
   OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
   STA: B.PS.9 TOP: Foundation Edition BLM: knowledge
9. ANS: acquired

   PTS: 1 DIF: L1 REF: p. 456
   OBJ: 16.2.2 Describe Lamarck's hypothesis of evolution. STA: B.PS.9
   TOP: Foundation Edition BLM: knowledge

1

10. ANS:
organisms
living things

PTS: 1 DIF: L2 REF: p. 457
OBJ: 16.2.3 Describe Malthus's view of population growth. STA: B.PS.9
TOP: Foundation Edition BLM: comprehension

MODIFIED TRUE/FALSE

11. ANS: T PTS: 1 DIF: L1
REF: p. 451 OBJ: 16.1.1 State Charles Darwin's contribution to science.
TOP: Foundation Edition BLM: knowledge

12. ANS: T PTS: 1 DIF: L2
REF: p. 454 OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
STA: B.PS.9 TOP: Foundation Edition BLM: comprehension

13. ANS: T PTS: 1 DIF: L2
REF: p. 455 OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
STA: B.PS.9 BLM: application

14. ANS: F
phenotype
body

PTS: 1 DIF: L2 REF: p. 456
OBJ: 16.2.2 Describe Lamarck's hypothesis of evolution. STA: B.PS.9
TOP: Foundation Edition BLM: comprehension

15. ANS: F, Malthus

PTS: 1 DIF: L1 REF: p. 457
OBJ: 16.2.3 Describe Malthus's view of population growth. STA: B.PS.9
TOP: Foundation Edition BLM: knowledge

16. ANS: T PTS: 1 DIF: L1
REF: p. 457 | p. 458
OBJ: 16.2.4 Explain the role of inherited variation in artificial selection.
STA: B.PS.9 TOP: Foundation Edition BLM: knowledge

17. ANS: F, artificial selection

PTS: 1 DIF: L2 REF: p. 458
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: knowledge

18. ANS: F, common descent

PTS: 1 DIF: L1 REF: p. 464
OBJ: 16.3.2 Explain the principle of common descent. STA: B.8.5
TOP: Foundation Edition BLM: knowledge

19. ANS: F, biogeography

PTS: 1 DIF: L2 REF: p. 465
OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
TOP: Foundation Edition BLM: comprehension

20. ANS: F, homologous

PTS: 1 DIF: L1 REF: p. 468
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: knowledge

21. ANS: T PTS: 1 DIF: L2
REF: p. 470
OBJ: 16.4.4 Explain how molecular evidence can be used to trace the process of evolution.
STA: B.PS.6 | B.8.3 | B.8.4 BLM: comprehension

22. ANS: F
physical characteristics
phenotype

PTS: 1 DIF: L2 REF: p. 472
OBJ: 16.4.5 Explain the results of the Grants' investigation of adaptation in Galapagos finches.
STA: B.8.5 TOP: Foundation Edition BLM: comprehension

SCIENCE SKILLS

23. ANS:
The tortoises have necks of different lengths and shells that differ in overall shape and in the size of the opening for the neck.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: analysis

24. ANS:
The Hood Island tortoise has the longest neck.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: application

25. ANS:
Ancestral tortoises with long necks and shells that permitted greater neck movement obtained food more easily, survived longer, and produced more offspring than other tortoises.

PTS: 1 DIF: L3 REF: p. 452
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 BLM: synthesis

26. ANS:
The Pinta Island tortoises would be likely to survive more successfully because they appear to be more similar to the Hood Island tortoises.

PTS: 1 DIF: L3 REF: p. 452
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: evaluation

27. ANS:
No. The diagram does not provide information on the ancestral species.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. BLM: analysis

28. ANS:
Darwin proposed that over time, natural selection made a population more fit for its environment. Sharks and dolphins both live in the ocean, where natural selection favors organisms that move efficiently through water.

PTS: 1 DIF: L3 REF: p. 452 | p. 453
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: synthesis

29. ANS:
Sharks show fitness because they are able to survive and reproduce successfully in their ocean environment. Students should give two of the following examples: (1) Sharks have an overall body shape that enables them to move rapidly through water. (2) Sharks have a large tail and fins that provide balance and enable them to steer. (3) Sharks have teeth that make them successful predators.

PTS: 1 DIF: L3 REF: p. 461
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: synthesis

30. ANS:
Student answer may include that the dolphin's land-dwelling ancestors were probably made up of populations with different body shapes and limbs. Those land-dwellers began to spend more time in the ocean, perhaps because food was easier to find. In each generation, those with bodies that moved efficiently in water survived longer and produced more offspring than others. Eventually, the whole population came to resemble today's dolphins.

PTS: 1 DIF: L3 REF: p. 463
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: synthesis

31. ANS:
It is not likely. Possible arguments: (1) Darwin emphasized that evolution usually requires millions, not thousands, of years. (2) The bodies of dolphins are well adapted to life in water, with little observable variation; it's unlikely that the population's relevant characteristics could change in just thousands of years.

PTS: 1 DIF: L3 REF: p. 450 | p. 460
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 BLM: synthesis

32. ANS:
Student answer could include that although their skeletons are made of different materials, there are likely to be homologous structures in the skull, backbone, and limbs. There may also be homologous structures among internal organs such as heart, brain, and digestive system.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: synthesis

33. ANS:
Scientists probably used the fossil bones of ancient horses from several sites and compared them with the bodies of modern horses.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
TOP: Foundation Edition BLM: synthesis

34. ANS:
Body size increased in mass and volume. (The horse became taller and heavier.)

PTS: 1 DIF: L2 REF: p. 466 | p. 467
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

35. ANS:
The head becomes larger.

PTS: 1 DIF: L2 REF: p. 466 | p. 467
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

36. ANS:
The number of toes decreased from three to one.

PTS: 1 DIF: L2 REF: p. 468
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

37. ANS:
No, this diagram shows a pattern only in horse evolution. Many other species have remained small.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: evaluation

ESSAY

38. ANS:
In their mature forms, homologous structures, such as bird wings and mammal forelimbs, appear somewhat different, but they develop from the same kinds of embryonic tissues. From this evidence, scientists infer that the particular species evolved from a common ancestor population that moved into different environments, where the populations were changed through natural selection.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: synthesis

39. ANS:
Darwin considered the fossil record, the geographic distribution of living species, the evidence of homologous body structures, and similarities in embryological development of vertebrates.

PTS: 1 DIF: L2 REF: p. 465 | p. 466 | p. 467 | p. 468 | p. 469
OBJ: 16.1.1 State Charles Darwin's contribution to science. TOP: Foundation Edition
BLM: application

40. ANS:
On the *Beagle*, Darwin saw three species of large, flightless birds living in similar habitats on different continents. Rheas lived only in South America, ostriches only in Africa, and emus only in Australia.

PTS: 1 DIF: L2 REF: p. 451
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: comprehension

Student Post-assessment:

Name: _____ Class: _____ Date: _____ ID: A

Chapter 16: Darwin's Descent with Modification Post-assessment

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Based on the adaptations Charles Darwin observed in finches and tortoises in the Galápagos, he wondered
a. if species living on different islands had once been members of the same species.
b. if finches and tortoises had originated from the same ancestral species.
c. if all birds on the different islands were finches.
d. why all tortoises on the different islands were identical.

____ 2. When a dairy farmer chooses to breed the cows that give the most milk in the herd, the farmers are following the principle of
a. acquired characteristics.
b. descent with modification.
c. artificial selection.
d. natural selection.

____ 3. The hypothesis that all species are descended from common ancestors was proposed by
a. James Hutton.
b. Jean-Baptiste Lamarck.
c. Thomas Malthus.
d. Charles Darwin.

____ 4. Darwin's concept of natural selection was NOT influenced by
a. the work of Charles Lyell.
b. knowledge about the structure of DNA.
c. his collection of specimens.
d. his trip on the H.M.S. *Beagle*.

____ 5. Modern sea star larvae resemble some primitive vertebrate larvae. This similarity may suggest that primitive vertebrates
a. share a common ancestor with sea stars.
b. evolved from sea stars.
c. evolved before sea stars.
d. belong to the same species as sea stars.

____ 6. Molecular evidence in support of natural selection includes
a. the nearly universal genetic code.
b. the presence of vestigial structures.
c. a tendency toward perfect, unchanging DNA in various species.
d. the transmission of acquired characteristics by DNA.

____ 7. According to the Grants' investigation of Galápagos finches, what happened to the beaks of finches?
a. Beaks became larger through artificial selection.
b. Beaks became smaller when they migrated.
c. Beaks became smaller during the finches' lifespan.
d. Beaks became larger over many generations.

Name: _____ ID: A

Completion
Complete each statement.

8. James Hutton and Charles Lyell held similar views about Earth's age. Both thought that Earth was _____ of years old.

9. According to Lamarck, evolution resulted from the inheritance of _____ traits.

10. Charles Darwin applied Thomas Malthus's thoughts about human population growth to all _____.

Modified True/False
Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

____ 11. After his voyage on the *Beagle*, Charles Darwin wondered whether similar species from the Galápagos Islands could once have been members of the same species. _____

____ 12. According to Lamarck, geological forces acting today are the same ones that have been acting in the past. _____

____ 13. Evidence that the surface of a mountain was once under the sea includes the presence of marine fossils on the mountain. _____

____ 14. According to Lamarck's hypothesis, an organism could change parts of its genotype and pass these changes to its offspring. _____

____ 15. Lyell hypothesized that human populations are kept in check by war, famine or starvation, and disease. _____

____ 16. Artificial selection as practiced by farmers is also called selective breeding. _____

____ 17. In natural selection, humans, rather than the environment, select the variations of traits to be passed to offspring. _____

____ 18. According to the concept of natural variation, living and extinct species evolved from the same ancestors. _____

____ 19. Darwin observed that birds in the Galápagos were closely related to species found in South America, but were not exactly the same. These observations of the patterns in the distribution of living things would be considered today to be in the field of embryology.

____ 20. The wings of birds and the flippers of dolphins are vestigial structures. _____

____ 21. When comparing the genomes of two species, the number of differences in their genetic codes can be used to estimate the time since their lineages split. _____

2

____ 22. In their studies of Galápagos finches, the Grants studied the molecular characteristics of finches from different islands. _____

Science Skills

Figure 16–4

23. **Infer** Scientists have never seen the ancient horses shown in Figure 16–4. What do you think was the main type of evidence scientists used to prepare these diagrams?

_____

_____

24. **Interpret Visuals** According to Figure 16–4, how did overall body size of the horse change during its evolution?

_____

_____

25. **Observe** In Figure 16–4, how does the size of the head change as the horse evolves?

_____

26. **Compare and Contrast** According to Figure 16–4, how did the number of toes of *Mesohippus* compare with that of *Equus*, the modern horse?

_____

_____

27. **Infer** Does Figure 16–4 show that all species get much larger as they evolve?

_____

_____

Name: _____ ID: A

Shark

Dolphin

Comparison of Two Vertebrates		
Characteristics	Shark	Dolphin
Habitat	Ocean	Ocean
Type of Vertebrate	Fish	Mammal
Composition of Skeleton	Cartilage	Bone
Type of Teeth	Large numbers of sharp teeth	Large numbers of sharp teeth
Respiration	Breathes in water	Breathes in air

Figure 16–3

28. **Compare and Contrast** In Figure 16–3, sharks and dolphins belong to different vertebrate groups and are not closely related. How can Darwin's ideas about evolution help explain their similar appearance?

_____

_____

29. **Apply Concepts** Charles Darwin would say that sharks like the one in Figure 16–3 exhibit fitness. Explain what that means, and discuss two specific adaptations as part of your explanation.

_____

_____

_____

30. **Apply Concepts** Fossil evidence indicates that dolphins evolved from ancestors that walked on land. How can the concept of natural selection be used to explain the evolution of the present-day dolphin body, as seen in Figure 16–3?

_____

_____

_____

_____

31. **Predict** Suppose a dolphin population, like those in Figure 16–3, becomes trapped in a harbor that is growing smaller and more shallow because of climate changes. Is it likely that the dolphins would evolve into a land-dwelling species in a few thousand years? Explain your answer. _____

_____

_____

_____

32. **Infer** Based on Figure 16–3, if you wanted to find out whether sharks and dolphins share homologous structures, what structures would you examine? Explain.

_____

_____

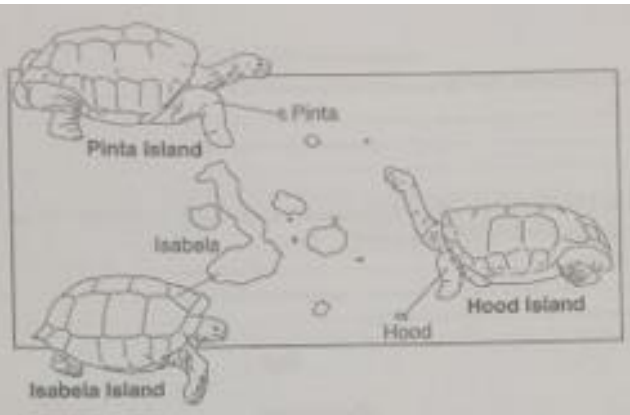


Figure 16–2

33. **Interpret Visuals** What adaptation is apparent in the bodies of the three tortoise species shown in Figure 16–2?

34. **Interpret Visuals** Which of the tortoises shown in Figure 16–2 has the longest neck?

35. **Infer** Vegetation on Hood Island is sparse and sometimes hard to reach. How might the vegetation have affected the evolution of the Hood Island tortoise shown in Figure 16–2?

36. **Form a Hypothesis** Considering the body structure of the tortoises shown in Figure 16–2, which tortoises—a population from Pinta Island or a population from Isabela Island—might survive more successfully on Hood Island? Why?

37. **Apply Concepts** Can you tell from Figure 16–2 how closely the three tortoise species resemble the ancestral species? Why or why not?

Short Answer

38. Summarize Charles Darwin's contribution to science.

39. What did Charles Darwin observe about some of the fossils he collected during his voyage on the *Beagle* and living species found in the same areas?

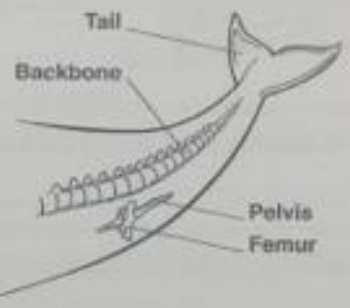
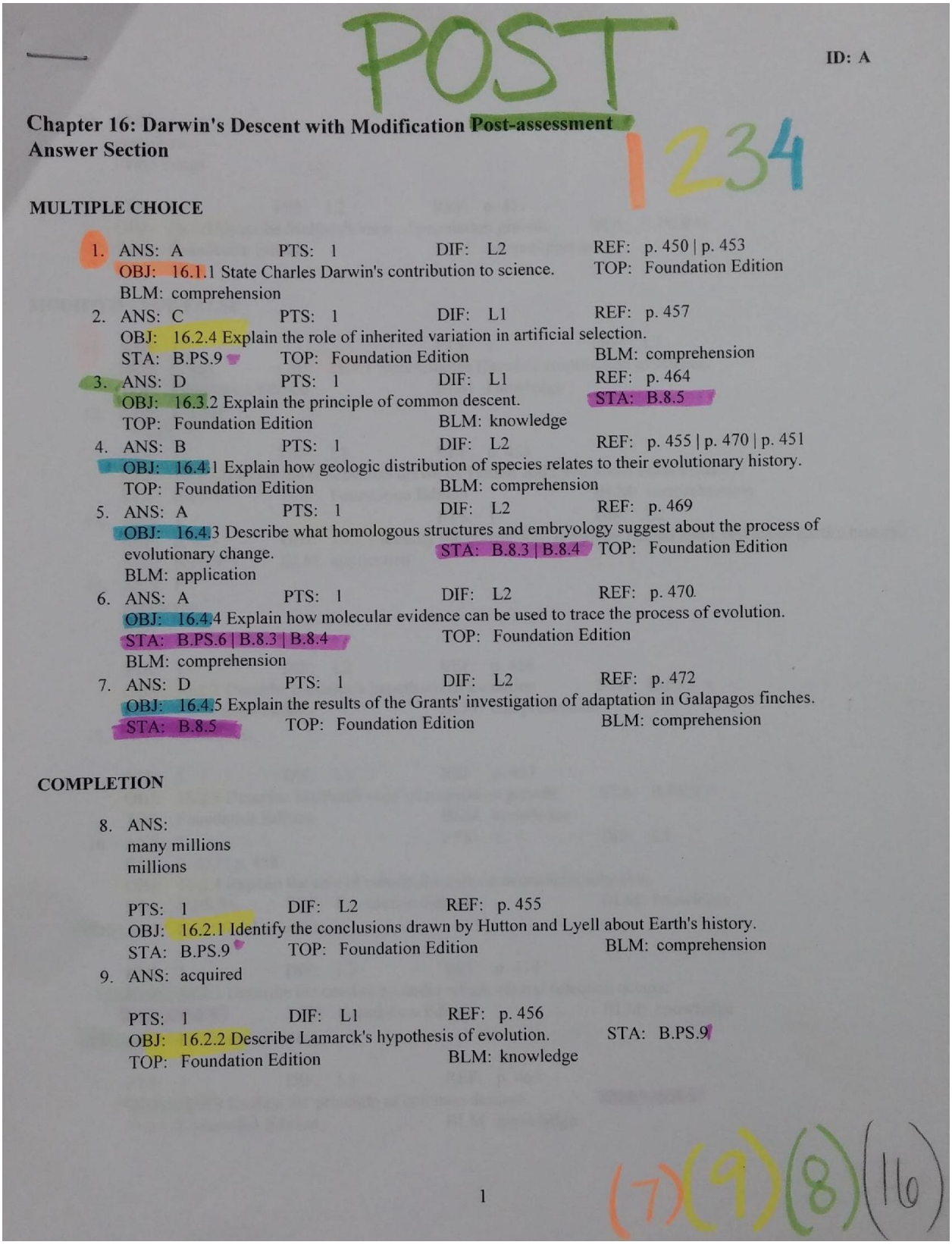


Figure 16–1

40. Many modern whales have a vestigial pelvis and femur, such as is shown in Figure 16–1. What does this evidence suggest about ancestors of modern whales?

Teacher Post-assessment:



POST

ID: A

Chapter 16: Darwin's Descent with Modification Post-assessment
Answer Section

1234

MULTIPLE CHOICE

1. ANS: A PTS: 1 DIF: L2 REF: p. 450 | p. 453
OBJ: 16.1.1 State Charles Darwin's contribution to science. TOP: Foundation Edition
BLM: comprehension
2. ANS: C PTS: 1 DIF: L1 REF: p. 457
OBJ: 16.2.4 Explain the role of inherited variation in artificial selection.
STA: B.PS.9 TOP: Foundation Edition BLM: comprehension
3. ANS: D PTS: 1 DIF: L1 REF: p. 464
OBJ: 16.3.2 Explain the principle of common descent. STA: B.8.5
TOP: Foundation Edition BLM: knowledge
4. ANS: B PTS: 1 DIF: L2 REF: p. 455 | p. 470 | p. 451
OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
TOP: Foundation Edition BLM: comprehension
5. ANS: A PTS: 1 DIF: L2 REF: p. 469
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: application
6. ANS: A PTS: 1 DIF: L2 REF: p. 470
OBJ: 16.4.4 Explain how molecular evidence can be used to trace the process of evolution.
STA: B.PS.6 | B.8.3 | B.8.4 TOP: Foundation Edition
BLM: comprehension
7. ANS: D PTS: 1 DIF: L2 REF: p. 472
OBJ: 16.4.5 Explain the results of the Grants' investigation of adaptation in Galapagos finches.
STA: B.8.5 TOP: Foundation Edition BLM: comprehension

COMPLETION

8. ANS:
many millions
millions

PTS: 1 DIF: L2 REF: p. 455
OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
STA: B.PS.9 TOP: Foundation Edition BLM: comprehension
9. ANS: acquired

PTS: 1 DIF: L1 REF: p. 456
OBJ: 16.2.2 Describe Lamarck's hypothesis of evolution. STA: B.PS.9
TOP: Foundation Edition BLM: knowledge

1

(7)(9)(8)(16)

10. ANS:
organisms
living things

PTS: 1 DIF: L2 REF: p. 457
OBJ: 16.2.3 Describe Malthus's view of population growth. STA: B.PS.9
TOP: Foundation Edition BLM: comprehension

MODIFIED TRUE/FALSE

11. ANS: T PTS: 1 DIF: L1
REF: p. 451 OBJ: 16.1.1 State Charles Darwin's contribution to science.
TOP: Foundation Edition BLM: knowledge
12. ANS: F, Lyell

PTS: 1 DIF: L2 REF: p. 455
OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
STA: B.PS.9 TOP: Foundation Edition BLM: comprehension
13. ANS: T PTS: 1 DIF: L2
REF: p. 455 OBJ: 16.2.1 Identify the conclusions drawn by Hutton and Lyell about Earth's history.
STA: B.PS.9 BLM: application
14. ANS: F
phenotype
body

PTS: 1 DIF: L2 REF: p. 456
OBJ: 16.2.2 Describe Lamarck's hypothesis of evolution. STA: B.PS.9
TOP: Foundation Edition BLM: comprehension
15. ANS: F, Malthus

PTS: 1 DIF: L1 REF: p. 457
OBJ: 16.2.3 Describe Malthus's view of population growth. STA: B.PS.9
TOP: Foundation Edition BLM: knowledge
16. ANS: T PTS: 1 DIF: L1
REF: p. 457 | p. 458
OBJ: 16.2.4 Explain the role of inherited variation in artificial selection.
STA: B.PS.9 TOP: Foundation Edition BLM: knowledge
17. ANS: F, artificial selection

PTS: 1 DIF: L2 REF: p. 458
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: knowledge
18. ANS: F, common descent

PTS: 1 DIF: L1 REF: p. 464
OBJ: 16.3.2 Explain the principle of common descent. STA: B.8.5
TOP: Foundation Edition BLM: knowledge

19. ANS: F, biogeography

PTS: 1 DIF: L2 REF: p. 465
OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
TOP: Foundation Edition BLM: comprehension

20. ANS: F, homologous

PTS: 1 DIF: L1 REF: p. 468
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: knowledge

21. ANS: T PTS: 1 DIF: L2
REF: p. 470
OBJ: 16.4.4 Explain how molecular evidence can be used to trace the process of evolution.
STA: B.PS.6 | B.8.3 | B.8.4 BLM: comprehension

22. ANS: F
physical characteristics
phenotype

PTS: 1 DIF: L2 REF: p. 472
OBJ: 16.4.5 Explain the results of the Grants' investigation of adaptation in Galapagos finches.
STA: B.8.5 TOP: Foundation Edition BLM: comprehension

SCIENCE SKILLS

23. ANS:
Scientists probably used the fossil bones of ancient horses from several sites and compared them with the bodies of modern horses.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.1 Explain how geologic distribution of species relates to their evolutionary history.
TOP: Foundation Edition BLM: synthesis

24. ANS:
Body size increased in mass and volume. (The horse became taller and heavier.)

PTS: 1 DIF: L2 REF: p. 466 | p. 467
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

25. ANS:
The head becomes larger.

PTS: 1 DIF: L2 REF: p. 466 | p. 467
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

26. ANS:
The number of toes decreased from three to one.

PTS: 1 DIF: L2 REF: p. 468
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: analysis

27. ANS:
No, this diagram shows a pattern only in horse evolution. Many other species have remained small.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. TOP: Foundation Edition BLM: evaluation

28. ANS:
Darwin proposed that over time, natural selection made a population more fit for its environment. Sharks and dolphins both live in the ocean, where natural selection favors organisms that move efficiently through water.

PTS: 1 DIF: L3 REF: p. 452 | p. 453
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: synthesis

29. ANS:
Sharks show fitness because they are able to survive and reproduce successfully in their ocean environment. Students should give two of the following examples: (1) Sharks have an overall body shape that enables them to move rapidly through water. (2) Sharks have a large tail and fins that provide balance and enable them to steer. (3) Sharks have teeth that make them successful predators.

PTS: 1 DIF: L3 REF: p. 461
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: synthesis

30. ANS:
Student answer may include that the dolphin's land-dwelling ancestors were probably made up of populations with different body shapes and limbs. Those land-dwellers began to spend more time in the ocean, perhaps because food was easier to find. In each generation, those with bodies that moved efficiently in water survived longer and produced more offspring than others. Eventually, the whole population came to resemble today's dolphins.

PTS: 1 DIF: L3 REF: p. 463
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: synthesis

31. ANS:
It is not likely. Possible arguments: (1) Darwin emphasized that evolution usually requires millions, not thousands, of years. (2) The bodies of dolphins are well adapted to life in water, with little observable variation; it's unlikely that the population's relevant characteristics could change in just thousands of years.

PTS: 1 DIF: L3 REF: p. 450 | p. 460
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 BLM: synthesis

32. ANS:
Student answer could include that although their skeletons are made of different materials, there are likely to be homologous structures in the skull, backbone, and limbs. There may also be homologous structures among internal organs such as heart, brain, and digestive system.

PTS: 1 DIF: L3 REF: p. 468
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: synthesis

33. ANS:
The tortoises have necks of different lengths and shells that differ in overall shape and in the size of the opening for the neck.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: analysis

34. ANS:
The Hood Island tortoise has the longest neck.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: application

35. ANS:
Ancestral tortoises with long necks and shells that permitted greater neck movement obtained food more easily, survived longer, and produced more offspring than other tortoises.

PTS: 1 DIF: L3 REF: p. 452
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 BLM: synthesis

36. ANS:
The Pinta Island tortoises would be likely to survive more successfully because they appear to be more similar to the Hood Island tortoises.

PTS: 1 DIF: L3 REF: p. 452
OBJ: 16.3.1 Describe the conditions under which natural selection occurs.
STA: B.8.5 TOP: Foundation Edition BLM: evaluation

37. ANS:
No. The diagram does not provide information on the ancestral species.

PTS: 1 DIF: L2 REF: p. 452
OBJ: 16.4.2 Explain how fossils and the fossil record document the descent of modern species from ancient ancestors. BLM: analysis

RT ANSWER

38. ANS:
Darwin proposed a scientific theory of biological evolution to explain how organisms evolved over long periods of time through descent from common ancestors.

PTS: 1 DIF: L2 REF: p. 450
OBJ: 16.1.1 State Charles Darwin's contribution to science. TOP: Foundation Edition
BLM: comprehension

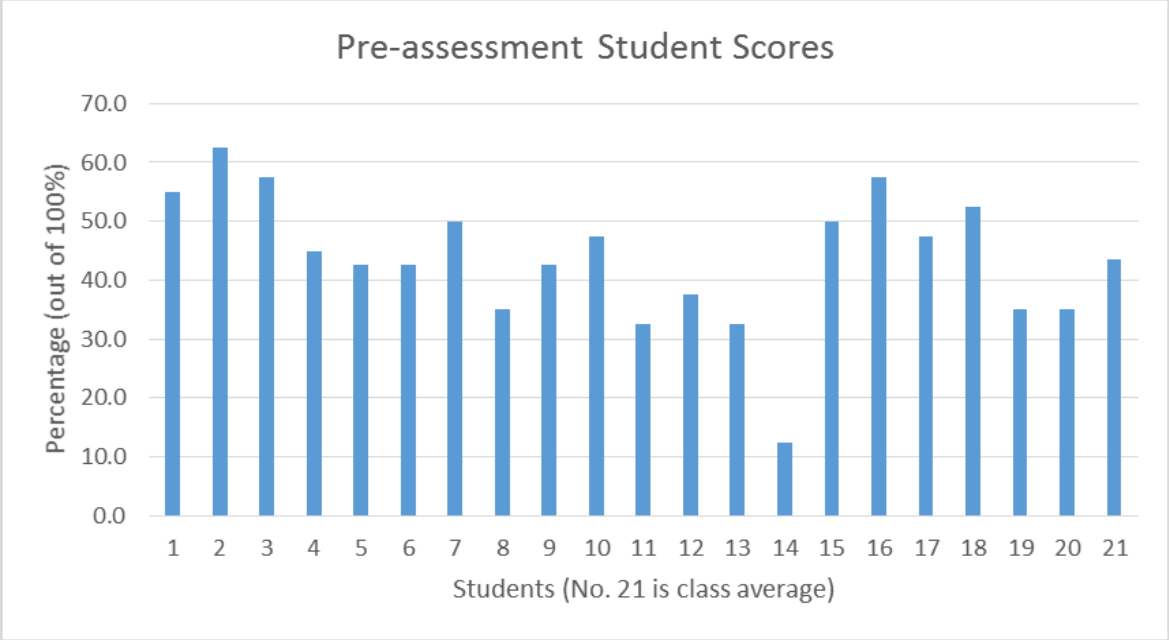
39. ANS:
Darwin noticed that some of the fossils were similar to living species.

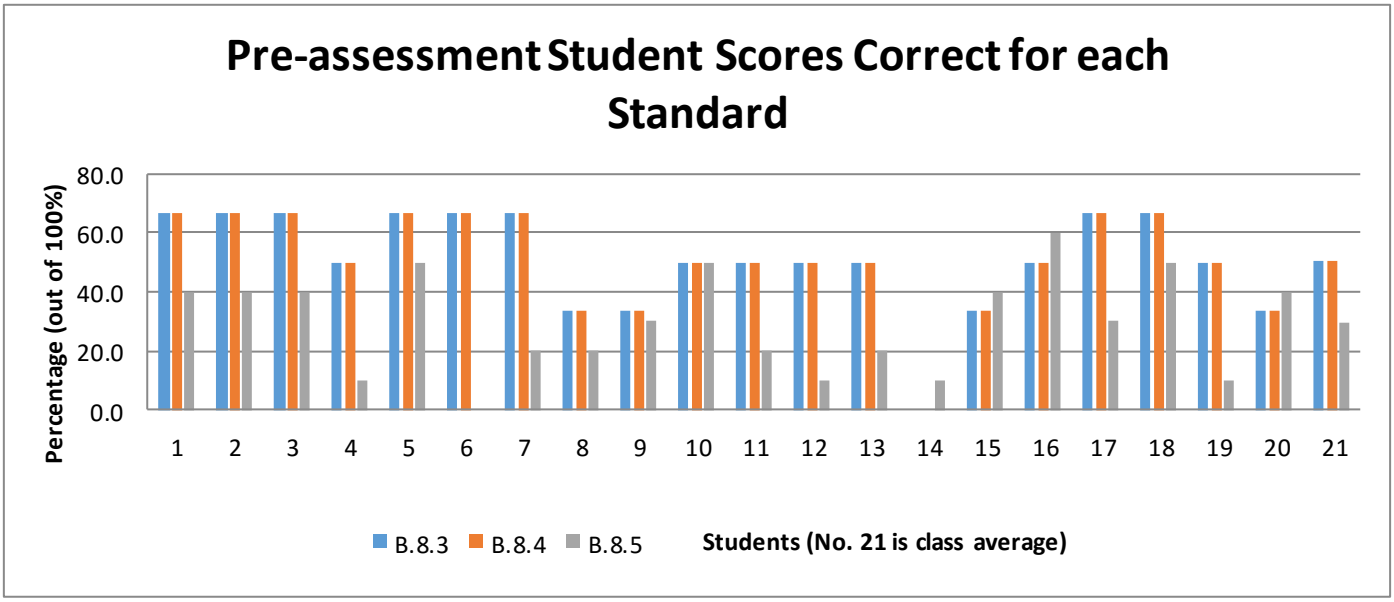
PTS: 1 DIF: L1 REF: p. 453
OBJ: 16.1.2 Describe the three patterns of biodiversity noted by Darwin.
TOP: Foundation Edition BLM: comprehension

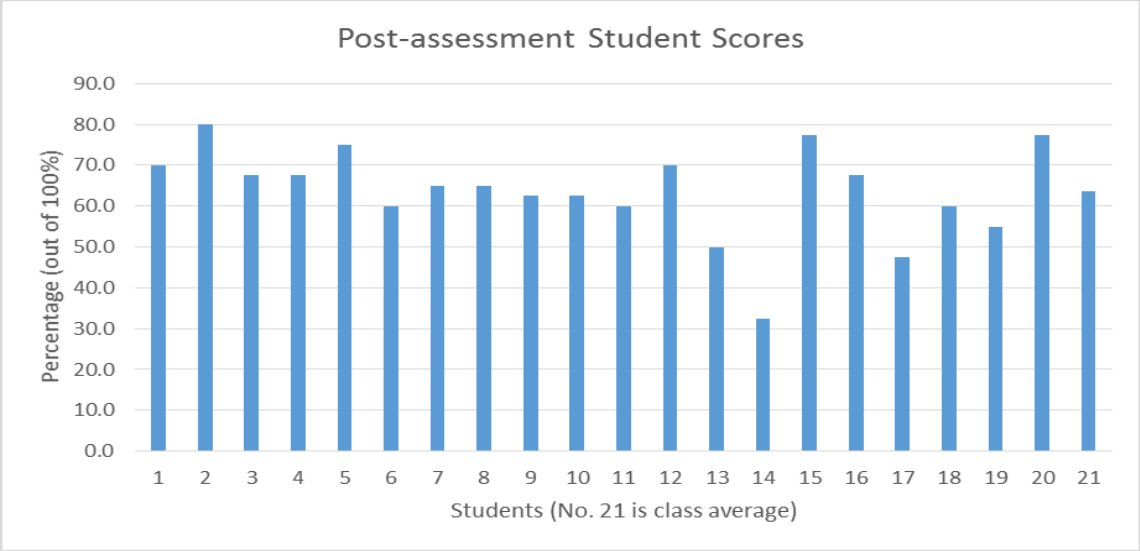
40. ANS:
Ancestors of modern whales probably had functional legs and lived on land.

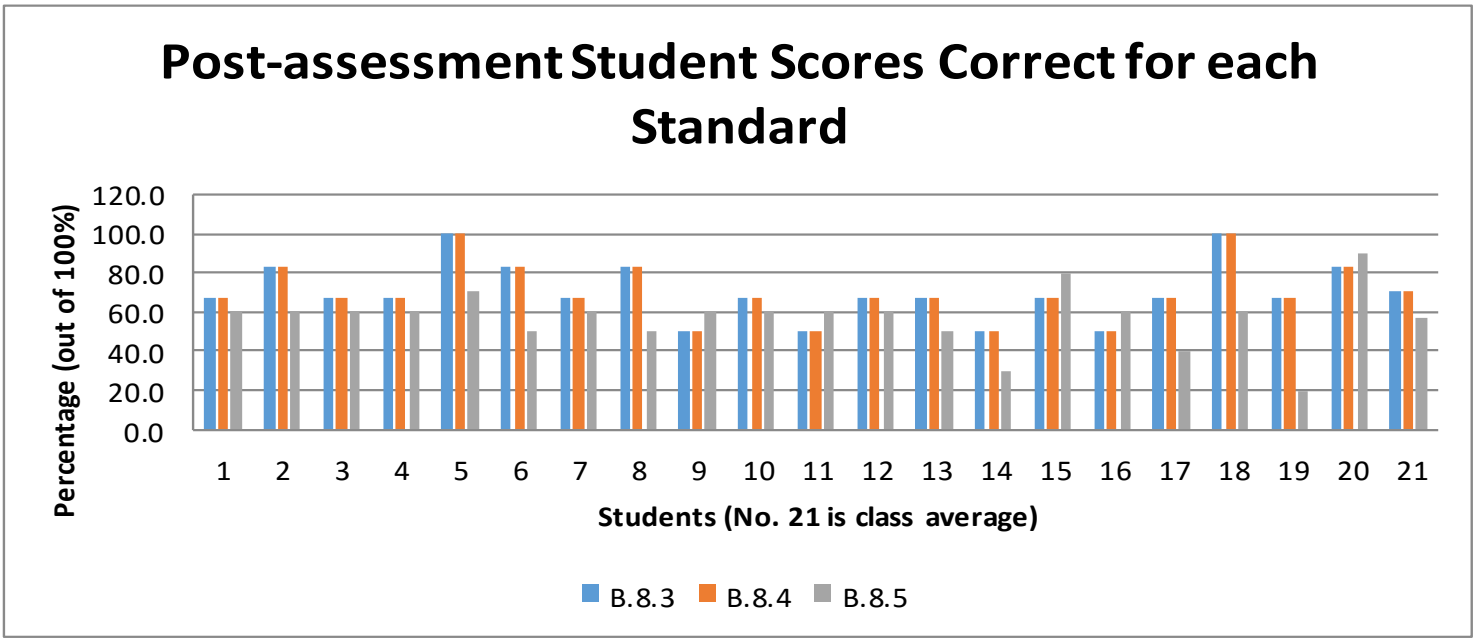
PTS: 1 DIF: L2 REF: p. 467
OBJ: 16.4.3 Describe what homologous structures and embryology suggest about the process of evolutionary change. STA: B.8.3 | B.8.4 TOP: Foundation Edition
BLM: application

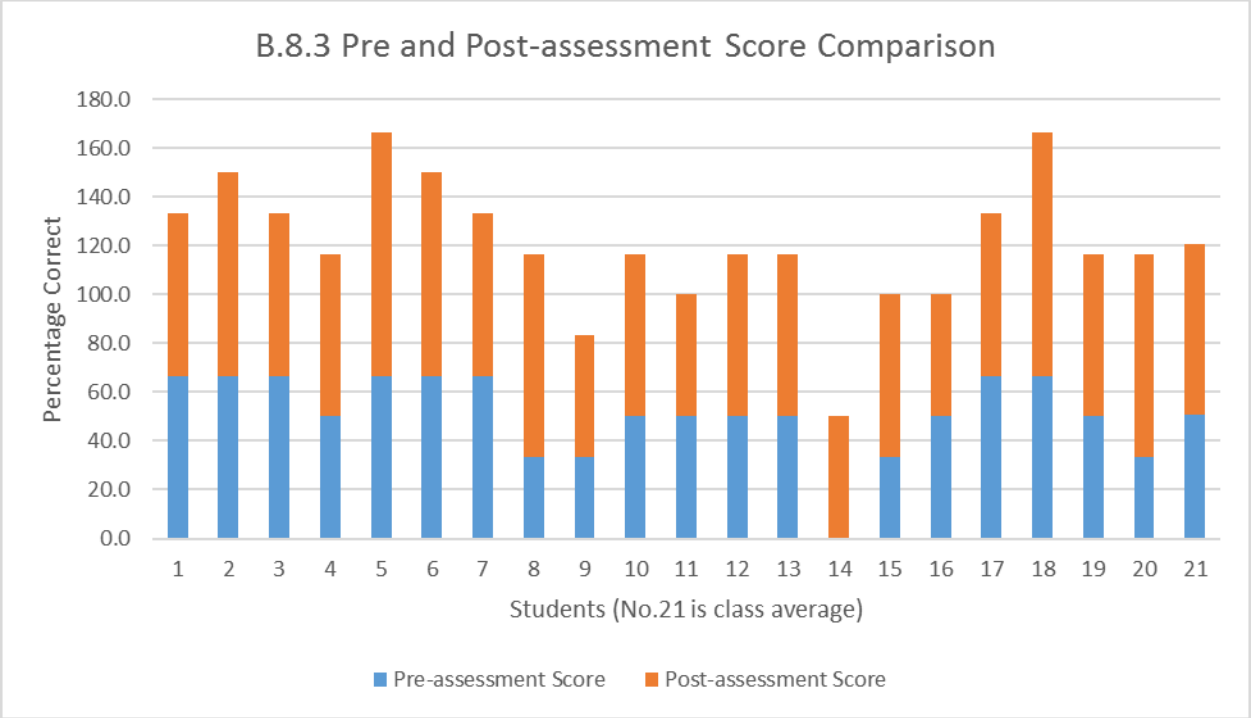
Pre and Post-test Graphs:

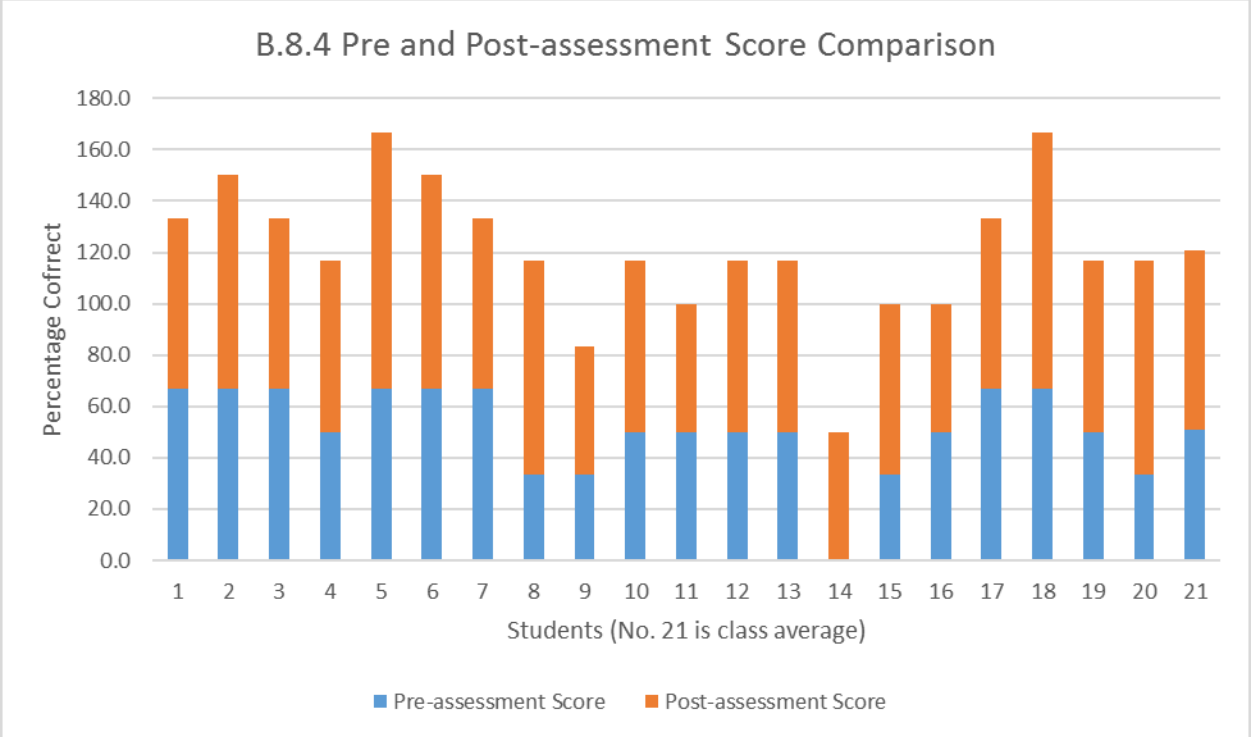


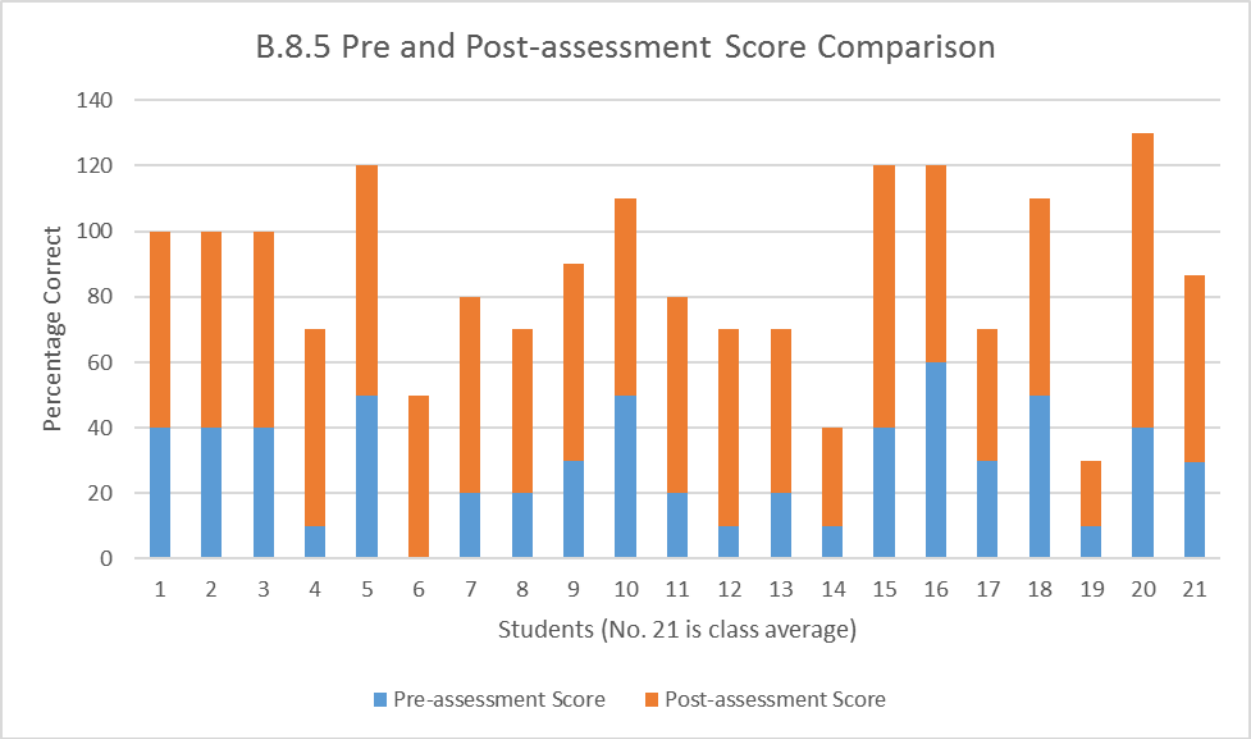



Post-assessment Student Scores
Percentage (out of 100%)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Students (No. 21 is class average)


Post-assessment Student Scores Correct for each Standard
Percentage (out of 100%)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Students (No. 21 is class average)
B.8.3
B.8.4
B.8.5


B.8.3 Pre and Post-assessment Score Comparison
Percentage Correct
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Students (No.21 is class average)
Pre-assessment Score
Post-assessment Score


B.8.4 Pre and Post-assessment Score Comparison
Percentage Cofrrect
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Students (No. 21 is class average)
Pre-assessment Score
Post-assessment Score



Narrative Statements and Reflection Questions:

1. Unit Narratives
   a) List of content standards addressed in the unit
      a. Standard No. 8: Evolution (B.8.3, B.8.4, & B.8.5)
   b) List of ancillary standards addressed in the unit
      a. None.
   c) Brief narrative addressing how you accommodated students of different abilities
      a. For special needs students, I always follow the directions in their IEP. This can include extended time with assignments and assessments, or allowing verbal answers. I only have a few special needs students and they do not have many accommodations listed in their IEP other than those previously mentioned.
      b. For enrichment activities for students who finish their work ahead of others, they can either move ahead into the next section, or they can dive deeper into the current section by looking up current articles and sharing the information with the class. This one is my favorite because it brings in current topics and relevant issues/stories.
      c. As for differentiation, I always try to cover a specific topic in at least three ways. For example, natural selection was first covered in the vocabulary assignment, followed by a brief discussion leading into notes, notes, lab activity using manipulatives and kinesthetic, video review and finally a group and class discussion. In this I am able to teach the topic using different modalities of learning in attempt to reach all students.

d) Brief narrative explaining what authentic (real-life) critical thinking and/or problem-solving skills students are developing through your unit
    a. In all lessons, I try to address relevant topics to the students and ones which will help them think critically. The mystery item lesson requires the student to think critically in order to figure out the mystery item. In class I make sure to state the connection to their lives because they should obtain all evidence before drawing conclusions. That skill can help students in all areas of life because it can help them evaluate the situation before making decisions or assumptions.
    b. One other real life example I like to present is antibiotic resistance, virus evolution, and personalized medicine. I had a student ask "when will we ever need to know this stuff?" – in reference to evolution of populations, and we were able to have a discussion about antibiotic resistance, the treatments for HIV, and personalized medicine to treat genetic disorders. The students will not only know about those topics, but how to think critically by seeking all the evidence before drawing conclusions and making decisions.
e) Brief narrative or bullets listing different instructional strategies used in the unit
    a. Lecture-discussion notes
    b. Follow along notes pages
    c. Class discussions
    d. Manipulatives
    e. Kinesthetic lab activities
    f. Visual representations
    g. Audio-Video simulations
f) Brief narrative describing technologies/media integrated in the unit
    a. Technology in the classroom can help advance the comprehension of complex topics, like evolution. I have not used technology in this unit as a means of an end, rather to advance and better describe natural phenomena. Main technology used was the projector and computer with audio-visual representations of topics covered in addition to notes presentation for lecture-discussion bits. In the future, I would like to integrate more student devices for formative assessments, such as Kahoot, Socrative, or clicker technology.

2. Assessment Narratives
    a) Brief narrative explaining any accommodations you made for the differing needs of the students in your assessment
        a. There were not many needs for special accommodations for testing. The only accommodation made was extra time offered to students to finish their exam of which they could come in before or after school to complete it.
3. Project Narratives
    a. Project not conducted in unit because of time restrictions with ISTEP testing.
4. Project Rubric Narratives
    a. Project not conducted in unit because of time restrictions with ISTEP testing.
5. Evaluation of Student Learning Narratives
    a) Brief narrative explaining, based on the graph information, how students performed collectively and individually on the pretest?

    a. As shown in the pre-assessment graphs, most students scored below a 50%, but a few students were above 50%, but no student reached 70% correct questions.
    b. In addition, when looking at the standards break down of questions, most students scored higher on indicators B.8.3 and B.8.4 and scored less on B.8.5. Only Students 15, 16 and 17 scored higher on B.8.5 than B.8.3 and B.8.4.

b) Brief narrative explaining what changes were made to the unit based on pre-test date; if no changes were necessary, explain why not
    a. Based on seeing the breakdown of questions by standards, I changed my lesson plans to hit more heavily on B.8.5 and less on B.8.3 and B.8.4.
    b. This was accomplished through spending more time in lecture-discussion with B.8.5 and increasing the bell work questions with B.8.5.

c) Brief narrative (if applicable) explaining, based on the project graph information, how students performed collectively and individually on the project? Include analysis of how the weighting and/or performance on the rubric elements may have affected the total score for the project.
    a. Project not conducted in unit because of time restrictions with ISTEP testing.

d) Brief narrative explaining, based on the graph information, how students performed collectively and individually on the post-test?
    a. Based on the post-assessment overall score graph, students performed better with six students reaching or exceeding 70%. The class average increased by 20% from 43% to 63%. Students showed improvement growth in understanding evolution from the pre-test to the post-test. All students showed growth, except student 17.
    b. When looking at the standards breakdown, B.8.3 and B.8.4 had an average increase of 20% from 50% on the pre-test to 70% correct on the post-test. B.8.5 had the greatest average increase of 27% from 30% to 57%.

e) Brief narrative explaining, based on graph and performance information, the strengths and weaknesses of instructional approaches used during the unit
    a. The strengths of my instructional approach was the use of labs and engaging class lecture-discussions aided with audio-visual and video technology support. The labs were beneficial for allowing students to have hands on manipulation of variables, observe the outcomes, and draw conclusions based on data. The lecture-discussions allowed students to voice their questions and comments while learning the new content growing from the old content. Students were able to give different examples and explain the content in a different way which helped other students understand. These two main approaches definitely helped with the increase in the scores as seen in the graphs and analyzed above.
    b. The greatest weaknesses of my instructional approach was the day with the stations for practice with the different types of evidence for evolution. The notes before were originally grouped together – which made for an entire day of note taking. Despite my "brain break" and attempts to make it engaging, the students are not use to full period notes. Therefore the students were not prepared for the next day's stations with the evidence. Next time, I would like to break up the notes and have students practice with the evidence to help

maintain motivation. This weakness definitely accounted for lower scores depicted in the graphs because most questions were about evaluating evidence.

END