DAY 11

Contrasting Cases Part 1 - Selective Breeding

This lesson provides an introduction to natural selection and selective breeding through the presentation of pairs of cases illustrating each concept. By comparing and contrasting pairs of selective breeding cases, students will begin to recognize the critical features of selective breeding. They will do the same for a pair of natural selection cases. By then comparing the key characteristics of the two sets of cases, students should develop a strong understanding of what makes selective breeding different from natural selection. It will also help them to recognize key features in new cases and determine whether they are examples of natural selection or selective breeding. The contrasting case serves as an introduction to these concepts and thus precedes all Chapter 5 work in the textbook. It also **replaces the material presented in Chapter 5, Section 2**, so you will be skipping this section entirely when you encounter it in the book.

Today students will begin by examining a single case of selective breeding and identifying key features.

Big Ideas

- There is natural variation of traits within a population, and this variation is necessary for natural selection or selective breeding to occur.
- Selective breeding occurs when certain heritable traits make an organism more desirable to humans, encouraging the humans to breed members of the species with those traits and thus increase the chances that those traits will be passed on to the next generation.

Materials

Teacher:

1. Warm-up Day 11 - Cells_warmups.ppt
2. Slides - day11.ppt

Students:

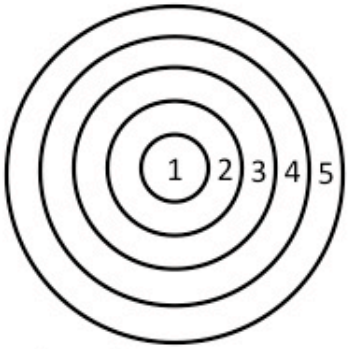
1. Selective Breeding Case 1 (WS 18; student resource p28)
2. Selective Breeding Case 1 Worksheet (WS 19; student resource p29)

Activities and Allotted time

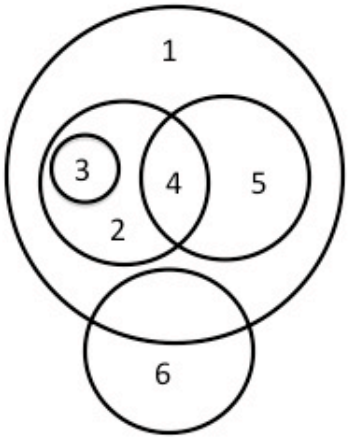
5 minutes - Warm-up
40 minutes - CC activity - Compare cases of selective breeding

Day 11 - Warm-up

Classification System A



Classification System B



Use the Venn diagrams to the left to answer the following statements.

1.For Classification System A, which of the following is true? Choose only one answer.
a.All organisms in group 2 are in group 3.
b.All organisms in group 5 are in group 4.
c.All organisms in group 4 are in group 2.
d.All organisms in group 2 are in group 1.

2. For Classification System B, which of the following is true? Choose only one answer.
a.All organisms in group 1 are in group 6.
b.All organisms in group 6 are in group 1.
c.All organisms in group 3 are in group 1.
d.All organisms in group 2 are in group 5.

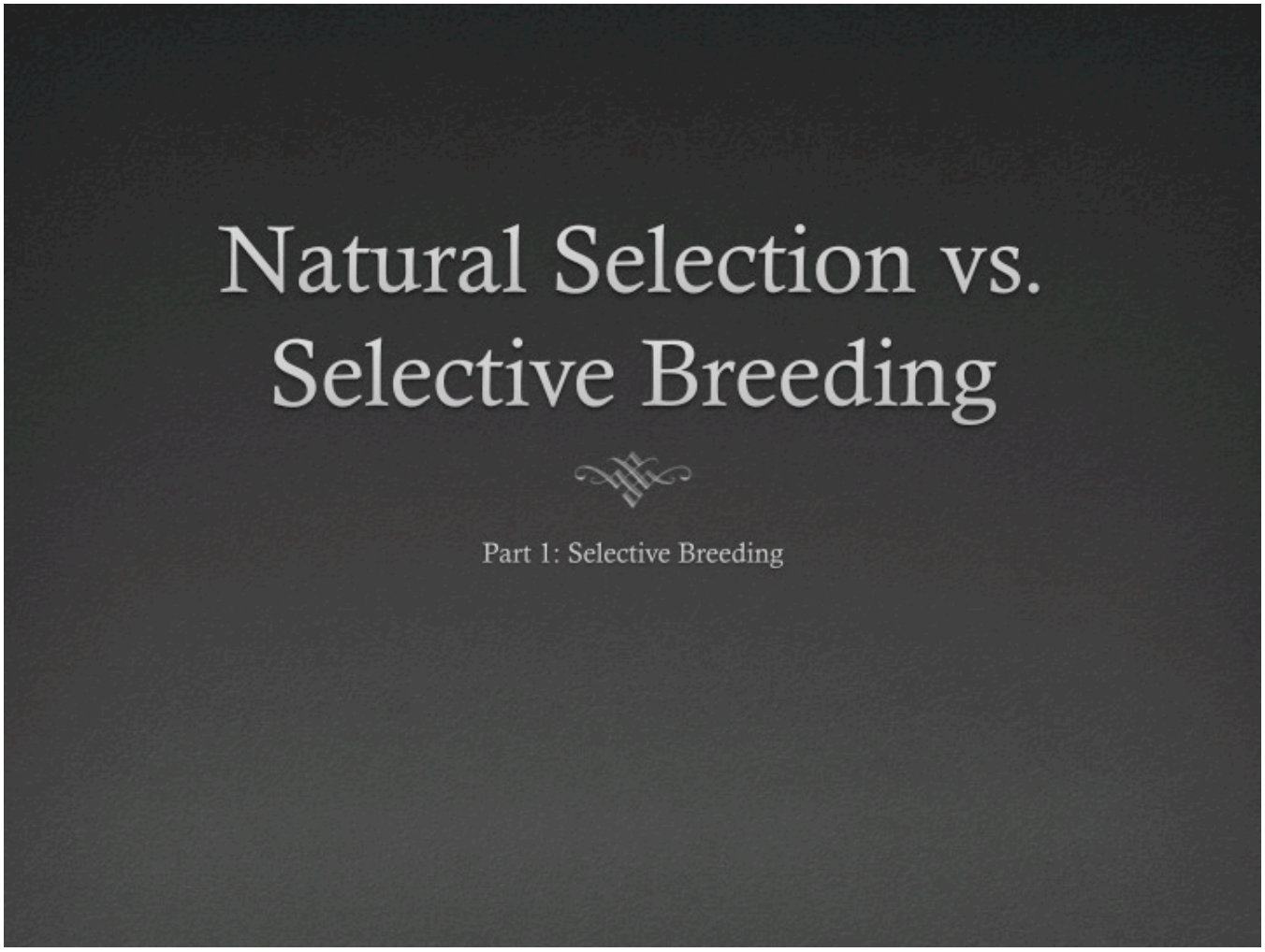
Answer:

1. A. All organisms in group 2 are in group 3.

2. C. All organisms in group 3 are in group 1.

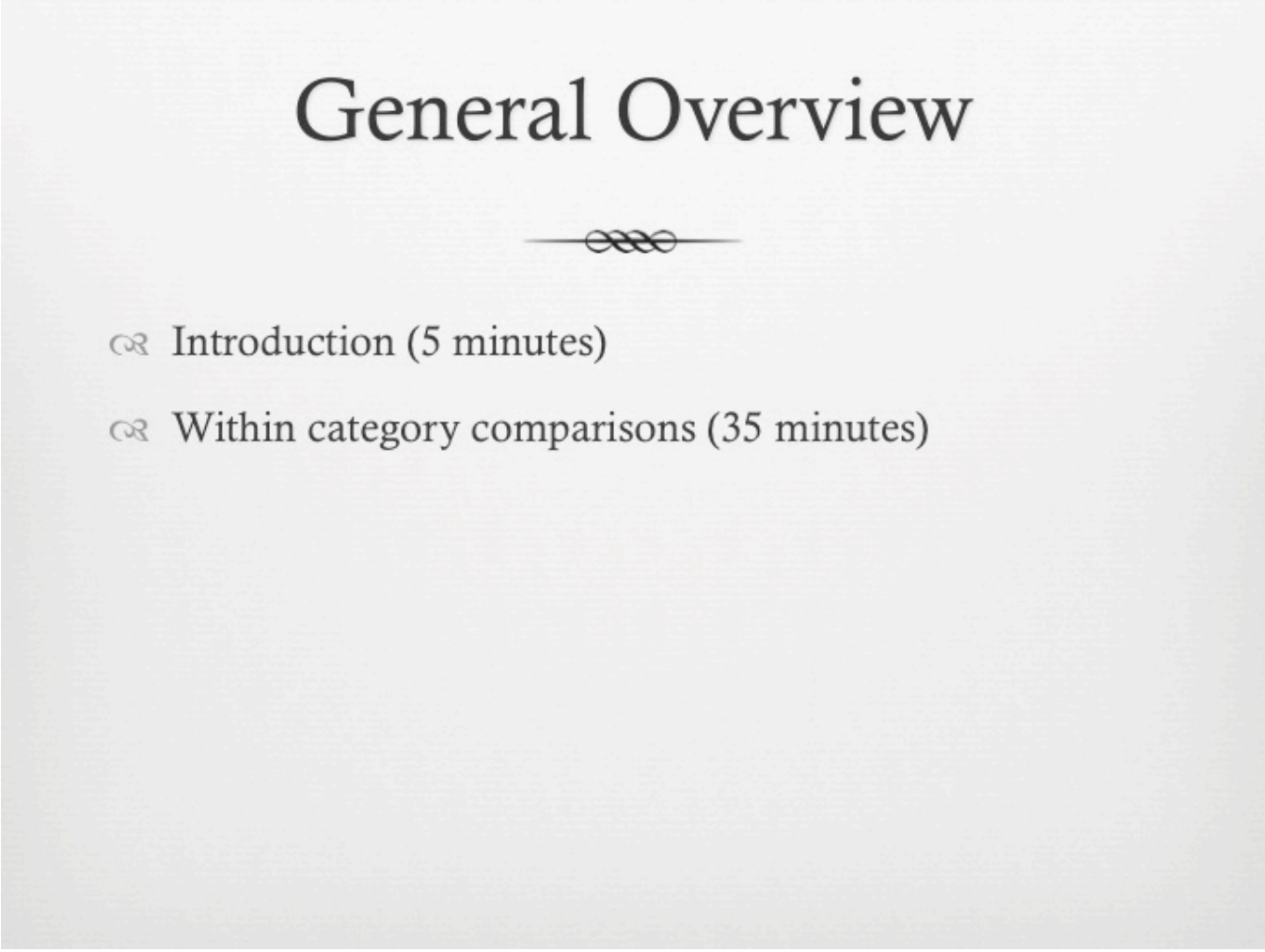
Purpose: This exercise gives students additional practice reading complex Venn diagrams, which will continue to appear throughout the unit.

Day 11 - Selective Breeding



Total time = 40 minutes

Day 11 - Selective Breeding

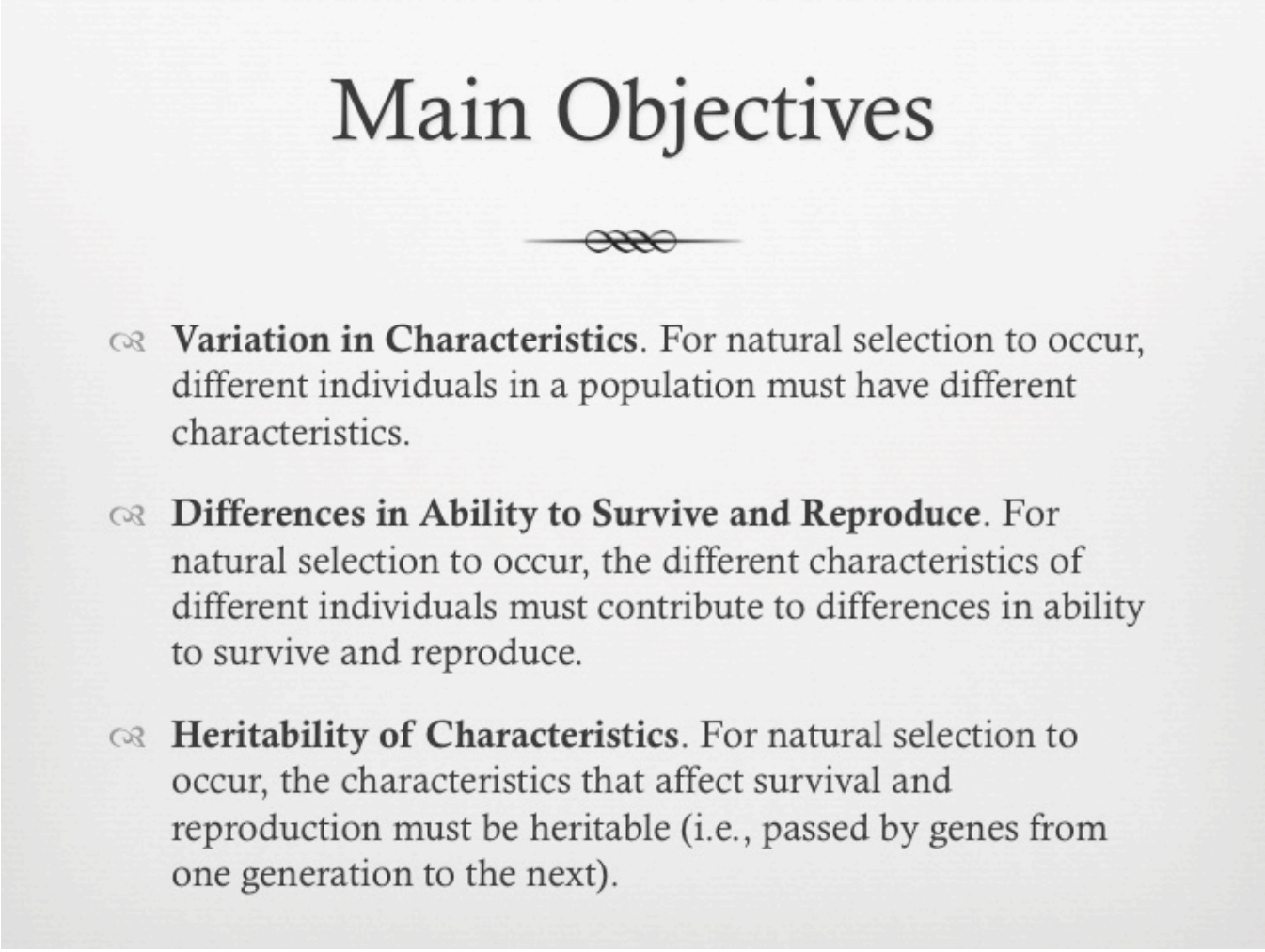


Distribute the materials for Selective Breeding – Case 1 (WS 18), which discusses the emergence of the husky breed of dogs, or direct students' attention to its location in the student resource book (p28). Instruct students to read through the case and answer the question at the end. You may wish to circulate through the room to assist students who might have trouble reading on their own.

As students finish, instruct them to begin answering the questions on Worksheet 19, or p29 in the student resource book. Once most students have had a chance to respond to these questions, proceed to the next slide for a class discussion.

You may wish to project the following slide, "Main Objectives," while students complete their work.

Day 11 - Selective Breeding



Main objectives to be put on the board and left up throughout the class.

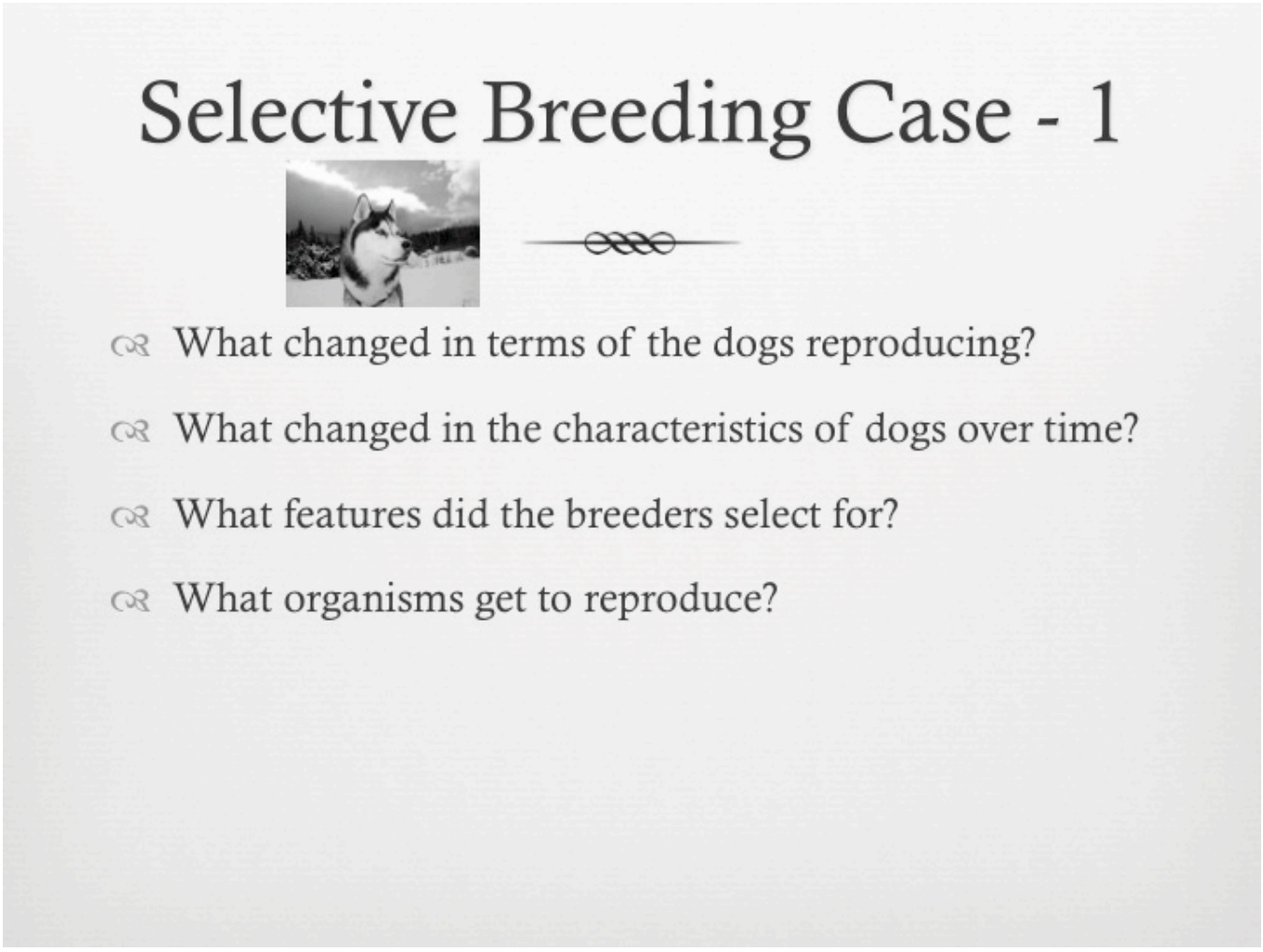
Day 11 - Selective Breeding

Selective Breeding Case - 1

- In this part you will learn about a case of selective breeding of dogs.
- First read through the story and then answer the questions about it.
- When you are finished you will discuss your answers with the class.

If you prefer, you may project these instructions while students complete their work.

Day 11 - Selective Breeding



Have students first work through the worksheet then have a quick class discussion checking their answers.

1. What changed in the environment**? Humans (breeders) selected for certain traits, needed work dogs in cold temperatures to pull sleds**

2. What changed in the organism**? Size, coat, energy**

3. What features did breeders select for? **Medium size, thick fur coat, high energy**

4. Which organisms get to reproduce? **Those that have the desired traits (see number 3)**

Student Worksheet 18 - Selective Breeding Case 1

Selective Breeding – Case 1

All dogs (Canis familiaris) come from a single arcestor, the grey wolf (Canis lupus). Over the past 15,000 years humans have selectively bred dogs to have particular characteristics and traits (height, size, weight, color, type of ear, herding or hunting behaviors, etc.). We now have over 200 breeds of dogs. Dog breeders select dogs to mate based on some set of desired characteristics or traits. For example, huskies were bred for certain traits including: medium size, thick fur coat, and high energy because they were needed for pulling sleds over long distances in extremely cold climates. The huskies with the desired characteristics were *bred* and passed their genes on to their offspring. The pups were born with combinations of the parents' genes. The huskies that showed the desired traits were then selected for the next round of breeding. Pups that were born with undesired traits such as small size or low energy were not selected for breeding. With each new generation, the dog breeders continued to select for the desired traits - medium sizes, thick fur coat, and high energy.

Why are there so many different breeds of dogs today?

Student Worksheet 19 - Selective Breeding Case 1 Questions

Case comparison handout 1

1. What changed in terms of the dogs reproducing?

2. What changed in the characteristics of the dogs over time?

3. What features did breeders select for?

4. Which organisms get to reproduce?

DAY 12 Contrasting Cases Part 1 - Selective Breeding (continued)

Today will pick up with the examination of a second case of selective breeding and a comparison of the two cases. This comparison is designed to help students identify the key features of selective breeding and separate them from insignificant specifics of each case. This will prepare them for tomorrow's introduction of natural selection, a concept many students have trouble differentiating from selective breeding

Big Ideas

- There is natural variation of traits within a population, and this variation is necessary for natural selection or selective breeding to occur.
- Selective breeding occurs when certain heritable traits make an organism more desirable to humans, encouraging the humans to breed members of the species with those traits and thus increase the chances that those traits will be passed on to the next generation.

Materials

Teacher:

1. Warm-up Day 12 - Cells_warmups.ppt
2. Slides - day12.ppt

Students:

1. Selective Breeding Case 2 (WS 20; student resource p30)
2. Selective Breeding Case 2 Worksheet (WS 21; student resource p31)
3. Compare Selective Breeding Worksheet (WS 22; student resource p32)

Activities and Allotted time

5 minutes - Warm-up
40 minutes - CC activity - Selective Breeding Case 2 and Compare Selective Breeding

Day 12 - Warm-up

Even when they are not trying to produce a new breed, dog breeders will choose the dogs that best represent the desired qualities of the breed to reproduce.

The most important qualities of a golden retriever are **intelligence, gentleness** and **trainability**. Pretend you are a dog breeder. Read about Bernie and Spike, two golden retrievers, and decide which dog you would choose to breed.

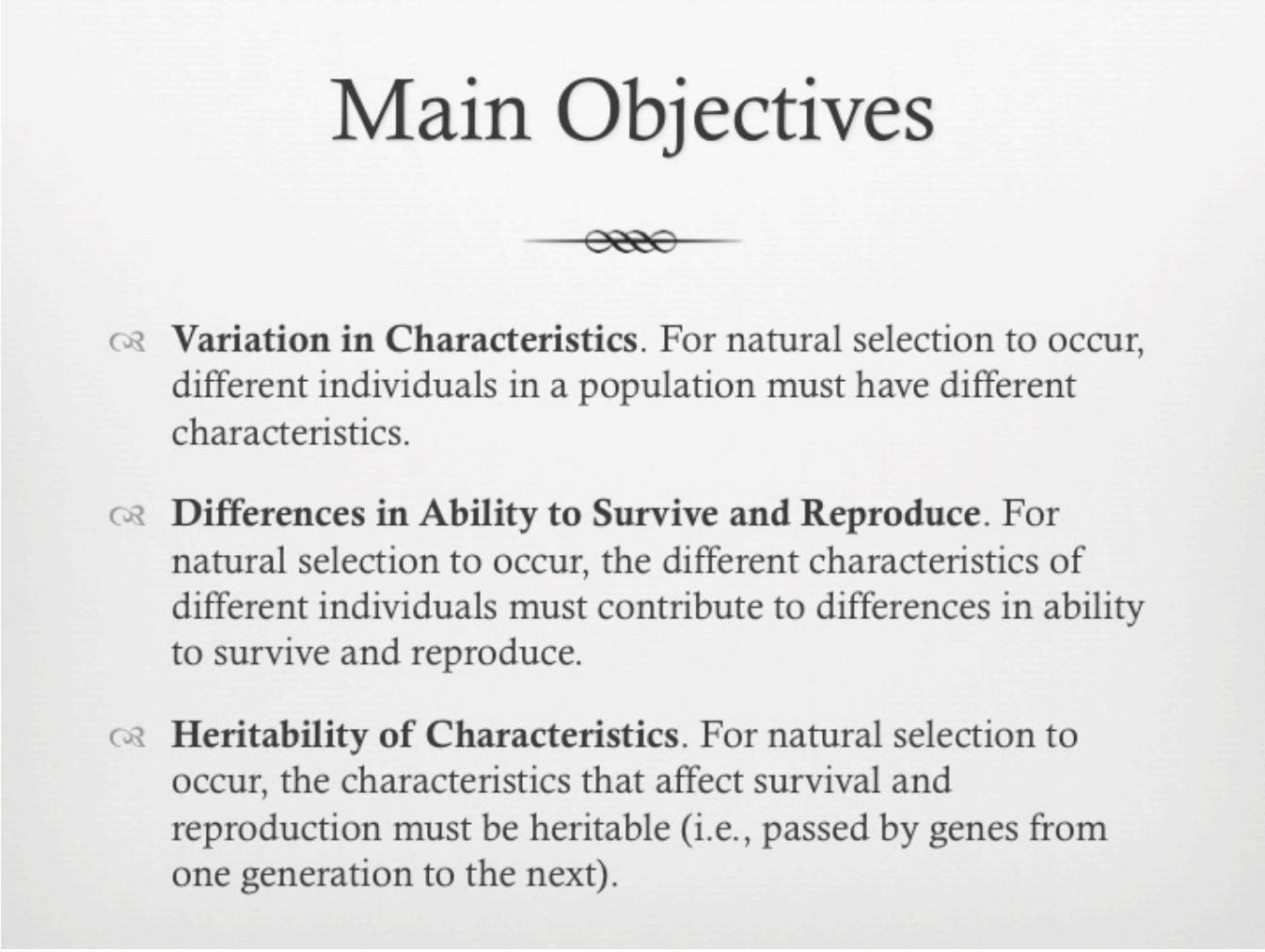
Bernie is moderately gentle, but he can be a little rough when he plays. He is very intelligent, but his owners have had a lot of trouble training him.

Spike is very gentle and especially good with children. He has average intelligence, but he is very obedient and easy to train.

Answer: Given that the golden retriever is valued for intelligence, gentleness and trainability, it would be better to breed Spike. Bernie is stronger in one of the three criteria given (intelligence), but Spike is stronger in the other two (gentleness and trainability).

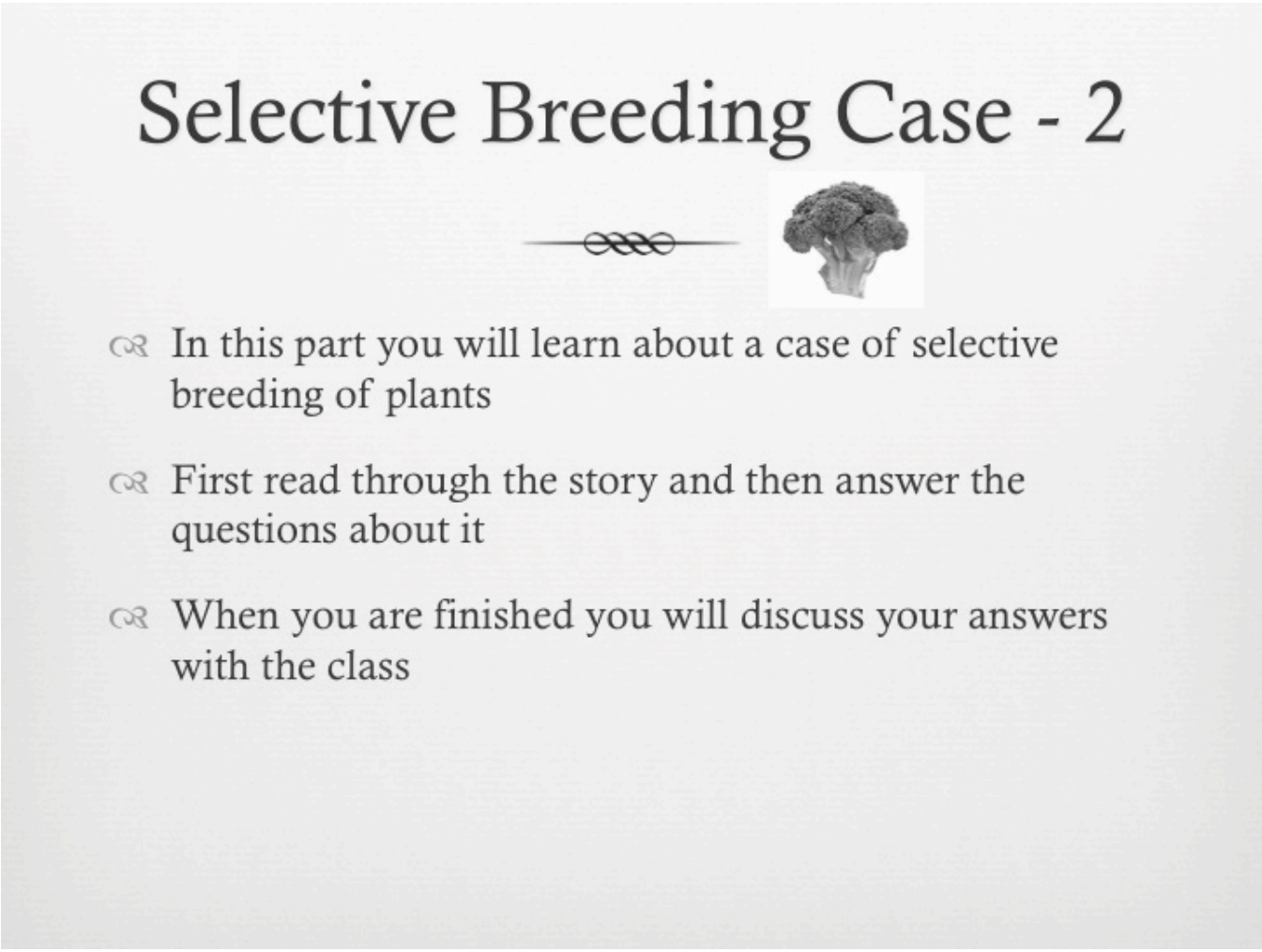
Purpose: This activity reinforces the idea that selective breeding involves people making choices about what traits they want an organism to have and breeding members of the population that demonstrate those desired traits. It also helps them to understand that the organisms chosen to breed for selective breeding do not necessarily possess ALL the desired traits; rather, they are just the members of the population that possess the most desired traits.

Day 12 - Selective Breeding

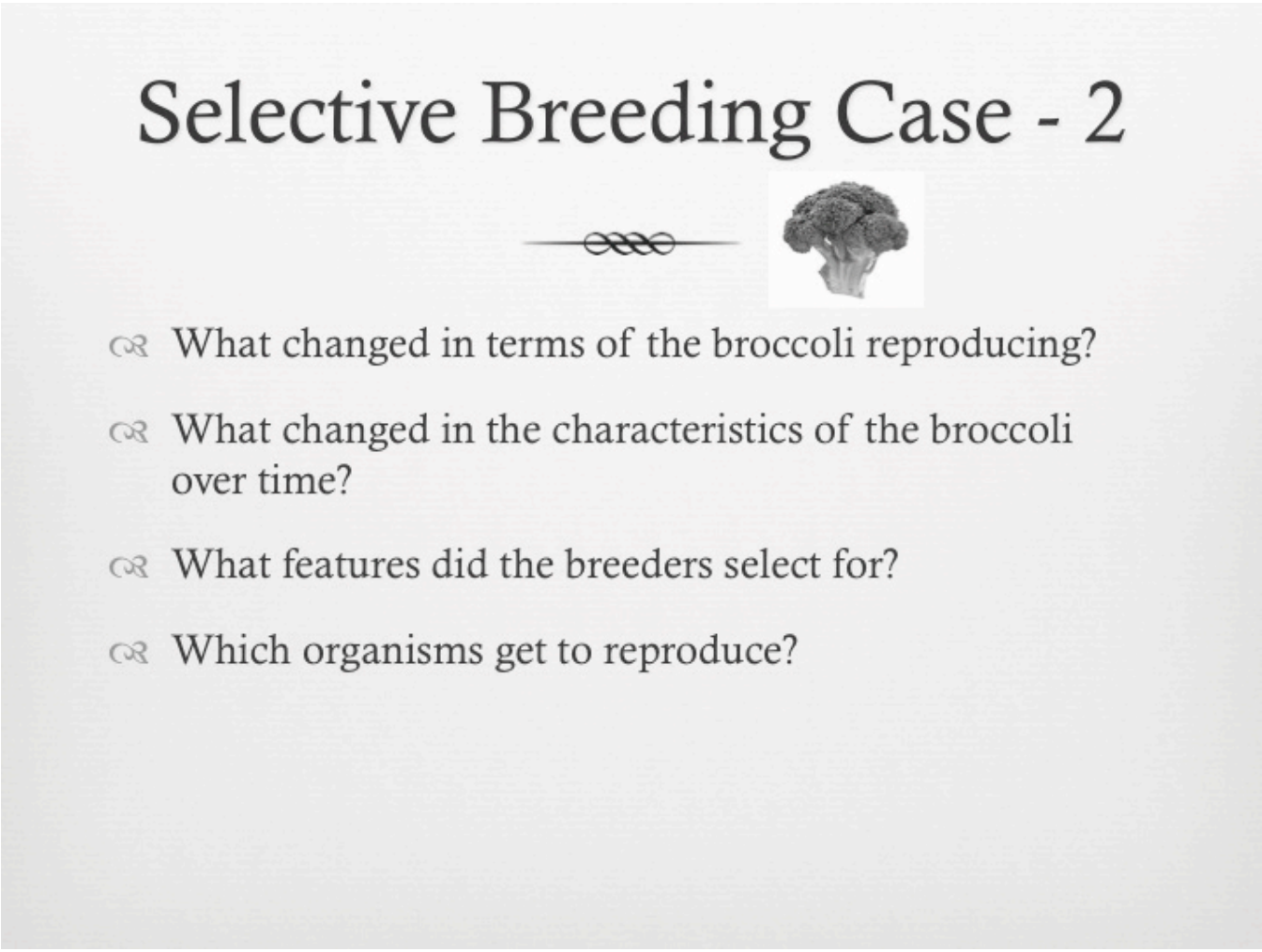


Again, main objectives may be projected and left up throughout the class.

Distribute Selective Breeding Case 2 (WS20) or direct students' attention to its location in the student resource book (p30). As you did yesterday, allow students to read and respond to questions while you circulate. Give then the case questions worksheet (WS21) or point it out in the resource book (p31) for them to work on when they have finished reading.



If you wish you may project this slide while students complete their work.



Have students first work through the worksheet then have a quick class discussion checking their answers.

Possible answers:

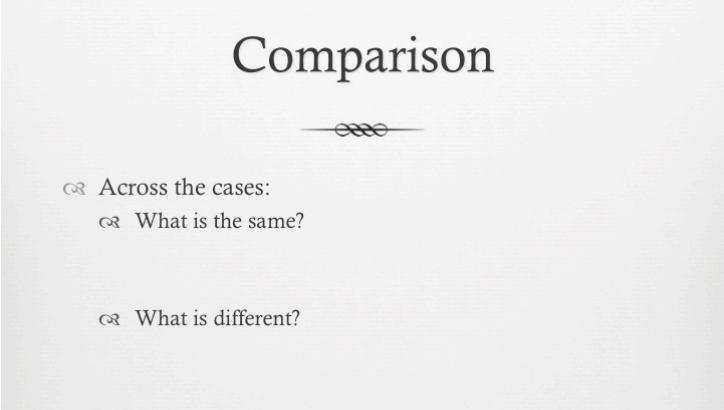
1. Human intervention (farmers), breeding for desired traits

2. Stalk type, flower clusters, stem, color, etc.

3. Large flower cluster, short stalk

4. Those with the desired traits

Day 12 - Selective Breeding



Have students get out Selective Breeding Case 1 from yesterday. Before the worksheet, you may lead a discussion in which students brainstorm about comparisons across the two cases.

What characteristics varied?

***Same*:** Both have variation in traits.

***Different*:** The particular traits varied: plants: Stalk type, flower clusters, stem, color, etc.; dogs: size, fur coat, energy, ears, tail, etc.

What characteristics were selected for?

***Same*:** Characteristics DESIRED by the external agent (breeder / farmer)

***Different*:** The particular desired traits. Plants: LARGE-Flower clusters, SHORT-stalk type; Dogs: MEDIUM-size, THICK-fur coat, HIGH-energy

How does the selection process work?

***Same*:** Agent picks the organisms with the desired traits to reproduce. Those selected organisms are bred and the ones not selected are not. The selected organisms reproduce and then pass their genes to the next generation. The organisms from the next generation are then evaluated and selected for the desired traits. This process continues until all of the desired traits are produced.

***Different*:** Specifics of the agent and the organism

What (who) determines which organisms reproduce?

***Same*:** Both have an external agent selecting which organisms should reproduce based on desired traits as determined by the agent.

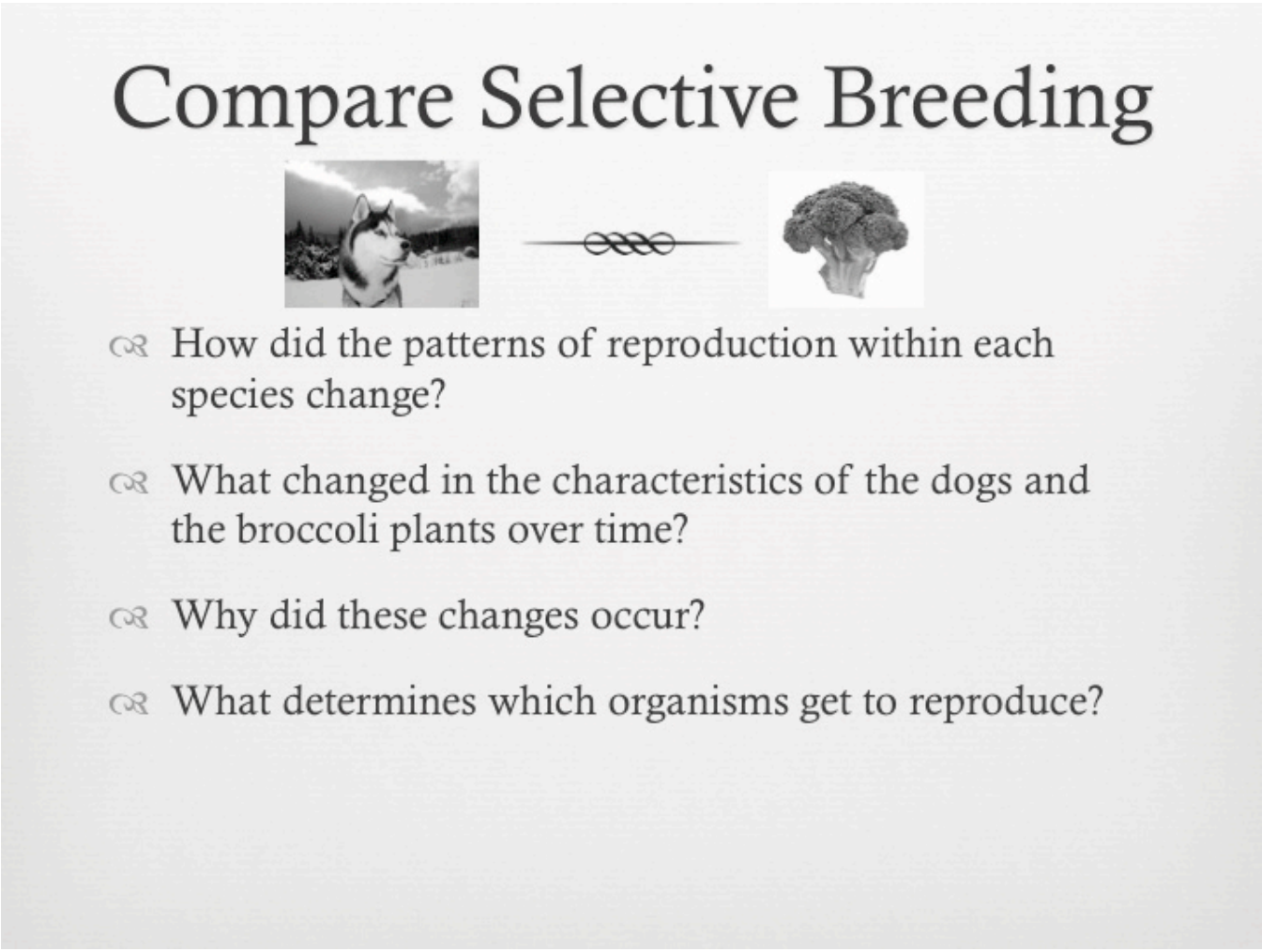
***Different*:** Particular agent. Plant: Farmer; Dog: Breeder

What factors drive reproduction?

***Same*:** Whatever traits are desired by the external agent.

***Different*:** Specific traits

Day 12 - Selective Breeding



Direct students' attention to the between-case comparison of selective breeding (WS 22, student resource p32). Allow students to complete the chart as best they can, then allow students to share their answers in a class discussion.

Compare Selective Breeding

- How did the patterns of reproduction within each species change? *The organisms with the traits humans desired were the ones allowed to reproduce.*
- What changed in the characteristics of the dogs and the broccoli plants over time? *Over time, the traits humans desired began to emerge; huskies showed thicker coats and higher energy and broccoli showed larger flower clusters and shorter stalks.*
- Why did these changes occur? *Humans were choosing individuals with desirable traits and having them reproduce.*
- What determines which organisms get to reproduce? *Humans*

Post these answers with responses after you have led a class discussion, so students can check their work and correct errors.

Student Worksheet 20: Selective Breeding Case 2

Selective Breeding – Case 2

Several kinds of vegetables (broccoli, cauliflower, cabbage, Brussels sprouts, kale, kohlrabi) come from a single ancestor, one species of plant called wild mustard. Over the past several thousand years humans have selectively bred the wild mustard plant for different characteristics or traits to create other types of vegetables. Farmers select plants to reproduce based on some desired set of characteristics. For example, broccoli was bred for large flower clusters and a short stalk. The plants showed the desired characteristics were *bred* and passed their genes on to their offspring. The offspring (seedlings) inherited combinations of the parents' genes. The plants that showed the desired traits (large flower clusters and a short stalk) were then selected for the next round of breeding. Plants with undesired traits (small flower clusters or long stalks) were not selected for reproduction. With each new generation the farmers continue to select for increases in the desired characteristics - larger flower clusters and shorter stalks.

Why do we have broccoli plants today?

Student Worksheet 21: Selective Breeding Case 2 Questions

Case comparison handout 2

1. What changed in terms of the broccoli reproducing?

2. What changed in the characteristics of the broccoli over time?

3. What features did breeders select for?

4. Which organisms get to reproduce?

Student Worksheet 22: Selective Breeding Case Comparison

Across the cases:

Question	Case 1: Dogs	Case 2: Broccoli
How did the patterns of reproduction within each species change?		
What changed in the characteristics of the dogs and the broccoli plants over time?		
Why did those changes occur?		
What (who) determines which organisms reproduce?		

DAY 13 Contrasting Cases Part 2 - Natural Selection

Students should now have a foundation of understanding about the critical features of selective breeding. Today they will receive a case study that illustrates natural selection. By now, students may be getting used to the format of receiving a case, reading it, and responding to questions.

Big Ideas

- There is natural variation of traits within a population, and this variation is necessary for natural selection or selective breeding to occur.
- Natural selection results from differences in the ability to survive and reproduce within a population. It occurs when certain heritable traits make an organism better able to survive and reproduce, thus passing those traits on to the next generation.

Materials

Teacher:

1. Warm-up Day 13 - Cells_warmups.ppt
2. Slides - day13.ppt

Students:

1. Natural Selection Case 1 (WS 23; student resource p34)
2. Natural Selection Case 1 Worksheet (WS 24; student resource p35)

Activities and Allotted time

5 minutes - Warm-up
40 minutes - CC activity - Natural Selection Case 1

Day 13 - Warm-up

Grey Wolf

Husky

Chihuahua

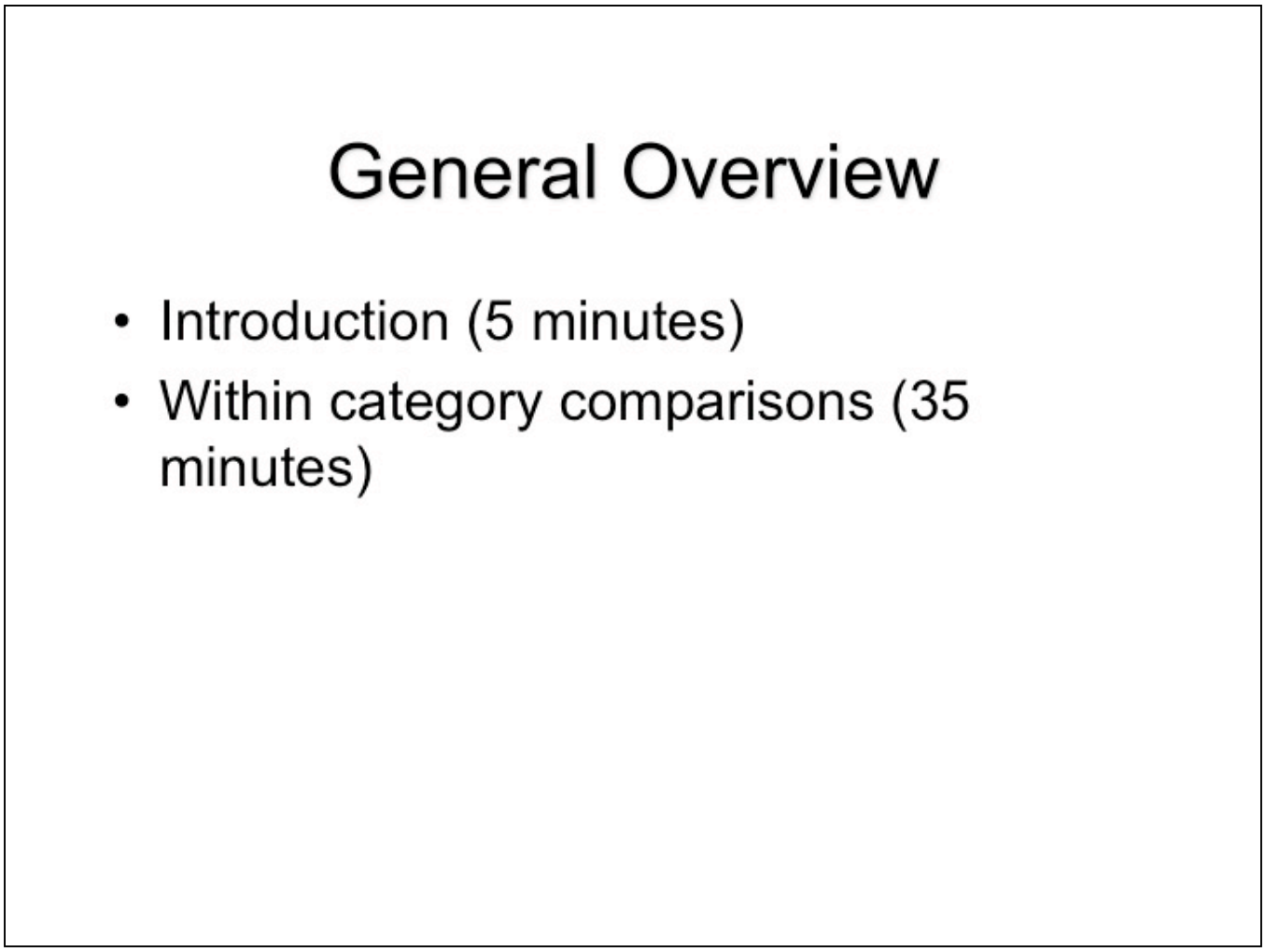
Recall from our selective breeding cases that all dogs come from the **grey wolf** (left), and the **Husky** (top right) was bred by selecting for medium size, thick fur coat and high energy.

The **Chihuahua** (bottom right) also came from the grey wolf. What traits do you think breeders selected for the Chihuahua?

Answers: Students' answers may vary, but they should describe the traits that differentiate a Chihuahua from a grey wolf: small size, fine coat, and large ears. If they are familiar with Chihuahuas, they might also mention some personality traits that cannot be deduced from the picture such has high energy and friendliness.

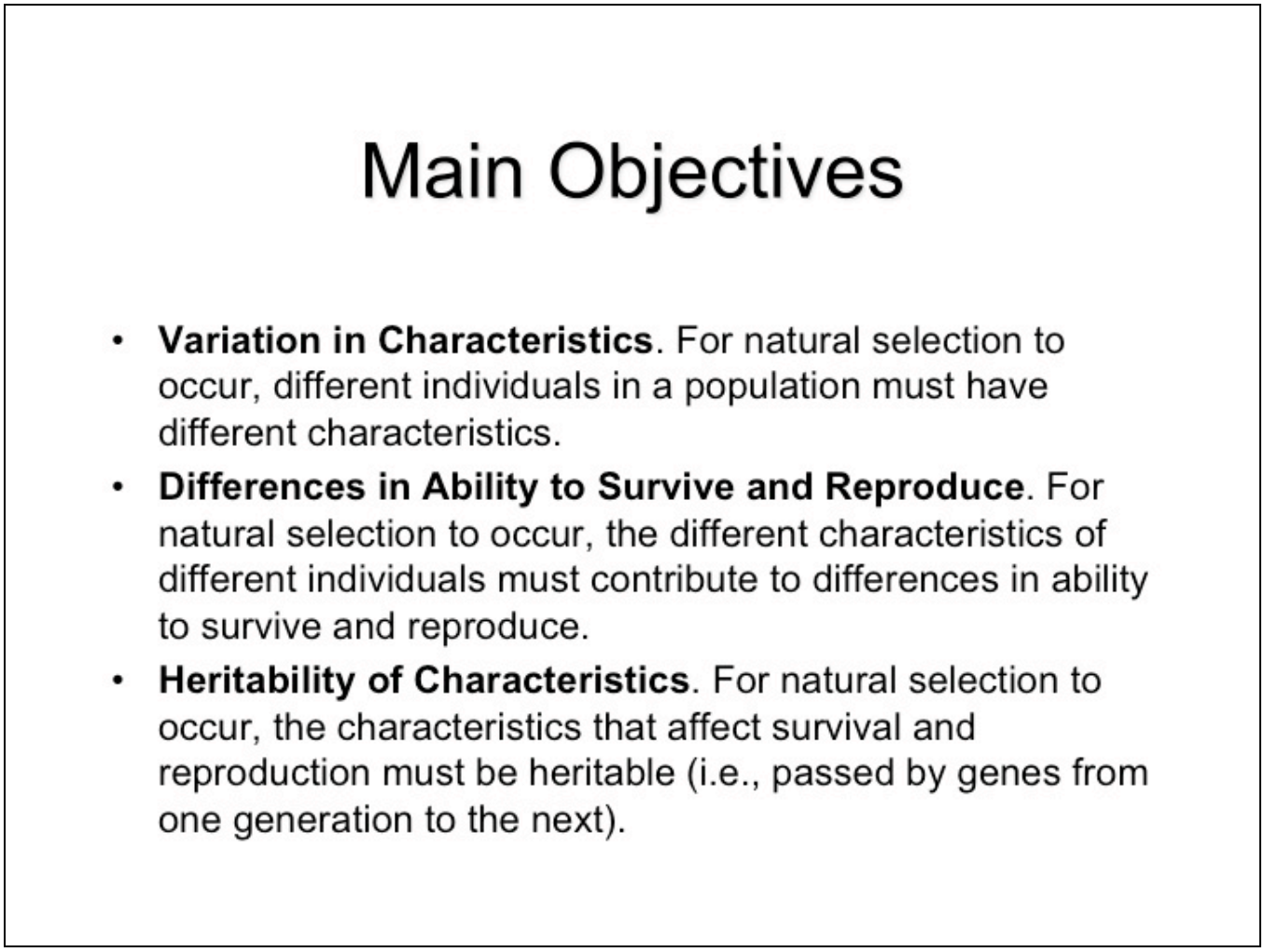
Purpose: This exercise helps students think about selective breeding in the reverse; while previous exercises have described how selecting for certain traits can produce organisms with certain sets of characteristics, in this exercise they must look at the resulting set of characteristics to describe the traits that were selected. This will reinforce concepts of selective breeding and make them better equipped to answer questions about it.

Day 13 - Natural Selection



Total time = 40 minutes.

Day 13 - Natural Selection



Again, main objectives may be projected and left up throughout the class.

Distribute Natural Selection Case 1 (WS23) or direct students' attention to its location in the student resource book (p34). Allow students to read and respond to questions while you circulate. Give then the case questions worksheet (WS24) or point it out in the resource book (p35) for them to work on when they have finished reading.

Day 13 - Natural Selection

Natural Selection Case - 1

- In this part you will learn about a case of natural selection of the peppered moth
- First read through the story and then answer the questions about it
- When you are finished you will discuss your answers with the class

You may wish to display these questions about Natural Selection Case 1 while students work through the materials.

Day 13 - Natural Selection

Natural Selection Case - 1

- What moth characteristics (traits) varied?
- What characteristics (traits) were selected for?
- How does the selection process work?
- What determines which organisms reproduce?

Give students case worksheet 1. Have students first work through the worksheet then have a quick class discussion checking their answers.

1. What moth characteristics (traits) varied? Wing color

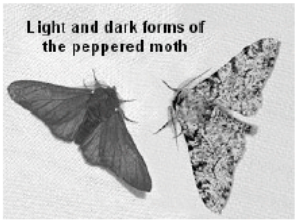
2. What characteristics (traits) were selected for? Before Industrial revolution – Lightly colored wings; During the industrial revolution – Darkly colored wings

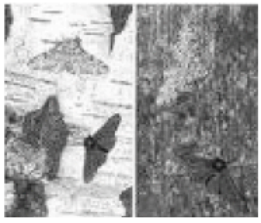
3. How does the selection process work? Variation in traits. Some types of traits contribute to the moths' ability to survive whereas others do not. Those that survive reproduce and pass their genes on to the next generation.

4. What (who) determines which organisms reproduce? The fitness of moth in relation to the environment – depends on wing color, tree color, and predatory birds, in this case. Walk through how this changed, from before to during the industrial revolution.

Student Worksheet 23: Natural Selection Case 1

Natural Selection – Case 1





The peppered moth evolution is an example of natural selection. The peppered moth varies in wing color from light to dark. In the early 1800's the peppered moth population had mostly light colored wings. The wing color served as a type of camouflage that protected them from bird predators because they were similar in color to the light-colored birch trees that they rested on and therefore were hard to see. In contrast, moths with darker wings were easier to see on the light colored trees (see above) and therefore less likely to survive The birds could see and eat them. The moths with light colored wings were better able to survive and were thus more likely to reproduce, passing their genes to their offspring who were then also likely to have light colored wings. The moths with darkly colored wings were not as likely to survive and thus were less likely to pass their genes on to the next generation. After several generations, the light winged moths outnumbered the dark winged moths.

However, things changed during the Industrial Revolution (late 1800's) because the pollution from the factories changed the environment. Many of the light colored trees became dark with soot (black smoke) from the pollution. Therefore, the dark colored moths now became better camouflaged than the light colored moths. The dark colored moths were now better able to survive, reproduce and pass on their genes to their offspring. The light colored moths now were easier to see on the darkened trees and be eaten by the birds. After several generations, the dark winged moths outnumbered the light winged moths.

What caused the number of light colored moths as compared to the number of dark colored moths to change over several generations?

_____

_____

_____

In the 1900's, pollution laws were made and factories had to install cleaner smokestacks. This decreased the amount of soot being put into the air. What do you think happened?

_____

_____

_____

Student Worksheet 24: Natural Selection Case 1 Questions

Case comparison handout 1

1. What moth characteristics (traits) varied?

2. What characteristics (traits) were selected for?

3. How does the selection process work?

4. What (who) determines which organisms reproduce?

DAY 14

Contrasting Cases Part 2 - Natural Selection (continued)

Today students will read the final case study, which again illustrates natural selection, and complete a comparison between the two natural selection cases. After they have identified critical features of natural selection, students will conduct a comparison between key features of natural selection and selective breeding. This between-category comparison will highlight the similarities and differences of the two concepts and should prepare them for the material that follows in Chapter 5.

Big Ideas

- There is natural variation of traits within a population, and this variation is necessary for natural selection or selective breeding to occur.
- Natural selection results from differences in the ability to survive and reproduce within a population. It occurs when certain heritable traits make an organism better able to survive and reproduce, thus passing those traits on to the next generation.

Materials

Teacher:

1. Warm-up Day 14 - Cells_warmups.ppt
2. Slides - day14.ppt

Students:

1. Natural Selection Case 2 (WS 25; student resource p36)
2. Natural Selection Case 2 Worksheet (WS 26; student resource p37)
3. Compare Natural Selection Worksheet (WS 27; student resource p38)
4. Compare Nat. Selection and Sel. Breeding (WS 28; student resource p29)

Activities and Allotted time

5 minutes - Warm-up
40 minutes - CC activity - Compare Natural Selection Cases

Day 14 - Warm-up

1. In selective breeding, humans influence the course of evolution. What determines the course of evolution in natural selection?

2. Sometimes when humans change the environment in which an organism lives, the organism must adapt over many generations to survive. In this case, the adaptation is an unintentional result of human actions. Is it natural selection or selective breeding?

Answers:

1. Natural selection is determined by which organisms are best adapted to survive and reproduce in their environment. Students should understand that the *environment*, and not humans, determines which organisms survive and pass on their traits to future generations.

2. This would be an example of natural selection.

Purpose: This exercise contrasts natural selection and selective breeding to emphasize that humans are the key determining factor in selective breeding, and environment – even an environment created or changed by humans – is the key determining factor in natural selection. Students should understand that humans being involved in the process does not necessarily make a case selective breeding. For selective breeding to occur, humans must *intentionally* breed certain members of a population with a desired set of traits.

Day 14 - Natural Selection

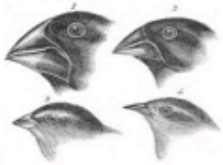
Main Objectives

- **Variation in Characteristics**. For natural selection to occur, different individuals in a population must have different characteristics.
- **Differences in Ability to Survive and Reproduce**. For natural selection to occur, the different characteristics of different individuals must contribute to differences in ability to survive and reproduce.
- **Heritability of Characteristics**. For natural selection to occur, the characteristics that affect survival and reproduction must be heritable (i.e., passed by genes from one generation to the next).

Again, main objectives may be projected and left up throughout the class.

Distribute Natural Selection Case 2 (WS25) or direct students' attention to its location in the student resource book (p36). As you did yesterday, allow students to read and respond to questions while you circulate. Give then the case questions worksheet (WS26) or point it out in the resource book (p37) for them to work on when they have finished reading.

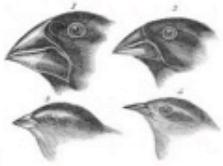
Natural Selection Case - 2



- In this part you will learn about a case of natural selection of the Galapagos Finch
- First read through the story and then answer the questions about it
- When you are finished you will discuss your answers with the class

If you wish you may project this slide while students complete their work.

Natural Selection Case - 2



- What finch characteristics (traits) varied?
- What characteristics (traits) were selected for?
- How does the selection process work?
- What determines which organisms reproduce?

Have students first work through the worksheet, then have a quick class discussion checking their answers.

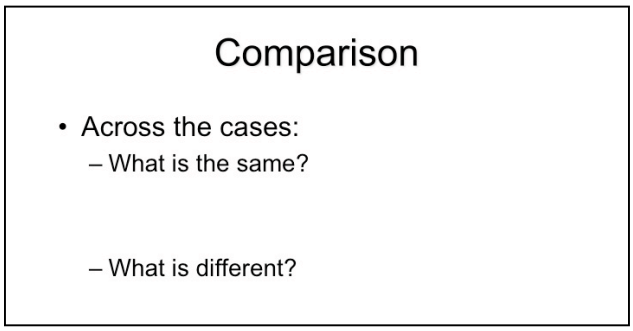
1. What finch characteristics (traits) varied? Beak type, body type, color

2. What characteristics (traits) were selected for? Different beaks were selected for different environments: islands with trees that produce nuts – beaks that were strong and blunt that could be used for cracking the nut shells were selected for.

3. How does the selection process work? Variation in traits. Some types of traits contribute to survival, whereas others do not. Those that survive reproduce.

4. What (who) determines which organisms reproduce? Fitness of organisms in relation to the environment – depends on food availability, which varies from island to island, and beak type

Day 14 - Natural Selection



Have students get out Natural Selection Case 1 from yesterday. Before moving on to the worksheet, you may wish to lead a short discussion in which students brainstorm about the comparison across the two cases.

1. **What characteristics (traits) varied**? **Same**: both had characteristics that varied **Different**: Particular traits. **Moth**: Wing color; **Finch**: Beak type, body type, color

2. **What characteristics (traits) were selected for**? **Same**: whatever traits contributed to the survivability of the individual. **Different**: particular characteristics. **Moths**: Before Industrial revolution – Lightly colored wings; During the industrial revolution – Darkly colored wings, **Finches**: Different beaks were selected for different environments: islands with trees that produce nuts – beaks that were strong and blunt that could be used for cracking the nut shells were selected for.

3. **How does the selection process work**? **Same**: Variation in traits. Some types of traits contribute to fitness to survive whereas others do not. Those that survive reproduce and pass their genes to the next generation. **Different**: Particular traits and environments

4. **What (who) determines which organisms reproduce**? **Same**: Fitness of organisms in relation to the environment. **Different**: Particular relationship between the organism and the environment: **Moths**: depends on wing color, tree color, and predatory birds. **Finches**: – depends on food availability and beak type

5. **What factors drive reproduction**? **Same**: Fitness, survivability **Different**: particulars of the organism and environment

Summary: What is the same? Both have variation in traits. Both have selection driven by the fitness of the organism to survive in its environment. Individual fitness is affected by the traits (i.e., traits contribute to survivability). Reproduction provides the mechanism to pass traits (via genes) to the next generation. The process is repeated.

What is different? Moths versus birds; moths change over time in the same area because the environment changed. Birds changed because they lived in different environments.

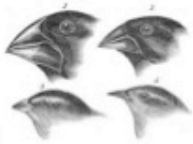
Compare Natural Selection

- What characteristics affected the survival of the organisms?
- Why were those characteristics important (selected for)?
- How does the selection process work?
- What determines which organisms reproduce?

Direct students' attention to the between-case comparison of selective breeding (WS 27, student resource p38). Allow students to complete the chart as best they can, then allow students to share their answers in a class discussion.

Day 14 - Natural Selection

Compare Natural Selection

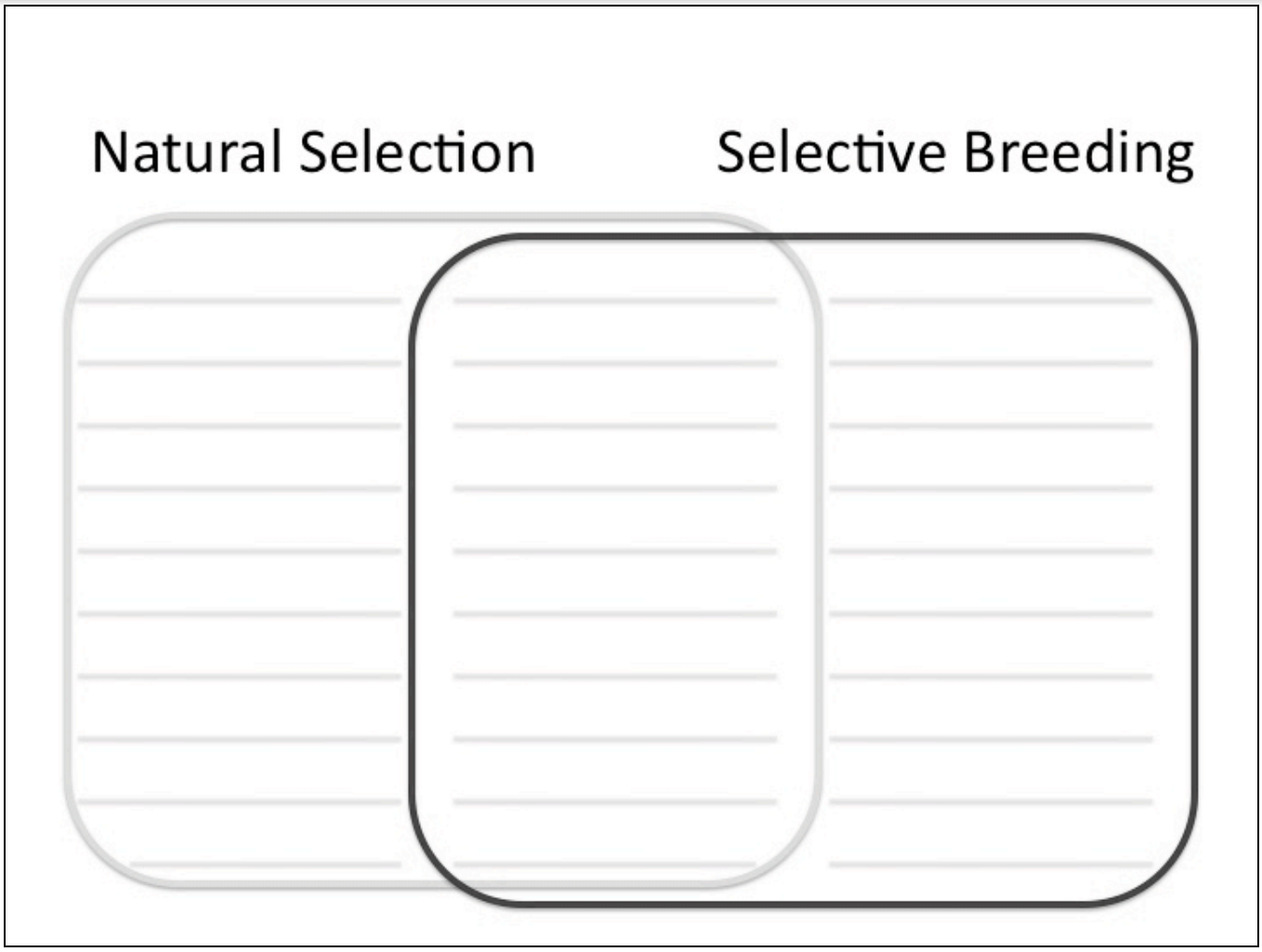


- What characteristics affected the survival of the organisms? *Color, beak shape*
- Why were those characteristics important (selected for)? *Enabled moths to hide from predators, enabled birds to eat nuts/fruit*
- How does the selection process work? *Those with the better characteristics for survival were more likely to survive and reproduce*
- What determines which organisms reproduce? *Likelihood of survival*

Post these answers with responses after you have led a class discussion, so students can check their work and correct errors.

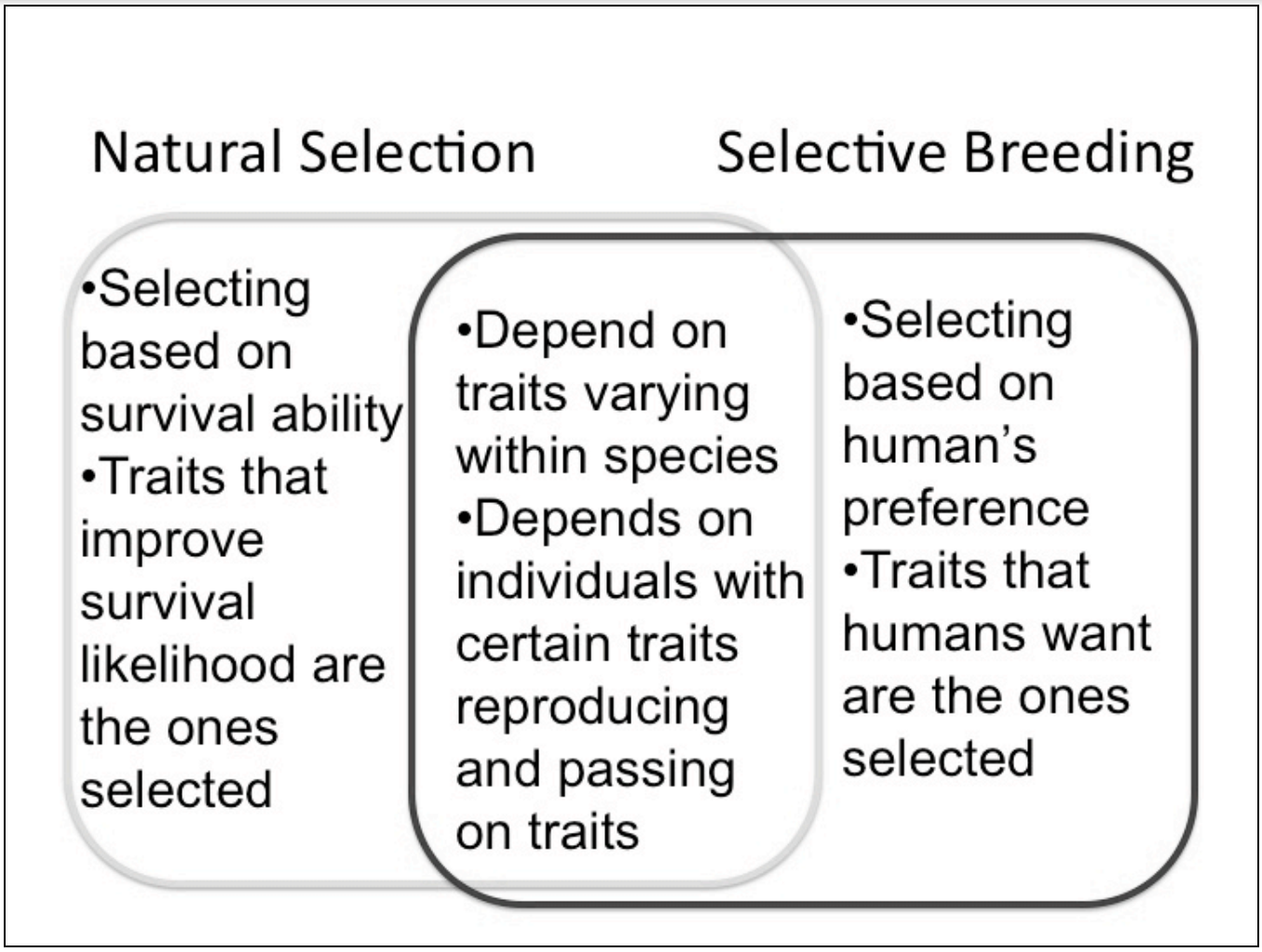
Now pass out worksheet 28, or direct students' attention to student resource p39, for a comparison of selective breeding and natural selection. Allow them to work through the worksheet and brainstorm for a few moments before opening it up to class discussion.

Day 14 - Natural Selection



You may draw this Venn on the board to record students' responses about the similarities and differences between natural selection and selective breeding, or you may simply project it as they discuss the question. The next slide has suggested responses.

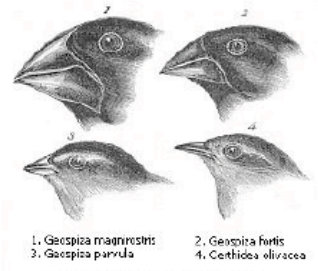
Day 14 - Natural Selection



At the end of the discussion, project this diagram to help students see the answers and correct their own responses.

Student Worksheet 25: Natural Selection Case 2

Natural Selection – Case 2



Finches from Galapagos Archipelago

The finch evolution on the Galapagos Islands is another example of natural selection. When Darwin visited the islands in the mid 1800's he found a wide variety of different types of finches. He hypothesized that the different kinds of finches were a result of natural selection and evolution. Although many of the finches shared similar coloring and body size they differed in their beak type (see the picture above).

Darwin hypothesized that some finches from the mainland of South America flew over to the islands, and those that were able to survive in the new environment reproduced and passed their genes to the next generation. Initially the birds varied in the size and shape of their beaks. The birds that were most able to survive were the ones who could live off the food found on the island. For example, islands that had nut trees supported finch populations that had blunt beaks that were strong enough to crack the nuts. Therefore, those finches with the strong, blunt beaks were better able to survive and reproduced, passing their genes to their offspring. Finches in the next generation who had those traits continued to survive and were more likely to reproduce. Finches in that environment who did not have the strong, blunt beaks did not survive as well as the others and therefore were less likely to reproduce and pass their genes to offspring in the next generation.

Other islands had different environments in which finches with different beak types were better able to survive. For example, one island did not have nut trees but instead had lots of berries, and finches with beaks that were better fit for picking berries survived and reproduced, passing their genes to the next generation. On each island the finches that were able to survive and reproduce were the ones that passed their genes on to the next generation. Eventually after many generations of natural selection most individuals in the population had a beak type that helped them survive in that particular environment.

How did the finches on different Galapagos Islands come to have different types of beaks?

Student Worksheet 26: Natural Selection Case 2 Questions

Case comparison handout 2

1. What finch characteristics (traits) varied?

2. What characteristics (traits) were selected for?

3. How does the selection process work?

4. What (who) determines which organisms reproduce?

Day 14 - Natural Selection

Student Worksheet 27: Natural Selection Case Comparison

Across the cases:

Question	Moths	Finches
What characteristics affected the survival of the organisms?		
Why were those characteristics important? (selected for)		
How does the selection process work?		
What (who) determines which organisms reproduce?		

Student Worksheet 28: Comparing Selective Breeding to Natural Selection

Comparing Selective Breeding to Natural Selection

What is similar? _____

What is different? _____

DAY 15

Chapter 5, Section 1: Change Over Time

After completing today's warm-up, conduct visualization exercise 5.1. Once you have completed the visualization focus, begin teaching Chapter 5, Section 1 in the normal manner in which you would present it. This section will teach students that species change over time and present the concepts of adaptation and evolution. If you wish, you can try presenting the concepts of evolution and adaptation in a contrasting case style (e.g., present more than one example of each concept at the same time rather than sequentially, and discuss the similarities and differences between them).

Big Ideas

- An adaptation is a characteristic that helps an organism survive and reproduce over time; it can be physical or behavioral.
- Inherited characteristics in populations change over time, ultimately giving rise to new species in a process called evolution.

Materials

Teacher:

1. Warm-up Day 15 - Cells_warmups.ppt
2. Slides - day15.ppt

Students:

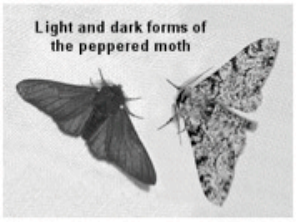
1. Holt textbook pages 108-109

Activities and Allotted time

5 minutes - Warm-up
5 minutes - Visualization activity 5.1
30 minutes - Holt Ch 5, Section 1, p108-109

Day 15 - Warm-up

Review your natural selection and selective breeding worksheets for help.



The peppered moth population changing from mostly light-colored wings to mostly dark-colored wings is an example of *natural selection*.

Over the past 15,000 years humans have selectively bred dogs to have particular characteristics and traits. The Husky, for example, has medium size, a thick fur coat and high energy.

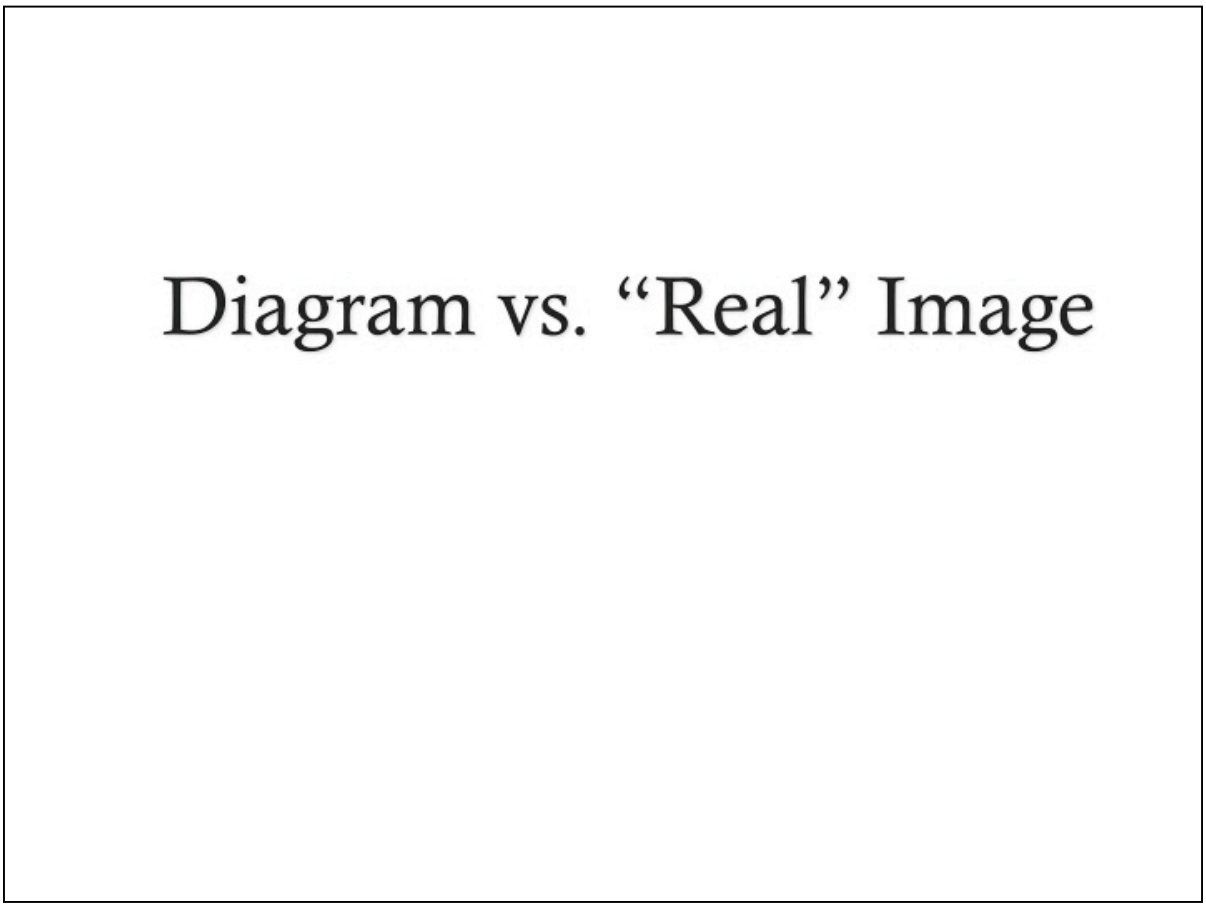
1. Why did the dark-winged peppered moths become more common than light-winged moths?
2. Why did the Husky emerge with its particular set of traits?

Answers:

1. When the moth's environment changed and the trees became dark, the dark-winged moths became better equipped to survive, reproduce and pass on their traits to future generations. The light-winged moths became more vulnerable to detection by predators, making them less likely to survive long enough to reproduce and pass on their traits to future generations.

2. The Husky emerged with its traits because humans wanted a dog that possessed its traits – high energy, thick coat and medium size – and thus chose the dogs that best exemplified these traits to breed.

Purpose: This exercise emphasizes the contrast between natural selection, in which environmental conditions determine which members of a population are better able to survive and reproduce successfully, and selective breeding, in which people determine which members of a population they want to reproduce based on a particular set of desired characteristics.



Exercise 5.1

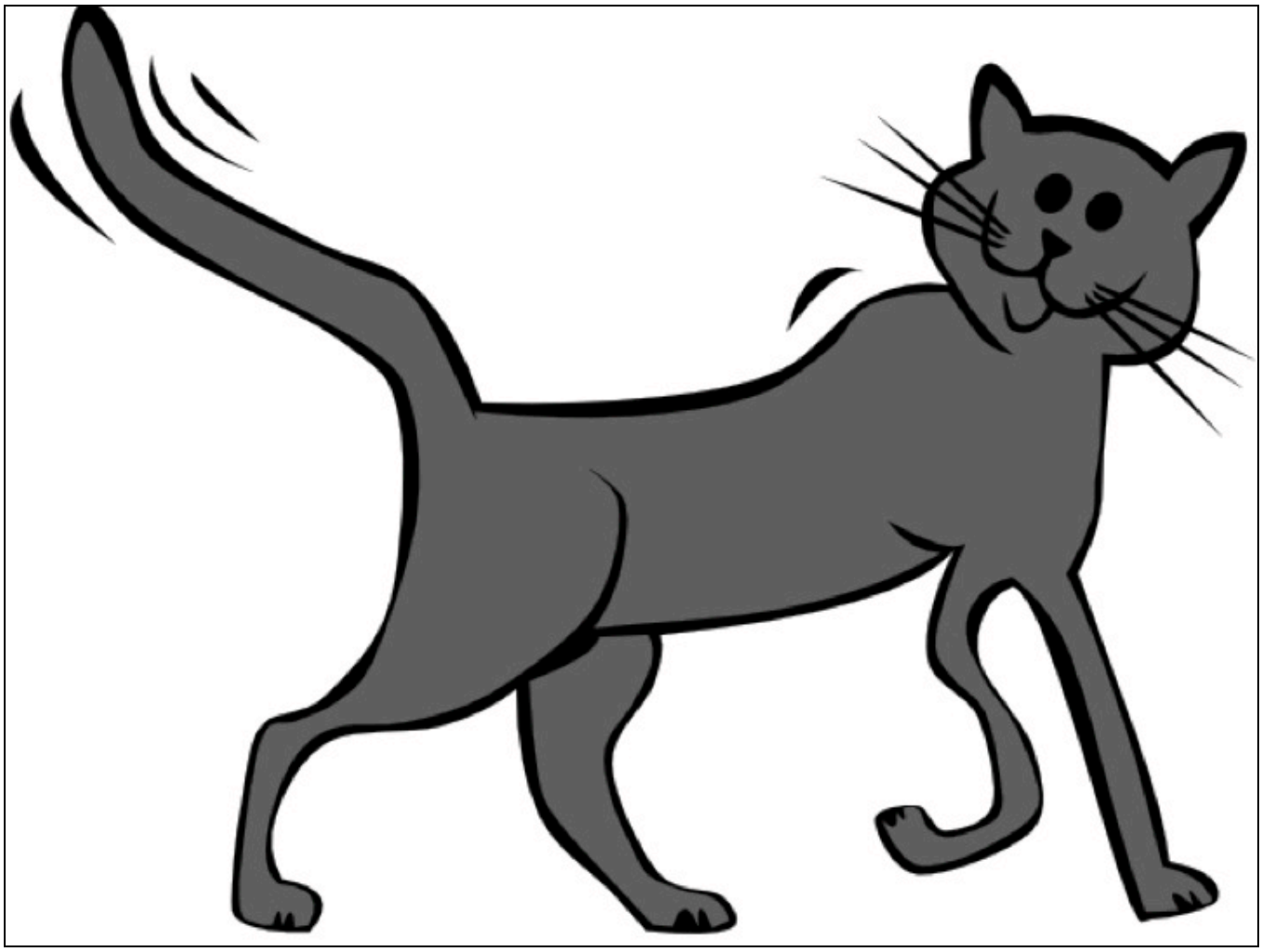
Image Comprehension Focus: Diagram vs. "Real" Image

Goal: Realize that diagrams may not be realistic but are designed to capture key aspects of an object or a process.

Type of Activity: Teacher Demo

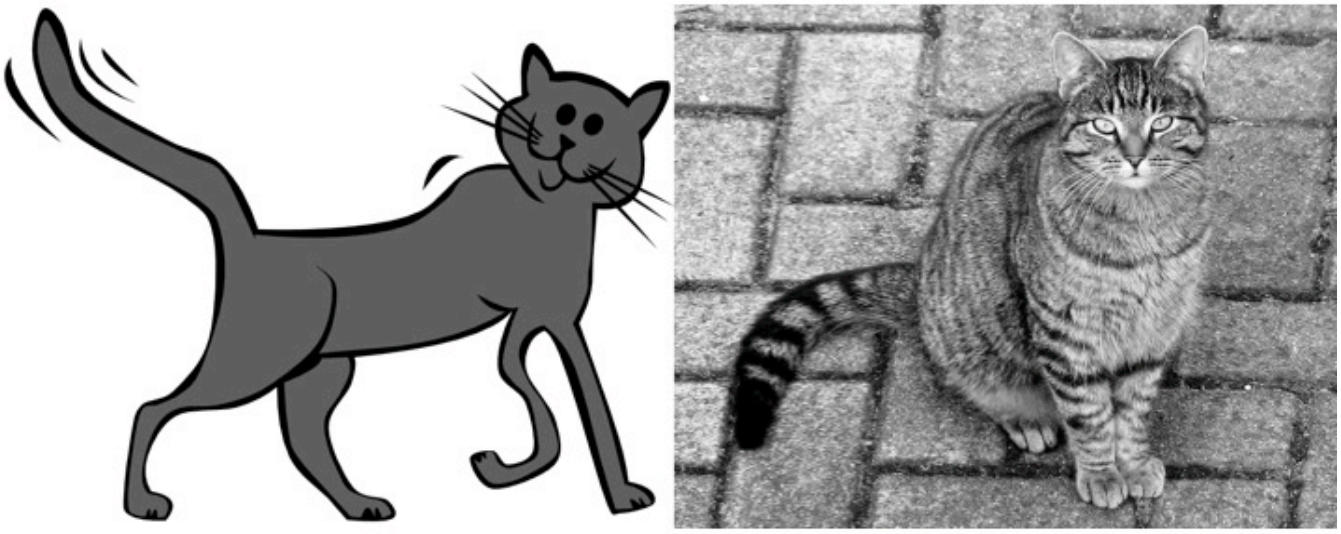
Overview: The purpose of this activity is to highlight that diagrams may not be realistic but that they capture enough key features of an object in order to aid in understanding about it or about the process in which it is involved. This type of understanding is important so that students can understand the role of diagrams as well as not develop misconceptions that diagrammatic representations are always realistic.

Day 15 - Change Over Time



Procedure: Show the class a cartoon and ask the student to identify what it is (a cat) … (proceed to next slide)

Day 15 - Change Over Time



The teacher can then show a photograph of a the real object and indicate that, while the cartoon doesn't look exactly like the real image, it has enough key features (facial features, whiskers, shape etc.) that it can "represent" it. The teacher can pick two of these features and show where they are on the photograph and on the cartoon.

The teacher can then indicate that diagrams in a textbook do the same thing, but the lack of realism may not be obvious, especially when they depict things that we cannot normally see. These diagrams are not created to be exact copies, but they are close enough that we get a sense of what that object looks like. This is what is done in some of the images in the resource book.

Next: Draw the students' attention to the squiggles near the end of the cartoon cat's tail. Ask them what these squiggles mean. If they say that the squiggles mean that the tail is moving, ask them if the tail is ACTUALLY moving. Explain that, in diagrams, sometimes shapes or symbols are used to add information. This trick can be very helpful if it is done well, and if the reader is familiar with the symbol, like the students are familiar with the squiggles. However, these symbols can be very confusing if the reader is not familiar with their meanings.

DAY 16

Chapter 5, Section 1: Change Over Time (continued)

After warming up, conduct visualization activity 5.2, which emphasizes the role of captions. Then proceed with pages 110 and 111 of Chapter 5, Section 1, following the procedures you would normally use. In this section, students will learn about evidence of changes over time (fossils and the fossil record) and evidence of ancestry.

Big Ideas

- Evidence that organisms evolve can be found by comparing living organisms to each other and to the fossil record. Such comparisons provide evidence of common ancestry.

Materials

Teacher:

1. Warm-up Day 16 - Cells_warmups.ppt
2. Slides - day16.ppt

Students:

1. Holt textbook pages 110-111

Activities and Allotted time

5 minutes - Warm-up
5 minutes - Visualization activity 5.2
30 minutes - Holt Ch 5, Section 1, p110-111

Day 16 - Warm-up

Red-eyed tree frog

Smoky jungle frog

Two frog populations have adapted to their environments over many generations.

1. Why might it be useful for the tree frog to be bright green?
2. Why might is be useful for the jungle frog to be brown?

Answers:

1. The tree frog probably lives in an environment where many of his surroundings are green.

2. The jungle frog probably lives in an environment where many of his surroundings are brown.

Purpose: This exercise should help students apply what they have learned about adaptation to explain how real organisms look, reinforcing the idea that adaptation occurs in response to an organism's environment.

Exercise 5.2 (Prior to the introduction of fossils)

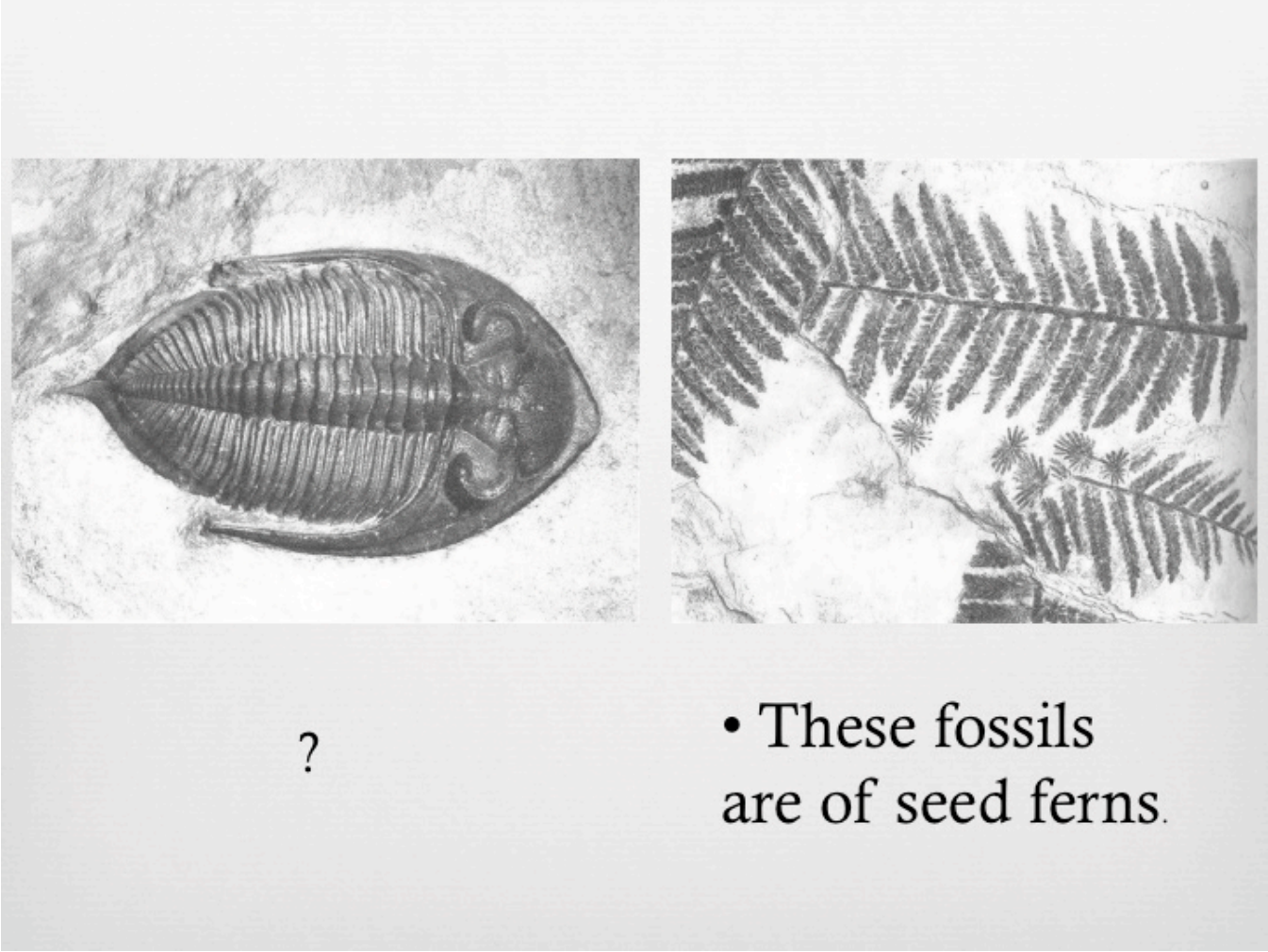
Image Comprehension Focus: captions

Goal: Reinforce the role of captions in image comprehension.

Type of Activity: Student activity

Overview: This activity is designed to provide an additional experience which illustrates the importance of reading the caption. Students will try to interpret two images, one with and one without a caption, and then will discuss how the caption aided image comprehension.

Day 16 - Change Over Time



Procedure: The teacher should show the students the two modified images based on p. 110/fig 5 (above). He/she should ask them to describe what is shown in each image. [The students should easily be able to describe that the fern image is of seed fern fossils but they should struggle to explain the trilobite image.] The teacher can lead a discussion about why one was much easier to understand than the other [the fact that the caption provided very critical information that was not in the photo itself]. The teacher should also emphasize to the students that, since captions often provide very useful information about the image and what is important, they should not be skipped when looking at diagrams and other images.

DAY 17

Chapter 5, Section 1: Change Over Time

After beginning the class with a warm-up, have students open their texts to p.112 and begin with visualization activity 5.3. Continue with Chapter 5, Section 1, p.112 as you normally would teach it. Please pause on p. 114 for two additional visualization activities highlighting diagrams that appear on that page. Today you will conclude Chapter 5, Section 1.

Big Ideas

- Evidence of common ancestry among living things is provided by comparing DNA and inherited traits. Species that have a common ancestor will have traits and DNA that are more similar to each other than to those of distantly related species.

Materials

Teacher:

1. Warm-up Day 17 - Cells_warmups.ppt
2. Slides - day17.ppt

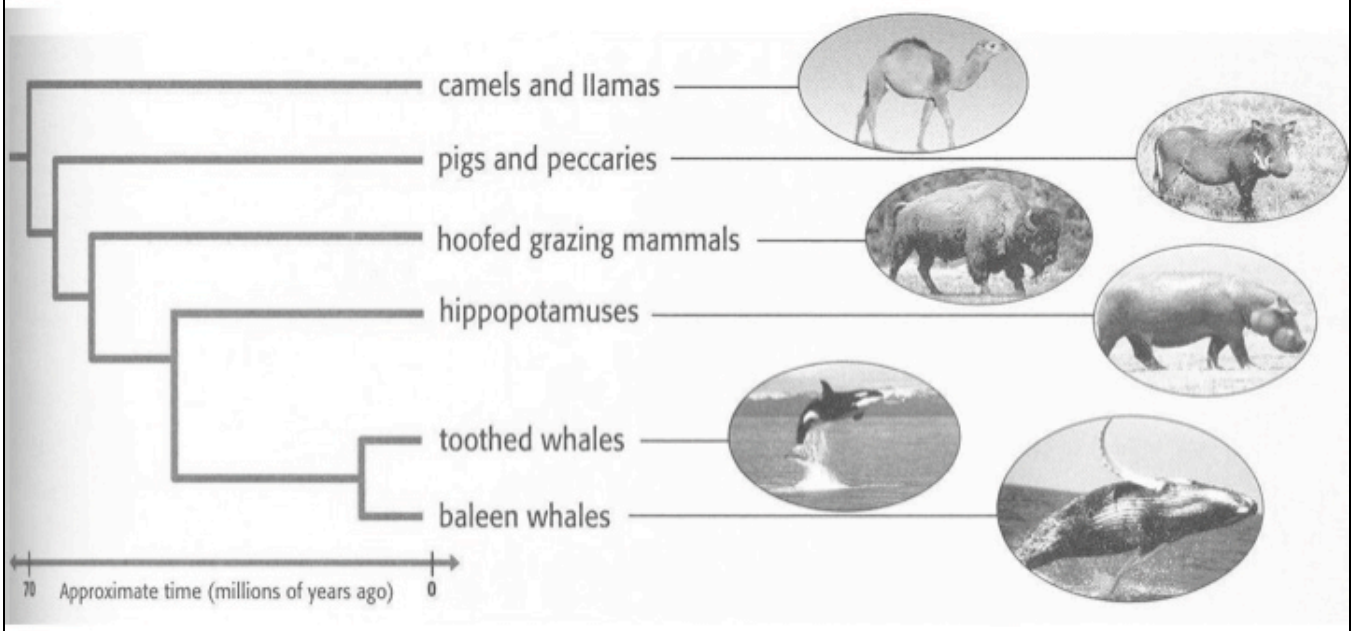
Students:

1. Holt textbook pages 112-114

Activities and Allotted time

5 minutes - Warm-up
5 minutes - Visualization activity 5.3 regarding p112
25 minutes - Holt Ch 5, Section 1, p112-114
5 minutes - Visualization activity 5.4 regarding p114
5 minutes - Visualization activity 5.5 regarding p114

Day 17 - Warm-up



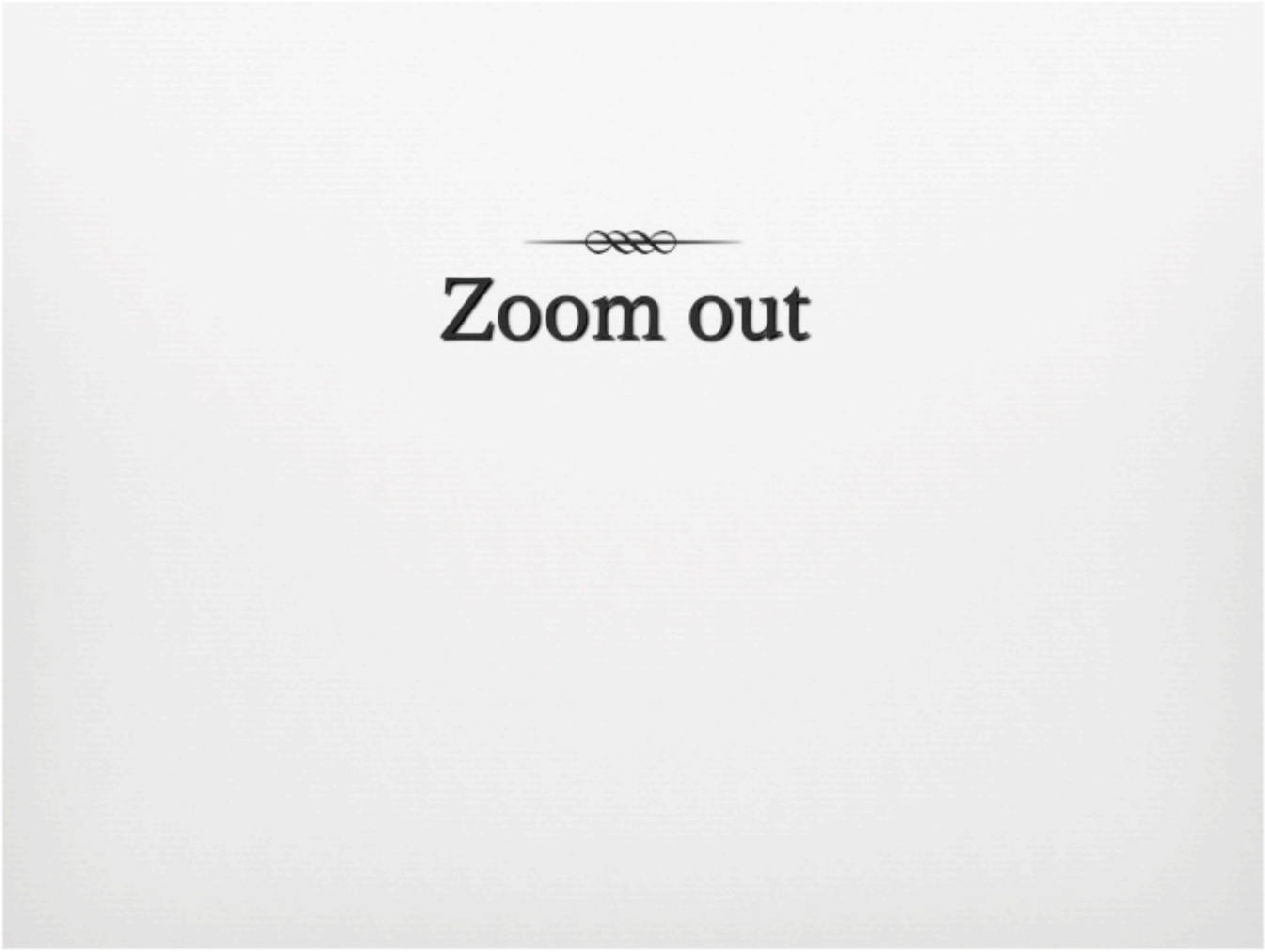
According to the diagram, which is more closely related to a hippopotamus – a pig, or a whale? Explain your answer

Hint: You might want to take a look at a similar picture that you have already seen. Try Figure 2 on page 165

Answer: The whale is more closely related to the hippopotamus. These two animals can both trace their ancestry back to a single common ancestor, which is shown in the picture using branches. The hippo branch and the whale branch both come out of the same fork. To find the connection between pigs and hippos you have to go back several forks, which shows that these two animals have a more distant relationship.

Purpose: The image displayed is from Page 111, Figure 6. This question reaches back to figure 2/p165.

Day 17 - Change Over Time



Exercise 5.3

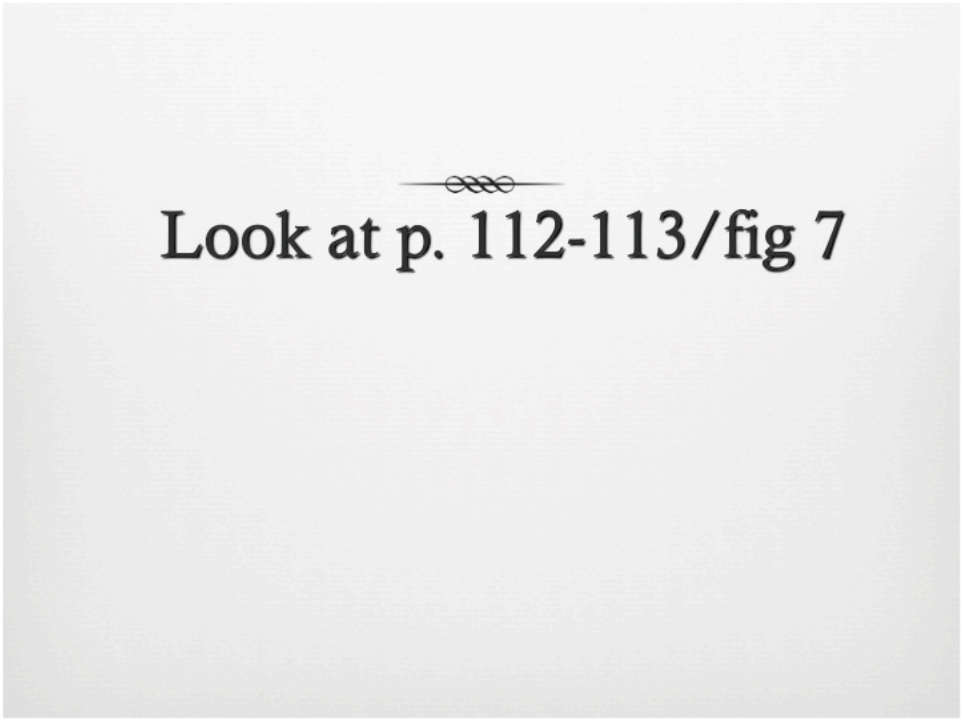
Image Comprehension Focus: Zoom out

Goal: To build understanding of what a "zoom-out" convention illustrates

Type of Activity: Teacher Comment

Overview: This activity is designed to help the students develop their understanding of the "zoom-out" convention by explicitly discussing how the perspective changes in a zoom-out. An explicit understanding of this change in perspective should assist students in developing strong image comprehension skills.

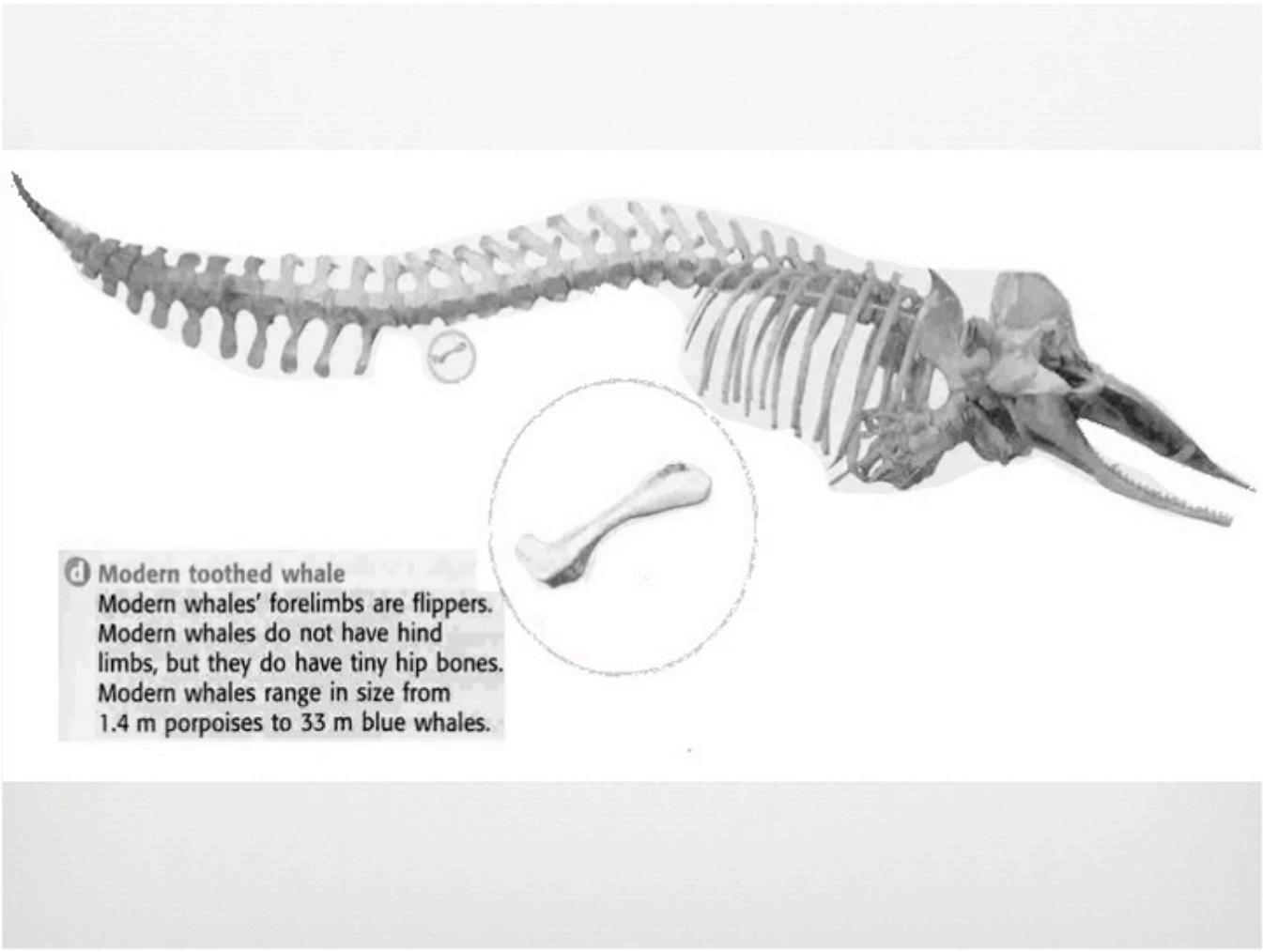
Day 17 - Change Over Time



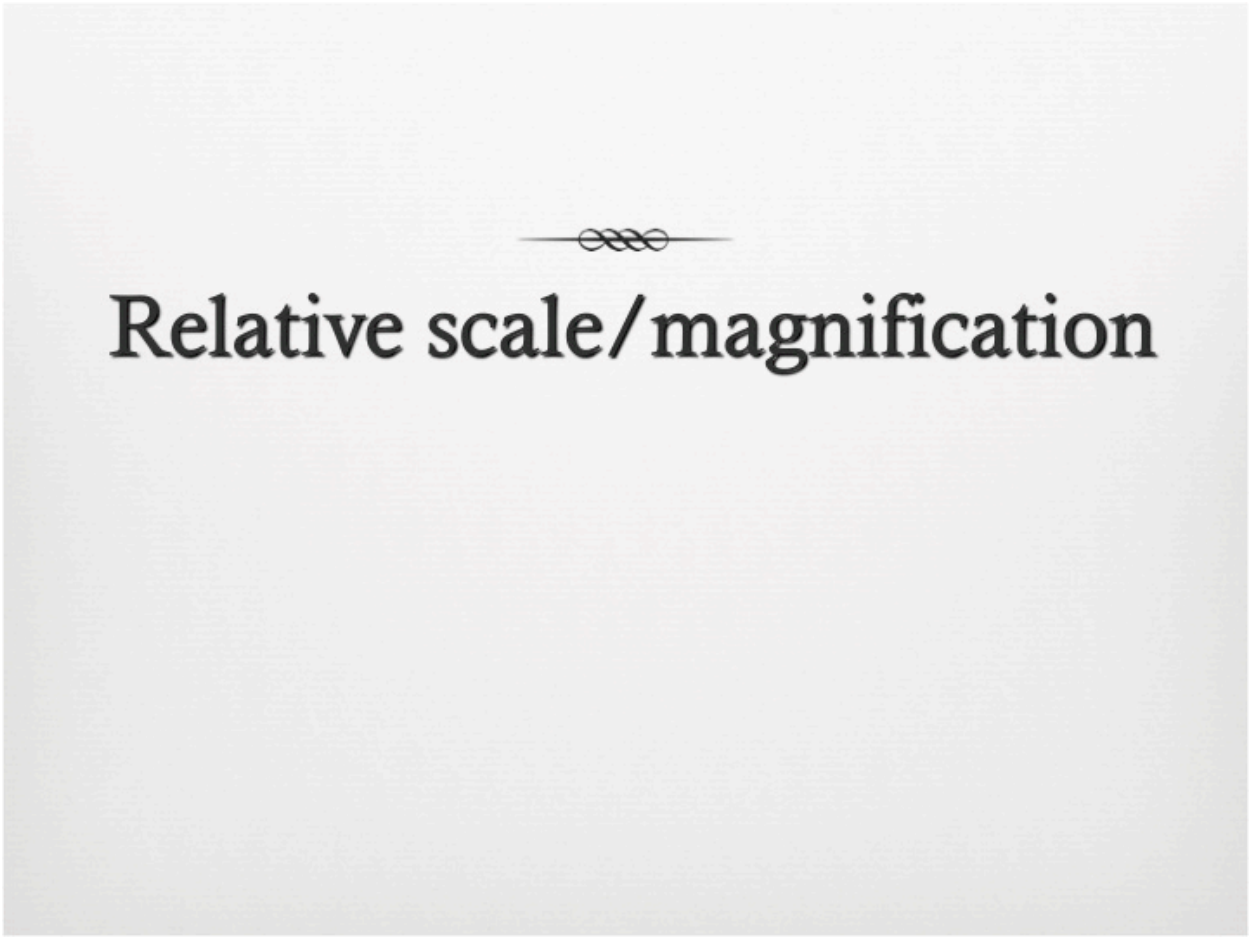
Procedure: The teacher should direct the students to look at p. 113/Fig 7. (Part of this image is shown on the next slide if you want to project it.) He/she should point out that the larger circle located below and to the right to the small circle illustrates what it would look like if one was looking at the hip bone through a magnifying glass. The idea is that you can see things on a very small scale at a much stronger level of magnification when you look through a magnifying glass. (See note below.) In this example, looking at a tiny hip bone through a magnifying glass allows the viewer to see that modern whales do have tiny hip bones. In addition, the teacher should note that this image also uses a "zoom-out" convention in that part of the image is at a much higher level of magnification than the rest. In this case, the hip bone is shown at a higher level of magnification. The teacher should conclude this explanation with the comment that images often have clues that they are using a "zoom-out" convention and that the next activity is to look at some examples that are used in the textbook in this chapter. Proceed to next activity

NOTE: If students do not have experience with magnifying glasses, it might be worthwhile to provide an opportunity to experience using a device to change the magnification of an object. One option would be to have the students use hand-held magnifying glasses to examine an object such as writing on a piece of paper and then to discuss how the image changes in appearance when looked at with one's eyes and when looked at through the glass. (Using the magnifying glass allows one to see details that cannot be seen by using one's eyes only.)

Day 17 - Change Over Time



Project this slide during visualization activity 5.3 if you wish.



Exercise 5.4 (After the content of comparing organisms has been introduced-directly before color activity-slide 11)

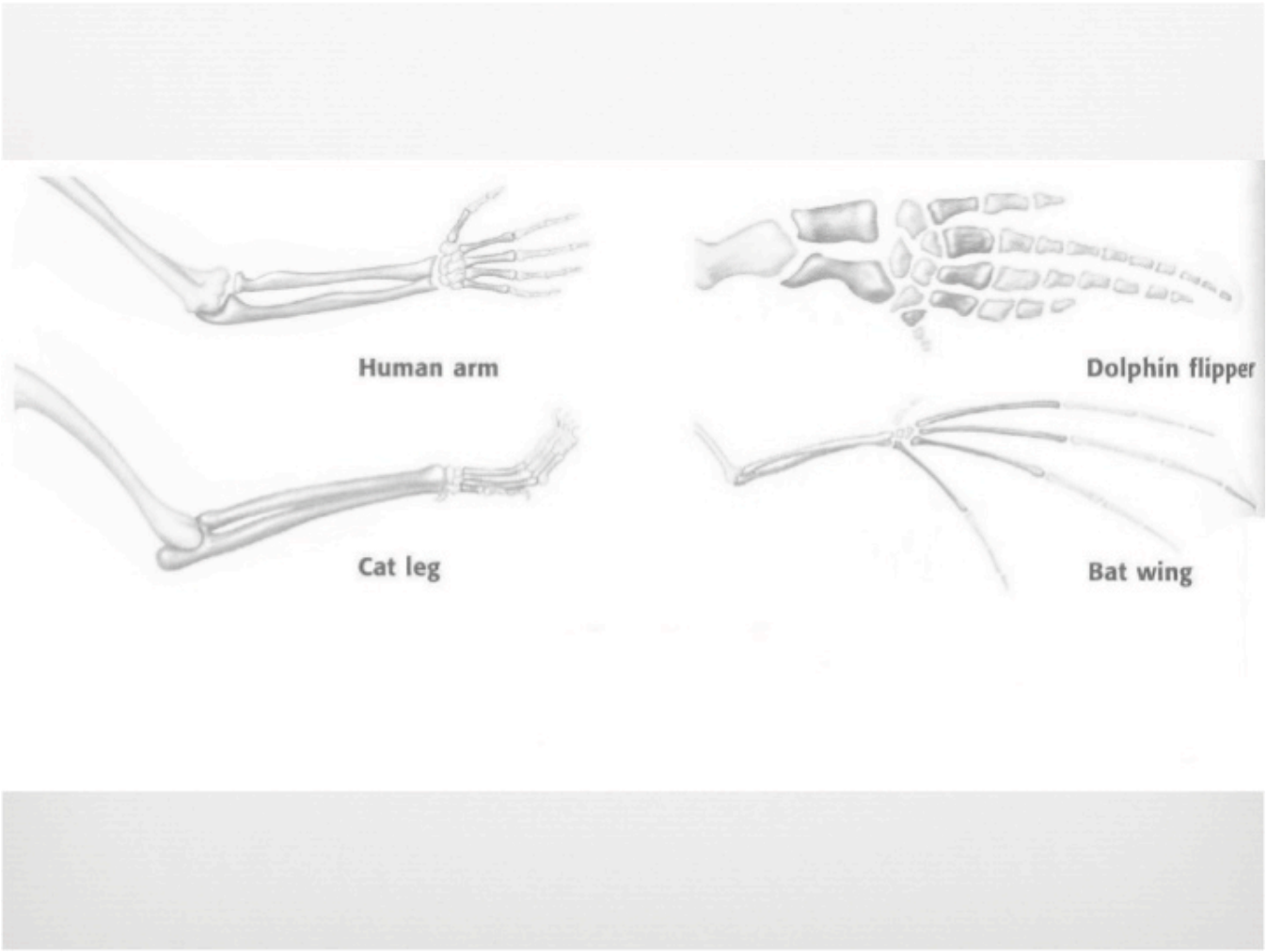
Image Comprehension Focus: Relative scale/magnification

Goal: Maintenance of the concept that the size of images may not reflect actual sizes of objects (building on bacteria/cell example from chap 1).

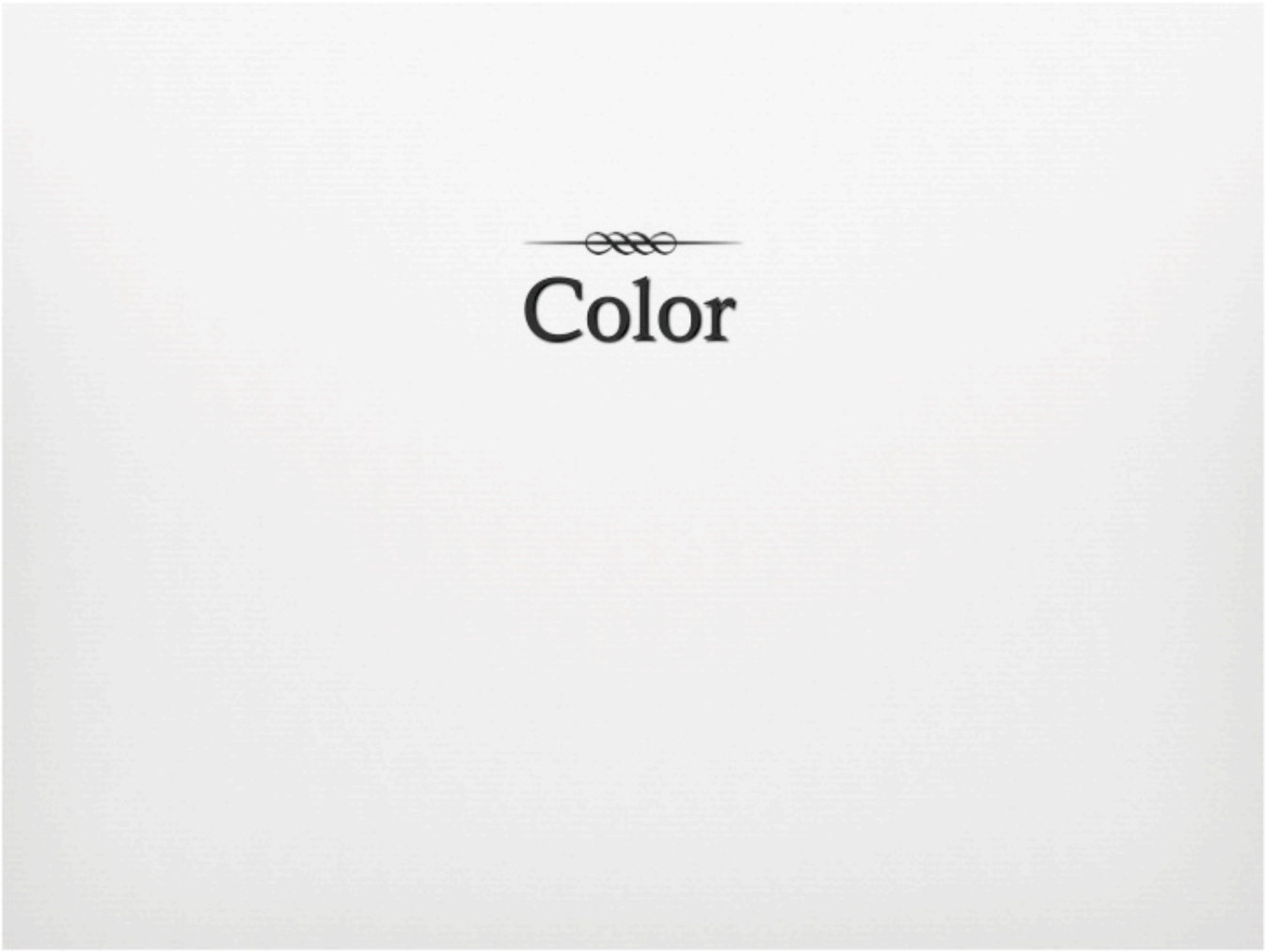
Type of Activity: Teacher comment

Overview: The purpose of this activity is to remind students that they need to consider the scale of images shown in the textbook by discussing how images of skeletal systems of different organisms shown in the textbook fail to convey an accurate sense of their relative size.

Day 17 - Change Over Time



Procedure: The teacher should direct the students to look at the modified p. 114/fig 8 (bone comparison-shown above). He/she should emphasize how the picture is misleading with respect to the relative size of the images. Although the structures shown look like they are the same size, in reality they are not. For example, the ratio of a human male arm to a cat leg is approximately four to one. If needed, teacher could provide a concrete reference (such as the difference between 1 cm and 4 cm) to illustrate the actual size difference. The focus here is to reinforce that the sizes of images may or may not actually represent their sizes in the "real world" or their relative sizes.



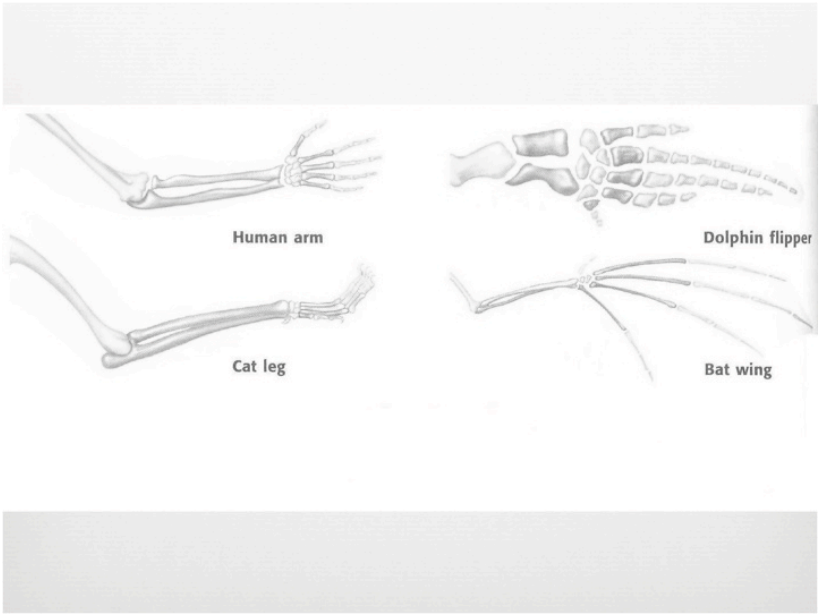
Exercise 5.5 (After the idea of comparing organisms has been introduced; directly after scale activity, slide 9)

Image Comprehension Focus: color

Goal: Developing the concept that colors are used to identify similar or identical structures

Type of Activity: Student activity

Overview: The purpose of this activity is to provide the students with an additional opportunity to practice interpreting the use of color as a mechanism to identify similar structures in a diagram.



Procedure: The teacher should show the students the modified image from, p. 114/Fig 8 (above) again. He/she should indicate that now the image will be analyzed based on the use of color. The teacher should ask the students a series questions to remind them of the function of different colors in diagrams. Help them use what they have learned about the use of color to predict which bones in the four creatures are similar.

The questions and answers are:

1) How many colors are used in this figure? **6.**

2) Are the colors false or real? **False.**

3) Why do you think different colors are used in these images? **To stand for different parts.**

4) Are all the colors used in every image in this figure? **Yes.**

5) What do you think is the connection among the parts with the same color? **They represent comparable parts.**

After the students have completed the activity, the teacher should ask them to reflect on how they made their selections. [They should be based on the fact that comparable bones were the same color in each image.]

DAY 18

Chapter 5, Section 1: Change Over Time Review

After warming up, use today to review Chapter 5, Section 1, or to catch up if you have not yet completed it. You may wish to use the section review at the end of Section 1. Try to draw in concepts from the natural selection/selective breeding contrasting case whenever possible.

Big Ideas

Review of all Big Ideas in Chapter 5.

Materials

Teacher:

1. Warm-up Day 18 - Cells_warmups.ppt

Students:

1. Holt textbook, Chapter 5, Section 1

Activities and Allotted time

5 minutes - Warm-up
40 minutes - Review of Chapter 5

Day 18 - Warm-up

To answer the following questions, look in your book at p112-113, fig.7, titled "Evidence of Whale Evolution."

1. How much time passed between the time when the *Pakicetus* lived and the time when the *Ambulocetus* lived?
2. How much time passed between the *Ambulocetus* and the *Dorudon*?
3. Which of the whale ancestors pictured in Figure 7 was the first to live exclusively in water and never walk on land?

Answers:

1. 1 million years

2. 9 million years

3. Dorudon

Purpose: This exercise gives students practice reading diagrams while also reinforcing their understanding of the great amount of time that passes over the course of evolution.

DAY 19

Chapter 5, Section 3: Natural Selection in Action

The topics of natural selection and selective breeding have already been covered in the contrasting case at the beginning of this chapter, so please **skip over Chapter 5, Section 2.** After the warm-up, ask students to open their books to p120 (note that this is one of the pages skipped in Section 2). Complete visualization activity 5.6, then begin instruction with Chapter 5, Section 3. Pause for visualization activity 5.7 on p123, when you reach the figure in the text. Conclude today's lesson on p123.

Big Ideas

- Natural selection explains how populations adapt to changes in their environment. A variety of examples of such adaptations can be found.

Materials

Teacher:

1. Warm-up Day 19 - Cells_warmups.ppt
2. Slides - day17.ppt

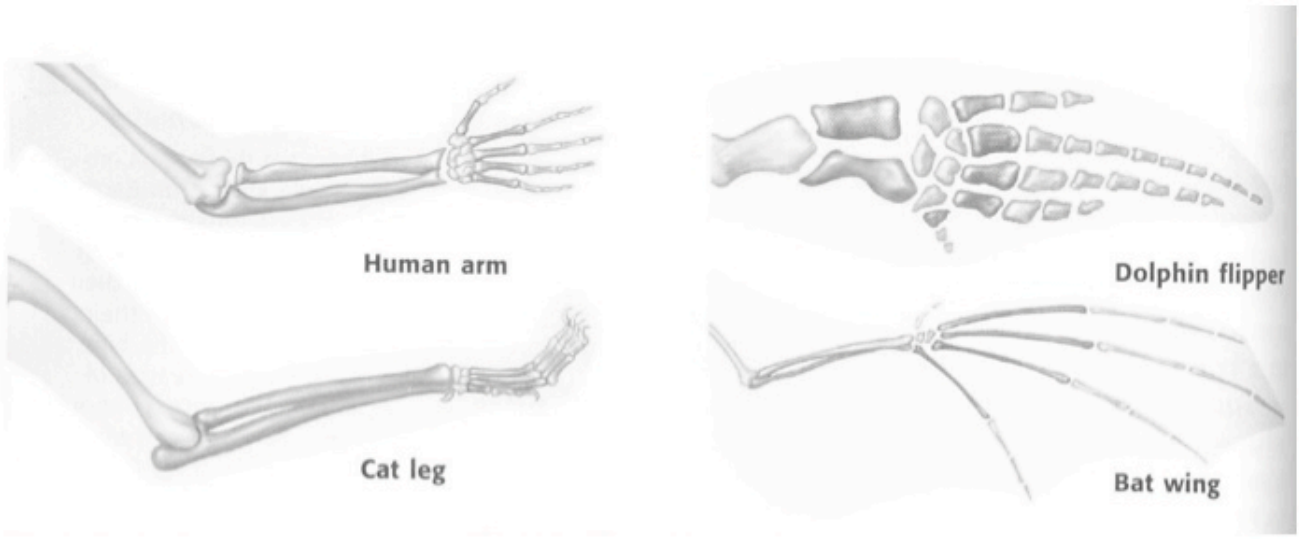
Students:

1. Holt textbook, Chapter 5, Section 3, p120 and 122-123

Activities and Allotted time

5 minutes - Warm-up
5 minutes - Visualization activity 5.6 regarding p120
25 minutes - Holt Ch 5, Section 3, p122-123
5 minutes - Visualization activity 5.7 regarding p123
5 minutes - Visualization activity 5.5 regarding p123

Day 19 - Warm-up



Examine this image of different organisms' bones, taken from p.114/ figure 8 in your text book.

Why do these images support the idea that humans, cats, dolphins and bats are descended from the same ancestors?

Answer: Although the four limbs look very different to the naked eye, the bone structures show a lot of similarities. Organisms that share similar structures are generally grouped more closely in the classification system and are often believed to be descended from common ancestors.

Purpose: This exercise gives students practice using diagrams and also reinforces the idea that organisms that look very different from the outside might have a lot in common in terms of their structure and function. This takes the classification concept from the last chapter and relates it to evolutionary similarities.

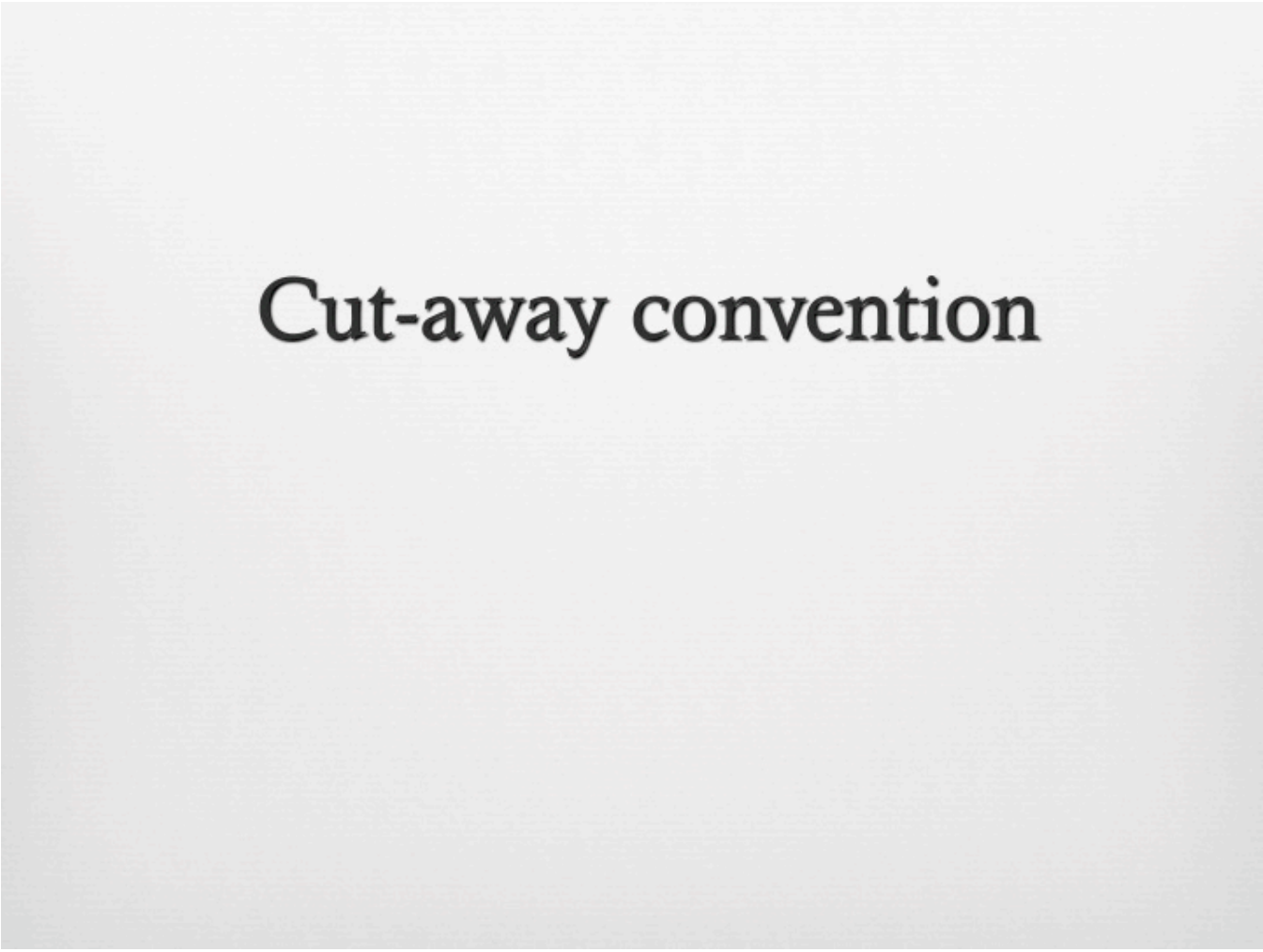
Common misunderstandings in applying concepts of evolution by natural selection

Heads Up on Student Learning

Many students think that a type of insect becomes resistant to a pesticide because individual insects acquire resistance or "adapt" to the pesticide within their lifetime. This may be the result of a combination of misunderstandings of how evolution by natural selection works. One misunderstanding is the belief that "adaptations" refer to changes that take place over time for a single individual. Another related misunderstanding is the belief that evolution can involve acquired characteristics that come about after something in the environment changes.

There are three important points to emphasize to help students understand insecticide resistance within an evolutionary framework. First, even before the pesticide is introduced, there are pre-existing, genetically-based differences among individuals within the population that affect whether they will survive exposure to the pesticide. Second, the shift in the population to a greater proportion of the insects being resistant to the pesticide is with later generations of the insects. They are not the same individuals who were originally exposed. Instead, they are the descendants of the insects who were first exposed to the pesticide but lived and reproduced. The proportion of insects in a population that is resistant to the pesticide changes gradually, after many generations of exposure and reproduction by survivors. Third, the original insects that were first exposed to the pesticide can only pass on to their offspring characteristics that are genetically encoded. If an insect managed to survive exposure to the pesticide for some reason other than a genetically encoded trait that increased its resistance to the pesticide, then it could not pass that on to its offspring.

Day 19 - Natural Selection in Action



Exercise 5.6 (As the content of natural selection is being introduced)

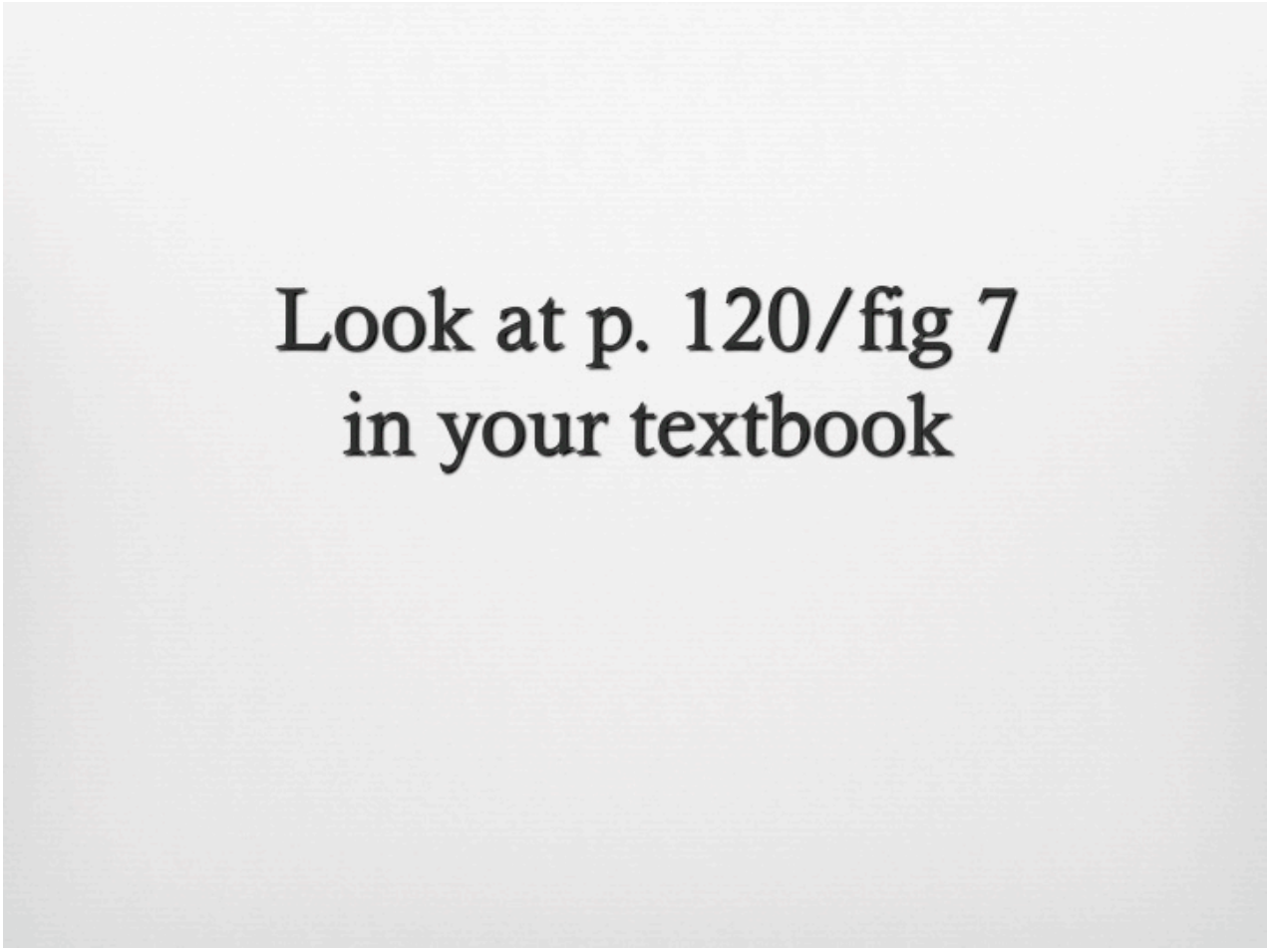
Image Comprehension Focus: cut-away convention

Goal: Assess students understanding of the perspective of a "cut-out" convention

Type of Activity: Student activity

Overview: This activity is intended to evaluate if the students understand how to recognize when a cut-away convention is being used in a diagram as well as the perspective that is employed by this type of convention.

Day 19 - Natural Selection in Action



Procedure: The teacher should direct students to look at p. 120/Fig 7 (shown on the next slide if the teacher wants to project it) and ask them to identify which two of the four scenes one would be unlikely to see in nature. [The two underground scenes are unnatural – a "cut-away" convention is being used in which the ground has been removed so what is happening underground can be seen.] The teacher should ask the students to describe what would have to happen or where one would have to be to have this view. [To see this image you would have to be inside the ground yourself or you would have to have removed the ground adjacent to the spider's den.] The teacher can illustrate with an orange: to see inside of the orange (e.g. seeds etc.), one has to cut a quarter or a half of the orange and remove the piece, so the inside is exposed and visible. The teacher can remind the students that, often in diagrams, we remove a part of the object or scene (a piece of the cell wall, as in an earlier chapter or, in this case, the ground) so we can see what we are interested in looking at.

Day 19 - Natural Selection in Action

Figure 7 Four Parts of Natural Selection

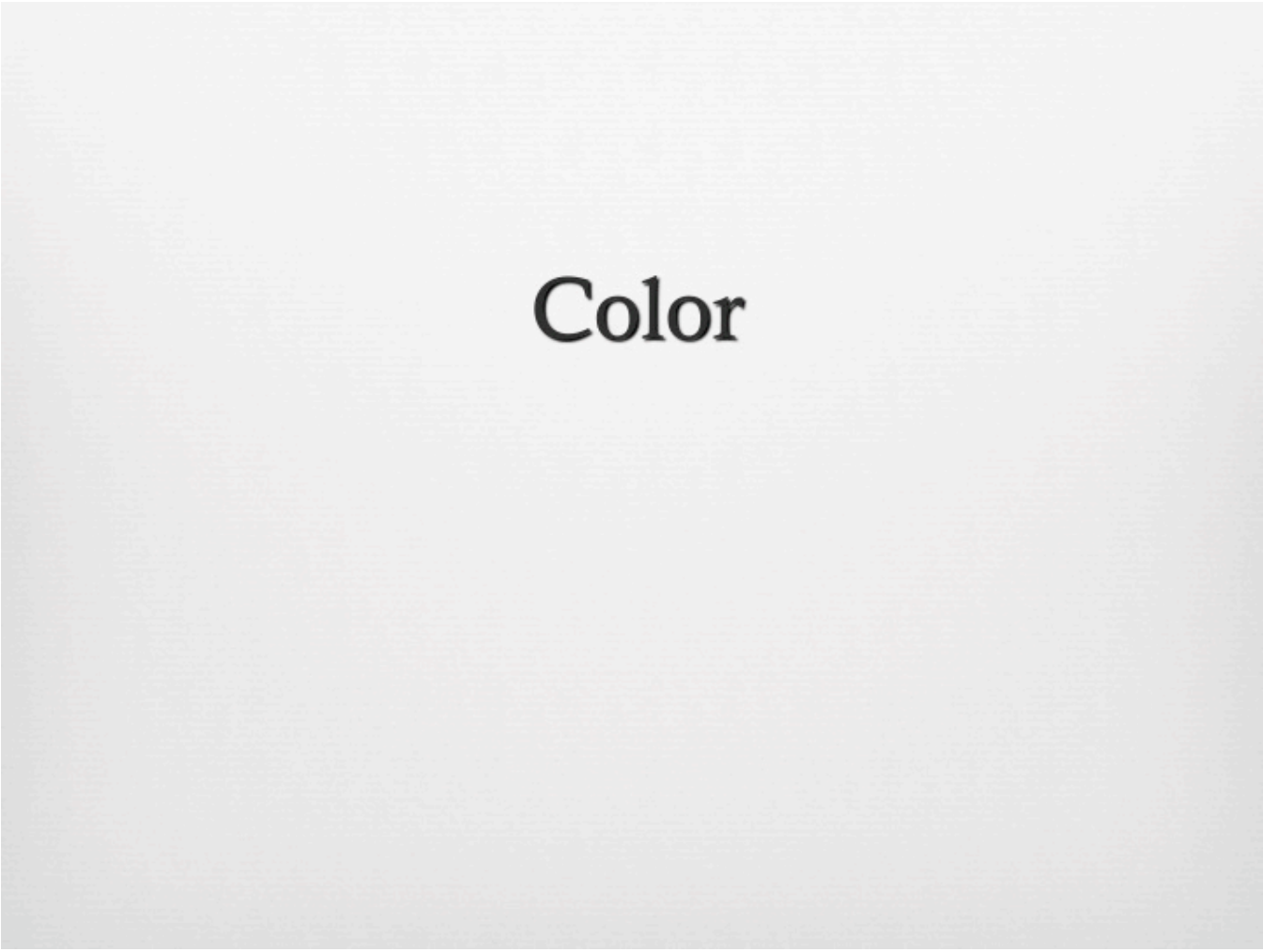
1 Overproduction A tarantula's egg sac may hold 500–1,000 eggs. Some of the eggs will survive and develop into adult spiders. Some will not.

2 Inherited Variation Every individual has its own combination of traits. Each tarantula is similar to, but not identical to, its parents.

3 Struggle to Survive Some tarantulas may be caught by predators, such as this wasp. Other tarantulas may starve or get a disease. Only some of the tarantulas will survive to adulthood.

4 Successful Reproduction The tarantulas that are best adapted to their environment are likely to have many offspring that survive.

Day 19 - Natural Selection in Action



Exercise 5.7 (After the content of natural selection has been introduced)

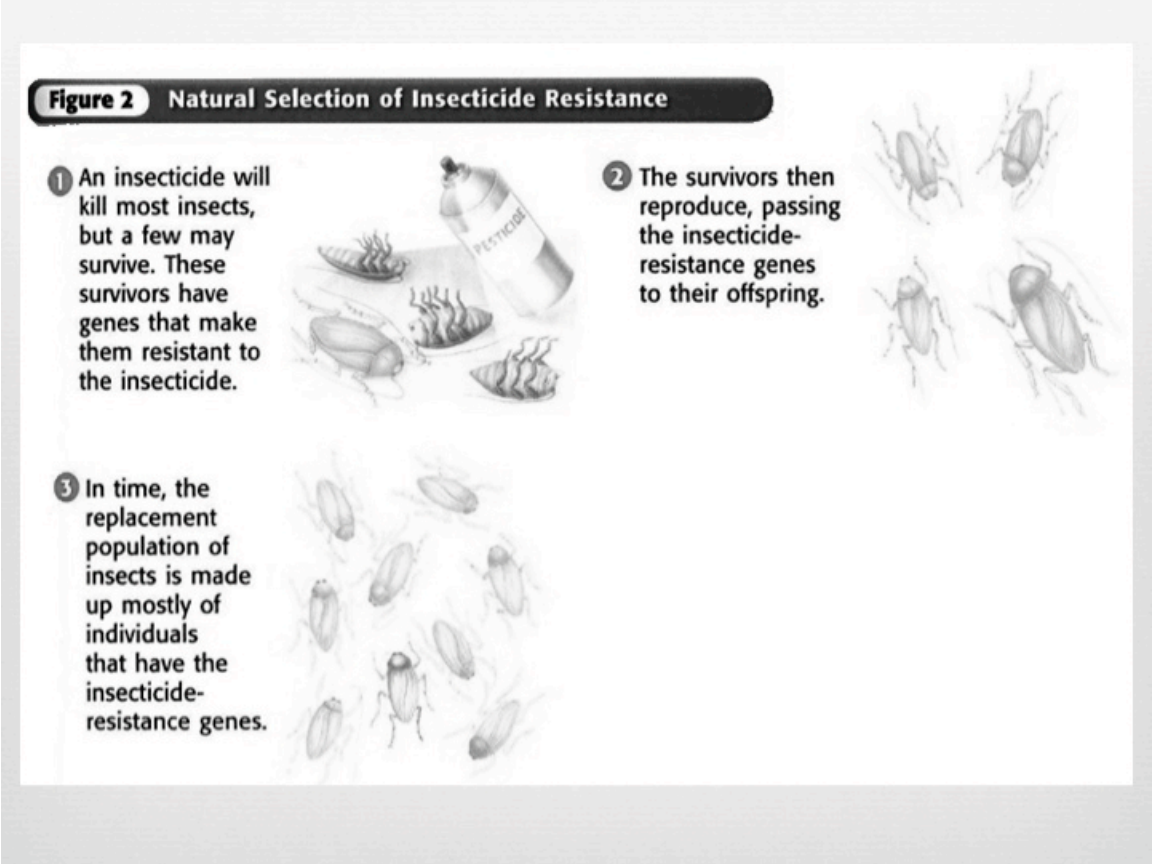
Image Comprehension Focus: color

Goal: Maintenance of the concept that colors are used to identify similar or identical structures

Type of Activity: Student activity

Overview: The purpose of this activity is to provide the students with an additional opportunity to practice interpreting the use of color as a mechanism to identify similar structures in a diagram.

Day 19 - Natural Selection in Action



Procedure: The teacher should show the students the modified image from p. 123/Fig 2 (above) and ask them to predict which of the insects will be resistant to the insecticide and which will die when exposed. A series of questions are asked to guide the students.

The questions are:

1) What colors are used in picture 1 to mark the survivor and the killed insects? Yellow and dark green.

2) How many colors are used in picture 2? What kind of insect is represented by this color? One. The survivors.

3) In picture 3, how many colors are used and what type(s) of insects do they stand for? Two. The ones with insecticide-resistance genes and the ones without.

The idea is that they will be aware that they used the varied colors of the insects as markers for the ones that did and did not inherit resistance to the insecticide.

DAY 20

Chapter 5, Section 3: Natural Selection in Action

After today's warm-up, begin with visualization activity 5.8, which concerns p124 of the textbook. You will then conclude Chapter 5, Section 3 by teaching p124-125 as you normally would.

Big Ideas

- Natural selection explains how one species may evolve into another. Speciation occurs as populations undergo separation, adaptation, and division.

Materials

Teacher:

1. Warm-up Day 20 - Cells_warmups.ppt
2. Slides - day20.ppt

Students:

1. Holt textbook, Chapter 5, Section 3, p120 and 124-125

Activities and Allotted time

5 minutes - Warm-up
5 minutes - Visualization activity 5.8 regarding p124
35 minutes - Holt Ch 5, Section 3, p124-125

Day 20 - Warm-up

Refer to p122/fig 2 in your textbook. One of the reasons insect populations adapt so quickly is that they reproduce very quickly. For example, about two weeks pass between each generation of fruit fly.

1. How many years might pass between two generations of humans?
2. Based on this, which species will adapt more quickly: fruit flies or humans?

Answers:

1. Responses can vary but should be somewhere in the range of 18-40 years. Students should understand that generation time is the period from the birth of one generation to the birth of the next, or the age of a population when they give birth to the next.

2. Fruit flies should adapt more quickly than humans because they will cycle through many more generations over a given span of time.

Purpose: This exercise should reinforce for students that adaptation is not dependent on the *length of time* that passes, but rather on the *number of generations* that pass. By contrasting human generation time with fruit fly generation time, students should recognize that organisms with short generation times have the potential to adapt much more quickly than organisms with long generation times.

Day 20 - Natural Selection in Action

Exercise 5.8 (Before the content of natural selection and species formation has been introduced)

Image Comprehension Focus: labeling

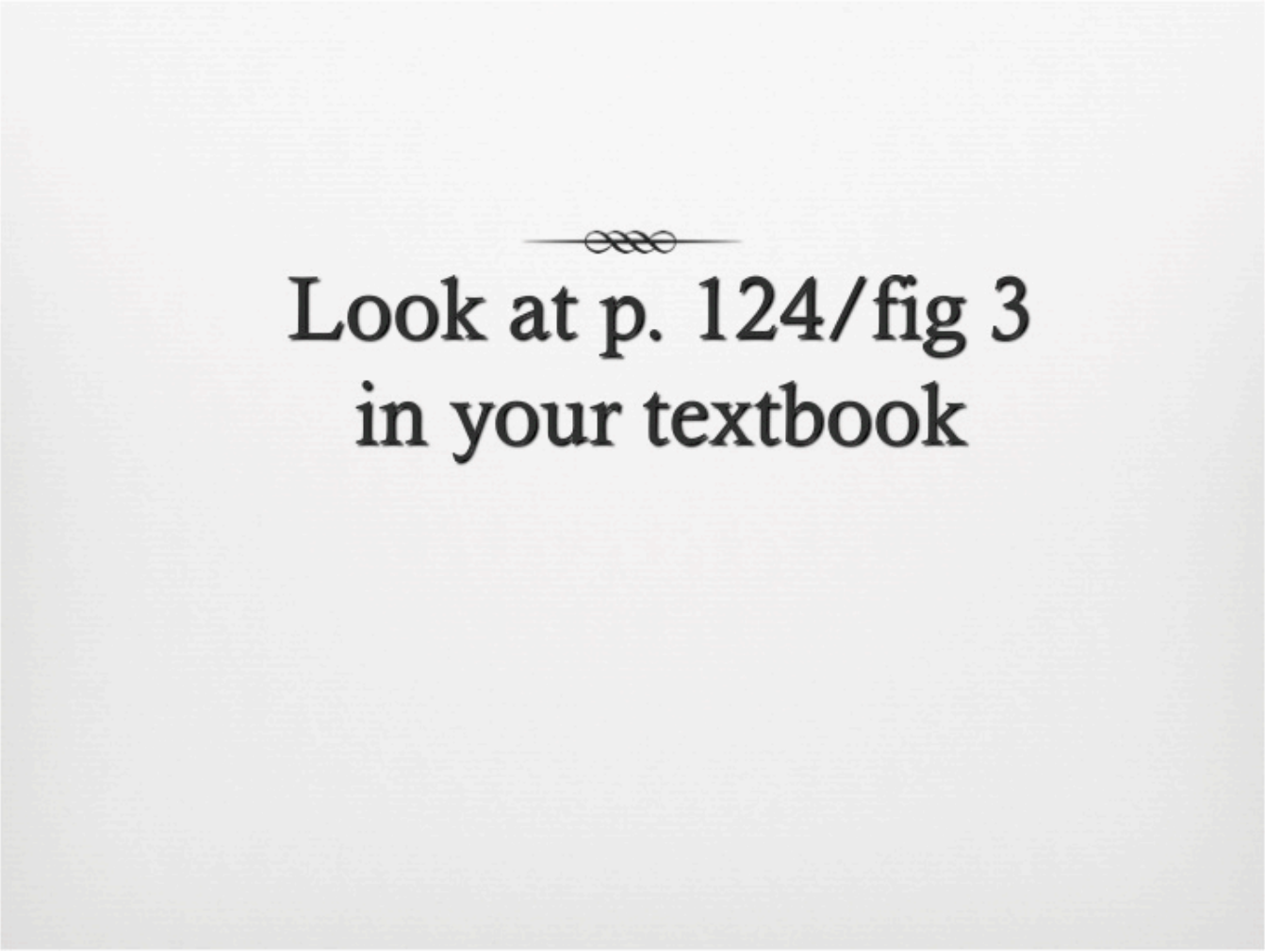
Goal: Maintain understanding of the role of different types of labels and their importance in image comprehension

Type of Activity: student activity

Overview: This activity is designed to help the students practice the fact that there are different types of labels and that they perform different roles in an image. In addition, this activity is designed to highlight the important role labels play in understanding an image and to encourage students to always read the labels when looking at a diagram.

Procedure: First the teacher should ask the students to indicate the two types of labels and their function [review of label exercise in chapter 7 – naming labels identify different parts of a diagram; explanatory labels provide more information about a particular part of a diagram].

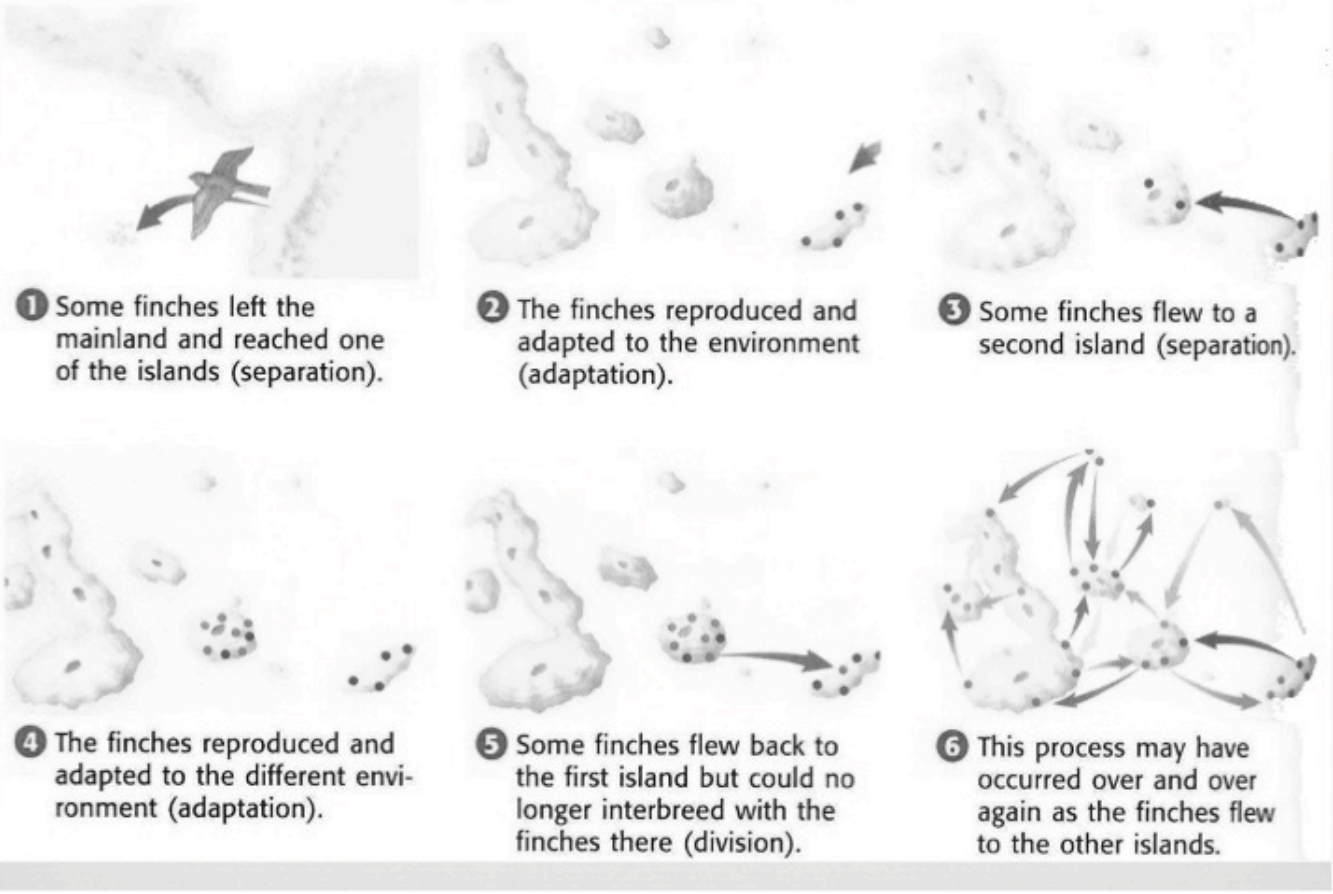
Day 20 - Natural Selection in Action



Procedure continued: The teacher should direct the students to look at p.124/fig3 (shown in the next slide if the teacher wants to project it) and ask them what types of labels are in this diagram. [They are explanatory labels; they explain the processes described in the pictures.] After the class has identified the types of labels, the teacher should indicate that, in this case, the labels are below each picture (in other cases, explanatory labels could be next to the picture or even in the picture). The teacher should reemphasize the function of explanatory labels (explain the processes described in the diagram or explain the meaning of an image), and that they are often more detailed than naming labels. The teacher should end the activity emphasizing the importance of reading labels since they provide detailed information on the parts of the diagram or image.

Day 20 - Natural Selection in Action

Figure 3 The Evolution of Galápagos Finch Species



DAY 21

Chapter 5: Review

After today's warm-up, you may review material from Chapter 5 or catch up on anything missed. Tomorrow's embedded assessment will take the entire class period, so you may wish to review topics relevant to the assessment.

Big Ideas

Review of all Big Ideas covered in Chapter 5.

Materials

Teacher:

1. Warm-up Day 21 - Cells_warmups.ppt

Students:

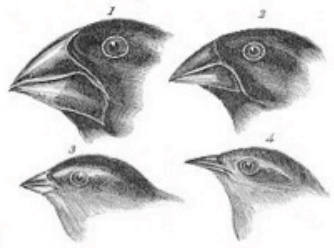
1. Holt textbook, Chapter 5

Activities and Allotted time

5 minutes - Warm-up
40 minutes - Review of Holt Chapter 5

Day 21 - Warm-up

The finch evolution on the Galapagos Islands is an example of natural selection. It is also an example of speciation. When Darwin visited the Galapagos Islands in the mid-1800s, he found a wide variety of finches with different types of beaks living on different islands.



1. What is speciation?
2. In the example of the finches, how did having a certain type of beak make some birds better able to reproduce, and thereby pass on their genes to future generations?

Answers:

1. Speciation occurs when a new species is formed through evolution.

2. Birds with beaks that were better for cracking nuts were best able to survive on islands where nuts were the main food source. Birds with beaks that were better for picking berries were best able to survive on islands where berries were the main source. The birds whose beaks were best for getting the food available on their island were most successful at passing on their genes to the next generation, and over time new species with those particular beak genes emerged on each island.

Purpose: This exercise reviews the natural selection case studied earlier in the chapter, this time incorporating the concept of speciation. Students should gain a better understanding of speciation by applying it to this familiar case.

DAY 22

Chapter 5: Embedded Assessment

After today's warm-up, immediately distribute the Chapter 5 Embedded Assessment. This assessment is significantly longer than the one given after Chapter 7, and it will require all of today's class time. The assessment has been lengthened to cover not only material in Chapter 5 but also in Chapter 7. By bringing up material covered in previous chapters, these assessments will help students to remember and continue learning material going all the way back through the unit. You may wish to explain this to students so they are not surprised to see material from previous chapters on each assessment.

Materials

Teacher:

1. Warm-up Day 21 - Cells_warmups.ppt

Students:

1. Embedded Assessment #2

Activities and Allotted time

5 minutes - Warm-up
40 minutes - Embedded Assessment

Day 22 - Warm-up

Look at the pictures of Beyonce and her parents. Think about what we learned concerning traits that are passed down from one generation to the next.

1. What is one thing about Beyonce's appearance that she inherited from her parents?
2. What is one thing about her appearance that she could not have inherited from her parents?

Answers:

1. Responses may vary but should be a genetic trait – eye color, skin tone, the shape of her facial features, etc.

2. Responses may vary but should be non-genetic – length of hair, dyed hair, make-up, whitened teeth, etc.

Purpose: This exercise allows students to apply inheritance concepts learned in Chapter 5 to the passing of traits from human parents to a human child – in this case, a famous pop star. It will also lay the foundation for the topics studied in Chapter 3.

Day 22 - Embedded Assessment

Embedded Assessment #2 - Answer Key

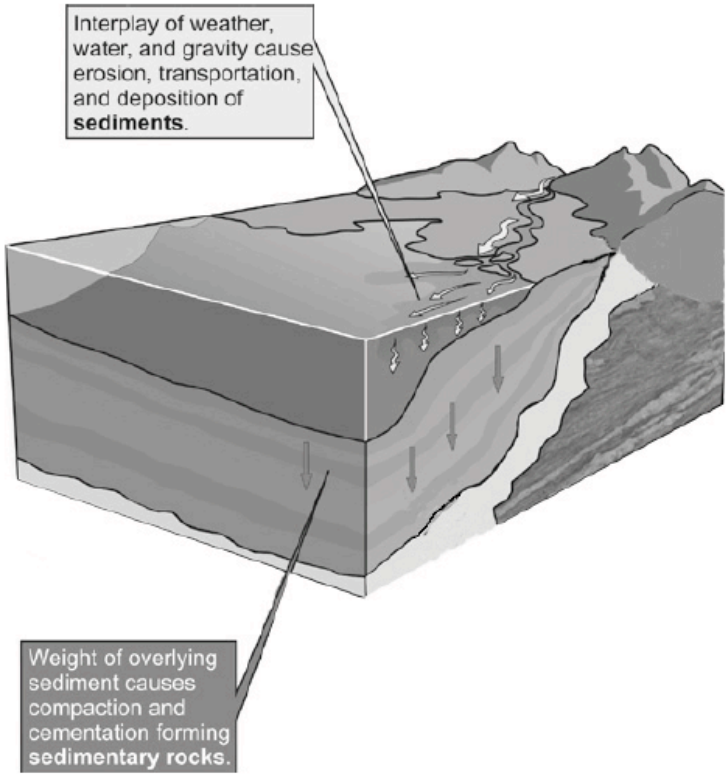
Embedded Assessment 2: The Evolution of Living Things

Please select the best answer to each question.

1. Which of the following is NOT a result of natural selection?
    a. Horses that are bred to be faster*
    b. Insects that are able to resist insecticides
    c. Bacteria that survive antibiotics
2. What process would farmers use to produce vegetables that will grow in a specific climate?
    a. Natural selection
    b. Adaptation
    c. Selective breeding*
3. Which of the following is NOT a kingdom in Domain Eukarya?
    a. Animalia
    b. Bacteria*
    c. Protista
4. Darwin's Theory of Natural Selection suggests that _____ within a species is an important part of the process of natural selection.
    a. being identical
    b. long life
    c. random variation*
5. What kind of organism thrives in hot springs and other extreme environments?
    a. Fungus
    b. Bacterium
    c. Archaean*

6. The scientific name for the European white waterlily is *Nymphaea alba*. To which genus does this plant belong?
    a. *Nymphaea**
    b. alba
    c. Water lily
7. A characteristic that improves an organism's ability to survive is a(n)
    a. adaptation.*
    b. inherited variation.
    c. reproduction.
8. What can two different species have in common?
    a. Populations
    b. Ancestors*
    c. Offspring
9. When the eight levels of classification are listed from broadest to narrowest, which level is sixth in the list?
    a. Order
    b. Genus
    c. Family*
10. The simple, single-celled organisms that live in your intestines are classified in the Domain:
    a. Protista
    b. Bacteria*
    c. Archaea

11.



According to the information in the diagram above, which of the following is NOT involved in the formation of sedimentary rock?

a. Weathering and erosion

b. Cementation

c. Crystallization*

d. Compaction

12. Evolution is illustrated by the greater similarity of _____ in species that appear to be closely related.

a. DNA and traits*

b. habitats

c. appearances

13. The physical separation of Galapagos finches on various islands resulted in new _____ that ultimately led to a separation into different species.

    a. ancestors

    b. adaptations*

    c. flight patterns

14. *Animalia*, *Protista*, *Fungi*, and *Plantae* are:

    a. scientific names of different organisms.

    b. names of kingdoms.*

    c. levels of classification.

15. Groups of organisms living in different environments that can mate and have fertile offspring are part of the same

    a. species.*

    b. population.

    c. fossil record.

Please answer the following question using complete sentences.

16. Explain why a species that has a short generation time will evolve more quickly than a species that has a long generation time.

Sample answer: Evolution occurs over the course of many generations, because it is the result of members in each generation passing on variations to the next generation. A species with a short generation time will have many more chances to pass on variations in the same period of time that a species with a long generation might go through just one generation.

Day 22 - Embedded Assessment

Read the passage below and use the information, along with what you have learned in class, to answer the question that follows.

In 1928, a biologist in London named Professor Alexander Fleming accidentally discovered penicillin. Professor Fleming had been studying cultures of bacteria in his laboratory when he left for a vacation with his family. When he returned, he found that a mold had started growin in one of his cultures and, to his surprise, it had destroyed the bacteria around it. This mold, which he named penicillin, became the first antibiotic, a discovery that revolutionized moder medicine. If you have ever gone to the doctor with an earache or other infection, you have probably received antibiotics to get rid of the infection and make you feel better.

As the use of antibiotics continues to grow in our society, however, bacteria have undergone changes as well. The strands of bacteria that are not resistant to antibiotics are easily destroyed, but any bacterium that contains abnormal resistance to antibiotics has a better chance of surviving, reproducing, and passing its genes to the next generation. As the bacteria not resistant to antibiotics are destroyed and bacteria that are resistant to antibiotics reproduce, these resistant bacteria can slowly come to represent a larger portion of the bacteria populations. As a result, scientists and doctors are seeing a growing number of dangerous bacteria that are resistant to antibiotics, making it more difficult to treat people who are infected with such bacteria.

17. As the use of antibiotics increases, doctors are also seeing an increase in the number of antibiotic-resistant bacteria they are asked to treat. This is an example of what important biological process?

    a. It is an example of selective breeding, because it describes a situation in which humans are involved in a process that changes populations.

    b. It is an example of natural selection, because penicillin occurs naturally and so do bacteria.

    c. It is an example of natural selection, because selective pressures in the bacteria's environment have increased the likelihood that certain bacteria – those resistant to antibiotics – will be able to reproduce and pass on their genes to the next generation.*