Class enrichment and review activities for April 1--9th.
Linda Henry- Advanced Biology

Mrs. Henry can be reached at lhenry@rockwoodschools.org OR by calling the school at 814-926- 4688 extension 2201. Mrs. Henry will send you an email to alert you to the location on her class page. Take care and stay healthy!

All assignments and materials for all classes are on Mrs. Henry's Google Classroom pages and also attached at the bottom of this PDF.

April 1—locate the notes for Chapter 15 on Evolution section 15.1. Attached below.
April 2— complete the review for section 15.1 with the fill in the blanks from the notes. This worksheet is attached below.
April 3— complete the handout using the notes for Chapter 15….called "The Beagle's Voyage" attached below.
April 6—look for the concept map for evolution. Knowing what you know now, complete the map using the terms in the word bank.
April 7—Darwin presents his case is a worksheet that discusses his publication of his book "The Origin of Species" and natural selection.
April 8—locate the notes for 15.3-15.4 and read over the evidence for evolution on these sections.
April 9—locate the worksheet for this section on 15.3 and 15.4—complete worksheet.

BELOW YOU WILL FIND ATTACHED DOCUMENTS FROM THE ABOVE ASSIGNMENTS FOR APRIL 1 THROUGH APRIL 9TH….

CHAPTER 15 Darwin and Evolution

15.1 History of Evolutionary Thought

1. In 1831, Charles Darwin, a 22-year-old naturalist, accepted a position aboard the ship HMS Beagle that began a voyage around the world; it provided Darwin with many observations.

The pre-Darwinian world-view was different from the post-Darwinian.

1) The earth is young.
2) Each species was specially created and did not change over time.
3) Variations are imperfections varying from a perfectly-adapted creation.
4) Observations are to substantiate the prevailing worldview.
b. Darwin's ideas were part of a larger change in thought already underway among biologists; this concept would eventually be known as evolution.

2. Mid-Eighteenth-Century Contributions

A. Carolus Linnaeus and Taxonomy

a. Taxonomy is the science of classifying organisms; taxonomy had been a main concern of biology.
b. Carolus Linnaeus (1707-1778) was a Swedish taxonomist wo developed a binomial system of nomenclature (two-part names for each species (*Homo sapiens*)
c. Like other taxonomists of his time, Linnaeus believed in the ideas of **special creation** and
the **fixity of species**; each species had a place in the **scala naturae**, a sequential ladder of life.

B. Georges Louis Leclerc

a. Georges Louis Leclerc, known by his title, Count Buffon (1707-1788), was a French naturalist.
b. He wrote on the natural history of all known plants and animals, provided evidence of **descent with modification**.
c. His writings speculated on influences of the environment, migration, geographical isolation, and the struggle for existence.
d. Buffon's Law is considered the first principle of **biogeography**

C. Erasmus Darwin

a. Erasmus Darwin (1731-1802) was Charles Darwin's grandfather.
b. He was a physician and a naturalist whose writings on both botany and zoology contained many comments that suggested the possibility of common descent.
c. He based his conclusions on devlopment, artificial selection, and anatomy

3. Late Eighteenth-/Early-Nineteenth Century Contributions

A. Cuvier and Catastrophism

a. George Cuvier (1769-1832), a French vertebrate zoologist, was the first to use comparative anatomy to develop a system of classifying animals.

b. He founded the science of **paleontology**-the study of fossils-and suggested that a single fossil bone was all he needed to deduce the entire anatomy of an animal.
c. To explain the fossil record, Cuvier proposed that a series of catastrophes and repopulations had occurred.
d. **Catastrophism** is the term applied to Cuvier's explanation of fossil history: the belief that catastrophic extinctions occurred, after which repopulation of surviving species occurred, giving an appearance of change through time.

B. Lamarck's Acquired Characteristics

a. Lamarck (1744-1829) was the first to state that descent with modification occurs and that organisms become adapted to their environments.
b. Lamarck, an invertebrate zoologist, held ideas at odds with Cuvier's.
c. Lamarck mistakenly saw "a desire for perfection" as inherent in all living things.
d. Inheritance of acquired characteristics was Lamarck's belief that organisms become adapted to their environment during their lifetime and pass these adaptations to their offspring.
e. Experiments fail to uphold Lamarck's inheritance of acquired characteristics;

----Stop and Think ----

17.2 Darwin's Theory of Evolution

1. Darwin's Background
a. His nature was too sensitive to pursue medicine; he attended divinity school at Cambridge.
b. He attended biology and geology lectures and was tutored by the Reverend John Henslow.
c. Henslow arranged his five-year trip on the HMS Beagle; Darwin was an observant student of nature.
d. Darwin's father objected to him going on this trip

2. Geology and Fossils

a. . Darwin took Lyell's book, Principles of Geology, on the voyage of the HMS Beagle.
b. In contrast to catastrophists, Hutton proposed that the earth was subject to slow but continuous geological processes that occur at a uniform rate, a theory called uniformitarianism.
c. Fossils of huge sloths and armadillo-like animals suggested modern forms were descended from extinct forms with change over time; therefore species were not fixed. (glyptodont, mylodon)

Other Resources

Understanding Evolution
Nova Evolution

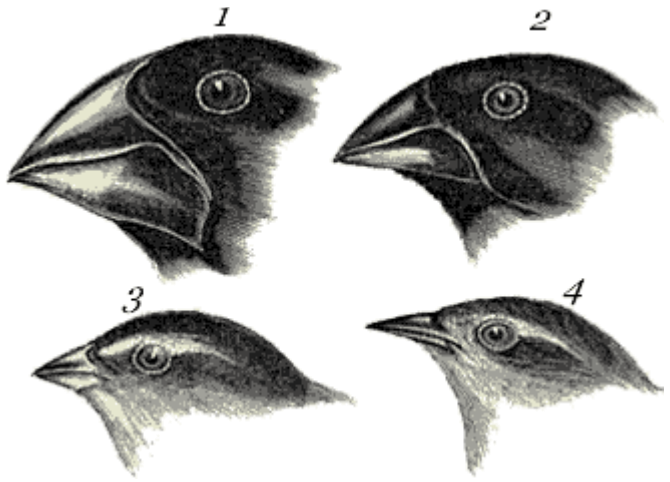
3. Biogeography

a. Biogeography is the study of the geographic distribution of life forms on earth.
b. Patagonian hares replaced rabbits in the South American grasslands.
c. The greater rhea found in the north was replaced by the lesser rhea in the south.

4. The Galápagos Islands
a. These volcanic islands off the South American coast had fewer types of organisms.
b. Island species varied from the mainland species, each island had different variations
c. Each island had a variation of tortoise; long and short necked tortoises correlated with different vegetation.

5. Darwin's Finches

a. Finches on the Galápagos Islands resembled a mainland finch but there were more types.
b. Galápagos finch species varied by nesting site, beak size, and eating habits.
c. One unusual finch used a twig or thorn to pry out insects, a job normally done by (missing) woodpeckers
d. The variation in finches posed questions to Darwin: did they descend from one mainland ancestor or did islands allow isolated populations to evolve independently, and could present-day species have resulted from changes occurring in each isolated population?



Questions to Ponder:

Did the animals on the islands descend from one mainland ancestor?
Did the island populations evolve independently?
Could present-day species have resulted from changes occurring in isolated populations?

6. Natural Selection and Adaptation

a. Natural selection was proposed by both Alfred Russel Wallace and Darwin
b. It is the driving mechanism of evolution caused by environmental selection of organisms most fit to reproduce, resulting in adaptation.

Wallace was not given credit for the theory because Darwin published first, however, there is a geographical area named for him called the "Wallace Line" which separates Australia and Asia.

c. . There are three preconditions for natural selection.

1. The members of a population have random but **heritable variations**.
2. In a population, many more individuals are produced each generation than the environment can support.

3. Some individuals have adaptive characteristics that enable them to survive and reproduce better.

d. There are two consequences of natural selection.

1. An increasing proportion of individuals in succeeding generations will have the adaptive characteristics.
2. The result of natural selection is a population adapted to its local environment.

e. Natural selection can only utilize variations that are randomly provided; therefore there is no directedness or anticipation of future needs.
f. Extinction occurs when previous adaptations are no longer suitable to a changed environment.

7. Organisms Have Variations

a. Variations are essential to natural selection
b. Variations are random and heritable
c. The mechanism for variation was not known (genetics had not been discovered)

8. Organisms Struggle to Exist
a. Malthus proposed that human populations outgrow food supply and death and famine were inevitable.
b. Darwin applied this to all organisms; resources were not sufficient for all members to survive.
c. Therefore, there is a constant struggle for existence; only certain members survive and reproduce.

9. Organisms Differ in Fitness

a. Fitness is a measure of an organism's reproductive success
b. Fitness does not necessarily mean stronger

10. Artificial Selection
a. Early humans likely selected wolf variants; produced the varieties of domestic dogs.
b. Many crop plant varieties can be traced to a single ancestor.
d. Evolution by artificial or natural selection occurs when more fit organisms reproduce and leave more offspring

11. Organisms Become Adapted

a. An adaptation is a trait that helps an organism be more suited to its environment.
b. Unrelated organisms living in the same environment often display similar characteristics.
c. Because of differential reproduction, adaptive traits increase in each succeeding generation.

12. On the Origin of Species by Darwin
1. After the HMS Beagle returned to England in 1836, Darwin waited over 20 years to publish.
2. He used the time to test his hypothesis that life forms arose by descent from a common ancestor and that natural selection is a mechanism by which species can change and new species arise.

3. Darwin was forced to publish Origin of Species after reading a similar hypothesis by Alfred Russel Wallace.

CHAPTER 15 Darwin and Evolution

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c. To explain the fossil record, Cuvier proposed that a series of _____ and _____ had occurred.
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4. The Galápagos Islands
a. These relatively newer _____ islands off the South American coast had fewer types of organisms.
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c. One unusual finch used a _____ to pry out insects, a job normally done by (missing) woodpeckers
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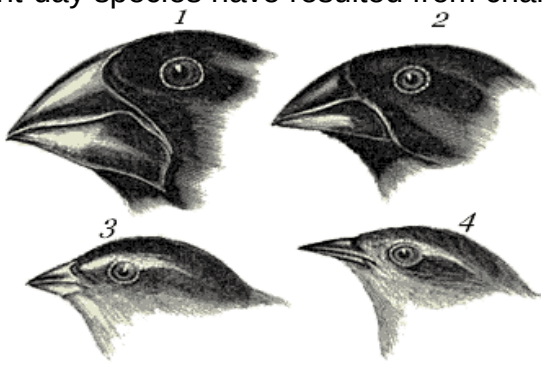

population?

Questions to Ponder:

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Did the island populations evolve _____?
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b. It is the driving mechanism of evolution caused by environmental selection of organisms most _____to reproduce, resulting in adaptation.

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c. . There are three preconditions for natural selection.

1. The members of a population have _____ but _____ **variations**.
2. In a population, many _____ individuals are produced each generation than the environment can support.
3. Some individuals have adaptive characteristics that enable them to_____ and _____better.

d. There are two consequences of natural selection.

1. An increasing proportion of individuals in succeeding generations will (have / have not) the adaptive characteristics.
2. The result of natural selection is a _____ adapted to its local environment.

e. Natural selection can only utilize _____ that are randomly provided; therefore there is no directedness or anticipation of future needs.
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Name_____ Class_____ Date _____

Chapter 15 Darwin's Theory of Evolution

Section 15-1 The Puzzle of Life's Diversity

Key Concepts

- What was Charles Darwin's contribution to science?
- What pattern did Darwin observe among organisms of the Galápagos Islands?

Introduction

1. The process by which modern organisms have descended from ancient organisms is called _____.

2. A well-supported explanation of phenomena that have occurred in the natural world is a(an) _____.

Voyage of the *Beagle*

3. Circle the letter of each sentence that is true about Charles Darwin.

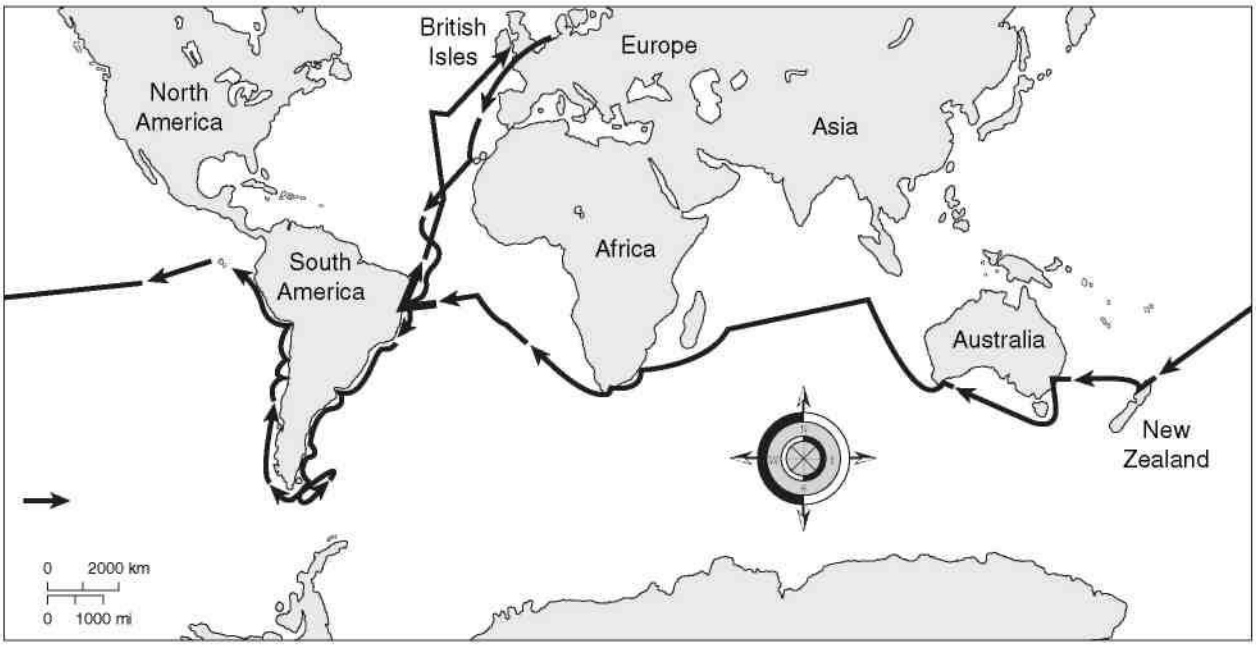
a. He was born in 1809.

b. He was an English naturalist.

c. He was 42 when he began the voyage on the *Beagle.*

d. The voyage lasted five years and took him around the world.

4. Label the Galápagos Islands on the map below.



5. Is the following sentence true or false? Darwin was looking for a scientific explanation for the diversity of life on Earth. _____

Name _____ Class _____ Date _____

Darwin's Observations

6. Circle the letter of each observation that Darwin made.

a. An enormous number of species inhabit Earth.

b. Many organisms seem to be poorly suited to their environment.

c. The same sorts of animals are always found in the same ecosystems in different parts of the world.

d. Some species that lived in the past no longer live on Earth.

7. The preserved remains of ancient organisms are called _____.

8. As Darwin studied fossils, what new questions arose? _____

9. How did Darwin explain differences in shell shape of tortoises from Hood Island and Isabela Island? _____

10. Darwin observed that small brown birds on the Galápagos Islands differed in the shape of their _____.

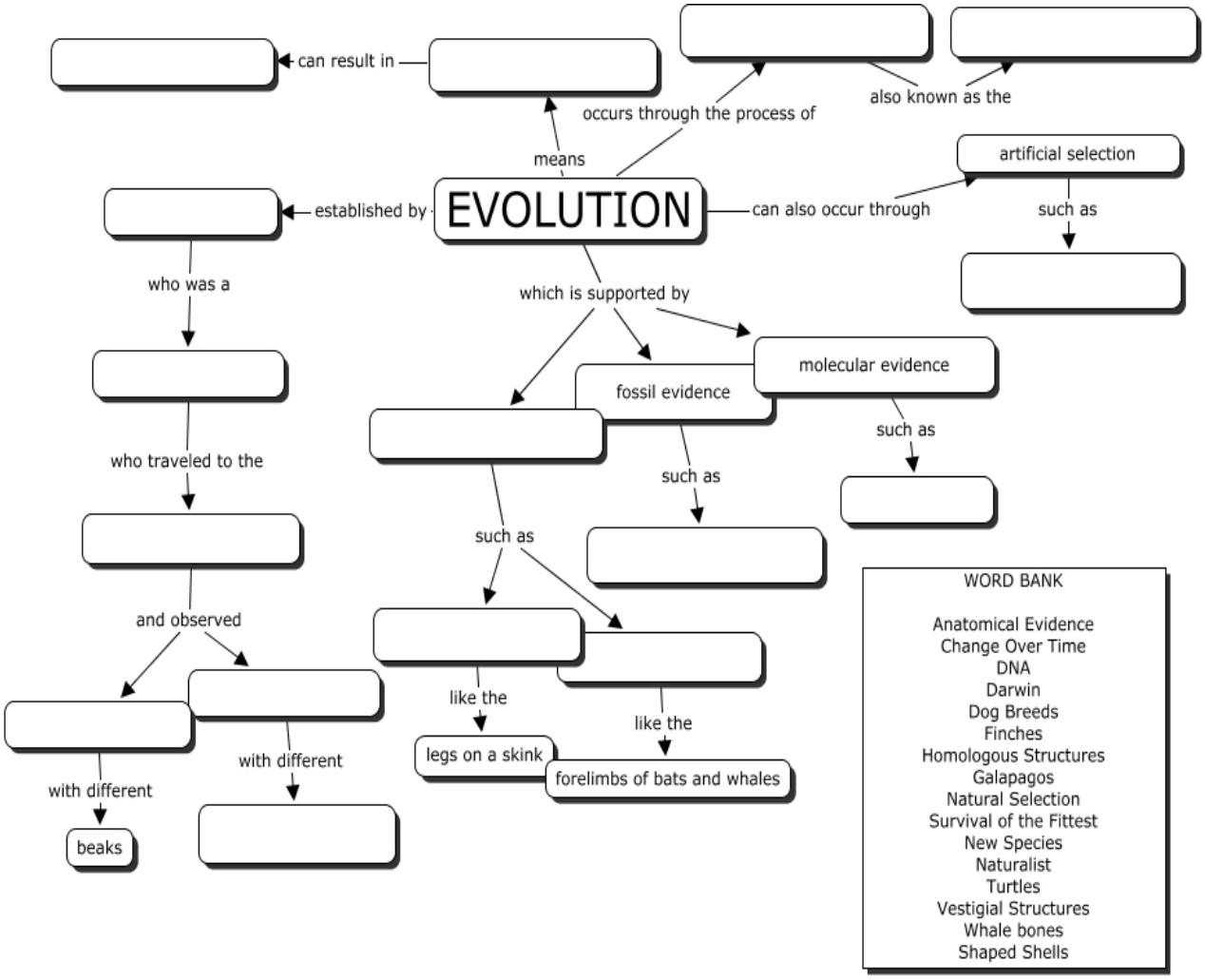
The Journey Home

11. What did Darwin think about on his journey home to England? _____

12. After he returned to England, what hypothesis did Darwin develop to explain his findings? _____

Name:_____

Evolution Concept Map



Section Darwin Presents His Case

Key Concepts

- How is natural variation used in artificial selection?
- How is natural selection related to a species' fitness?
- What evidence of evolution did Darwin present?

Publication of *On the Origin of Species*

1. Is the following sentence true or false? When Darwin returned to England, he rushed to publish his thoughts about evolution. _____

2. The naturalist whose essay gave Darwin an incentive to publish his own work was _____.

3. Circle the letter of each sentence that is true about Darwin's book *On the Origin of Species.*

a. It was published in 1869.

b. It was ignored when it was first published.

c. It contained evidence for evolution.

d. It described natural selection.

Inherited Variation and Artificial Selection

4. Differences among individuals of a species are referred to as _____.

5. Is the following sentence true or false? Genetic variation is found only in wild organisms in nature. _____

6. Circle the letter of each sentence that is true about artificial selection.

a. It is also called selective breeding.

b. It occurs when humans select natural variations they find useful.

c. It produces organisms that look very different from their ancestors.

d. It is no longer used today.

Evolution by Natural Selection

7. What was Darwin's greatest contribution? _____

_____

Match each term with its definition.

Terms

_____ **8.** fitness

_____ **9.** adaptation

_____ **10.** natural selection

Definitions

a. Any inherited characteristic that increases an organism's chance of survival

b. Survival of the fittest

c. The ability of an individual to survive and reproduce in its specific environment

Name _____ Class _____ Date _____

11. What does the phrase *struggle for existence* mean? _____

_____

12. Is the following sentence true or false? Adaptations can be physical characteristics but not more complex features such as behavior. _____

13. Explain what Darwin meant by the phrase *survival of the fittest.* _____

_____

_____

14. Circle the letter of each sentence that is true about natural selection.

a. It selects traits that increase fitness.

b. It takes place without human control.

c. It can be observed directly in nature.

d. It leads to an increase in a species' fitness.

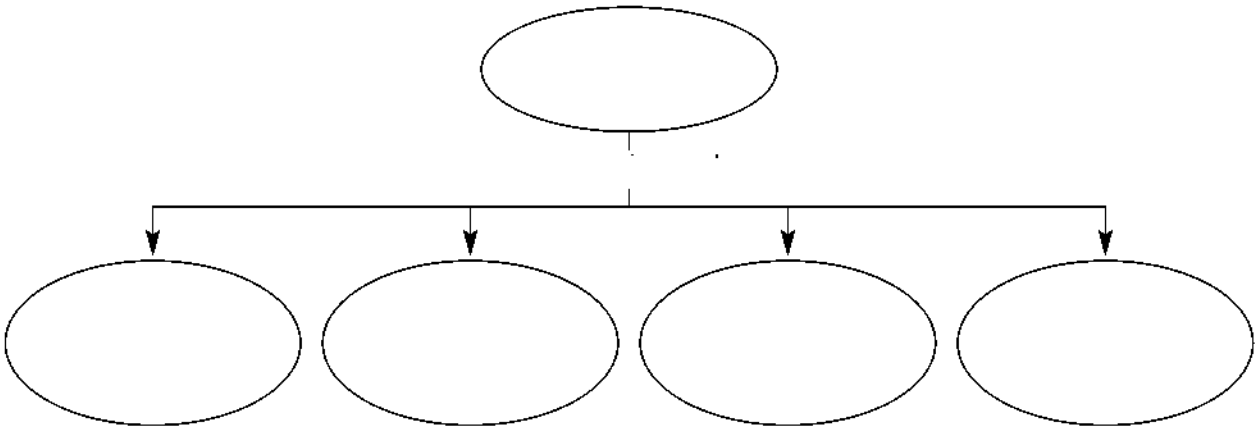
15. The principle that living species descend, with changes, from other species over time is referred to as _____.

16. The principle that all species were derived from common ancestors is known as _____.

Evidence of Evolution

17. Is the following sentence true or false? Darwin argued that living things have been evolving on Earth for thousands of years. _____

18. Complete the concept map.



19. How do fossils that formed in different rock layers provide evidence of evolution?

_____

_____

Name _____ Class _____ Date_____

20. Circle the letter of the way Darwin explained the distribution of finch species on the Galápagos Islands.

a. They had descended with modification from a common mainland ancestor.

b. They had descended with modification from several different mainland ancestors.

c. They had remained unchanged since arriving on the Galápagos from the mainland.

d. They had become more similar to one another after arriving on the Galápagos.

21. How did Darwin explain the existence of similar but unrelated species?

_____

_____

_____

22. Structures that have different mature forms but develop from the same embryonic tissues are called _____.

23. Is the following sentence true or false? Homologous structures provide strong evidence that all four-limbed vertebrates have descended, with modifications, from common ancestors. _____

24. Organs that are so reduced in size that they are just vestiges, or traces, of homologous organs in other species are called _____.

Summary of Darwin's Theory

25. Circle the letter of each idea that is part of Darwin's theory of evolution.

a. There is variation in nature.

b. Fewer organisms are produced than can survive.

c. There is a struggle for existence.

d. Species change over time.

26. According to Darwin's theory, what happens to individuals whose characteristics are not well suited to their environment? _____

_____

27. Darwin believed that all organisms on Earth are united into a single tree of life by _____.

Strengths and Weaknesses of Evolutionary Theory

28. What is the status of Darwin's hypotheses today? _____

_____

_____

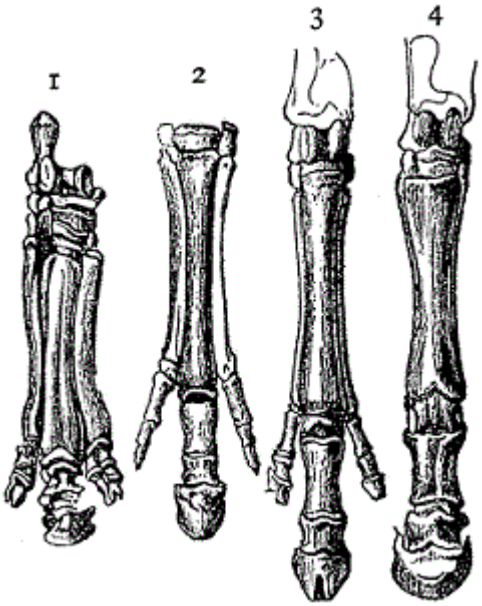
15.3 The Evidence of Evolution

1. Fossils Evidence

a. Transitional forms reveal links between groups.

- Archeopteryx is an intermediate between reptiles and birds.
- Eustheopteron is an amphibious fish.
- Seymouria is a reptile-like amphibian.
- Therapsids were mammal-like reptiles
- Ambulocetus was the ancestor of modern whales
- Various hominid species that existed prior to homo sapiens

b. The fossil record allows us to trace the history of the modern-day horse Equus



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2. Biogeographical Evidence

A. Biogeography studies the distribution of plants and animals worldwide.

- Darwin observed South America had no rabbits; he concluded rabbits originated elsewhere.
- Biogeography explains the abundance of finch species on the Galápagos Islands lacking on the mainland.
- Explains the presence of marsupials in Australia

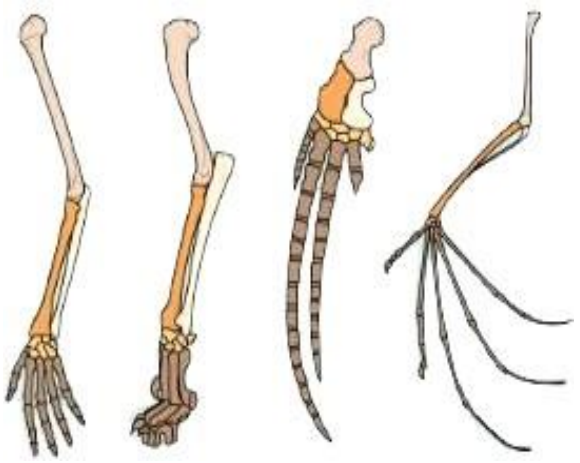
What are some marsupials only found in Australia?

What is the one type of Marsupial found on other continents?

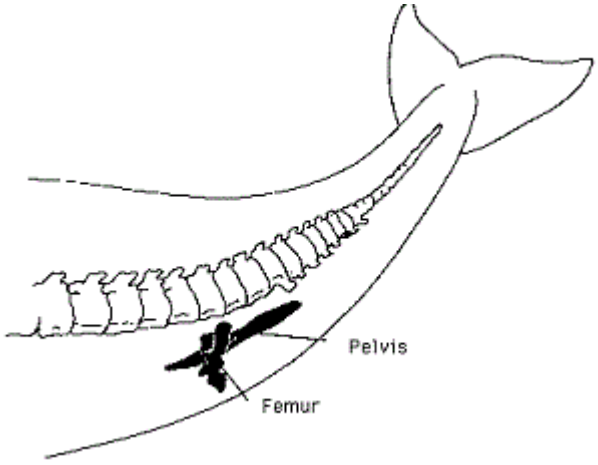
3 . Anatomical Evidence

A. Organisms have anatomical similarities when they are closely related because of common descent.
--- Homologous structures in different organisms are inherited from a common ancestor.
--- Analogous structures are inherited from unique ancestors and have come to resemble each other because they serve a similar function.

B. Vertebrate forelimbs contain the same sets of bones organized in similar ways, despite their dissimilar functions.



C. Vestigial structures are remains of a structure that was functional in some ancestors but is no longer functional in the organism in question.
--- Most birds have well-developed wings; some bird species have reduced wings and do not fly.
--- Humans have a tailbone but no tail.



4. Embryological development

A. During development, all vertebrates have a post-anal tail and paired pharyngeal pouches.

-- In fishes and amphibian larvae, the pouches become gills.
-- In humans, the pouches becomes the middle ear; tonsils, and glands

5. Biochemical Evidence

a. Almost all living organisms use the same basic biochemical molecules, e.g., DNA, ATP, enzymes.
b. Organisms utilize the same DNA triplet code and the same 20 amino acids in their proteins.
c. These similarities can be explained by descent from a common ancestor.
d. Life's vast diversity has come about by only a slight difference in the same genes.

Pace of Evolution

1. Phyletic gradualism - slow process with many transitional forms
2. Punctuated equilibrium - speciation occurs rapidly, transitional links not evident, explains lack of fossils
3. Living fossils (horseshoe crab, coelacanth) support punctuated equilibrium

Summary

Because it is supported by so many lines of evidence, evolution is no longer considered a hypothesis.

Evolution is one of the great unifying theories of biology, similar in status to the germ theory of disease in medicine.

In science, a theory is supported by a large number of observations or a large amount of experimental evidence

Chapter 15 Review Questions

1. What scientific observations and research influenced Darwin?

2. List the steps involved in natural selection. How does a population change over time? What environmental factors push these changes?

4. Summarize the various kinds of evidence for evolution (i.e., that all living organisms descended from a common ancestor)

5. In terms of evolution, what does "fitness" mean?

6. In science, an important part of a theory is that it is falsifiable

What observations could refute the hypothesis that an adaptation evolved by natural selection?

What observations could refute the theory of evolution?

7. A scientific theory stands or falls according to how well it is supported by the facts, not according to who believes it. Do you think higher education students should be encouraged to *believe* evolution?

15.3-4 The Evidence of Evolution

1. Fossils Evidence

a. _____ forms reveal links between groups.

- Archeopteryx is an intermediate between _____ and _____.
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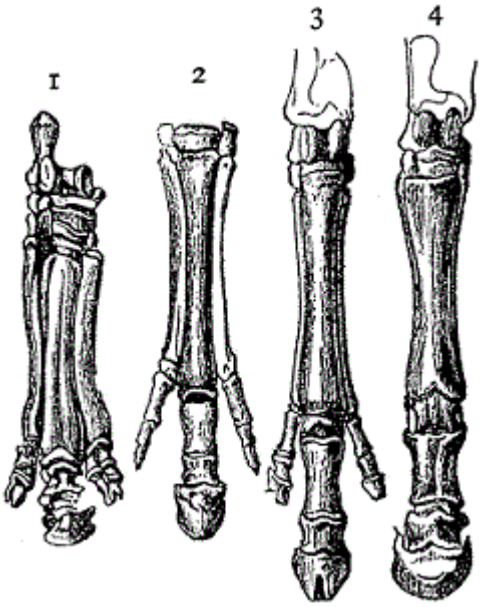

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- Explains the presence of _____- in Australia

What are some marsupials only found in Australia?

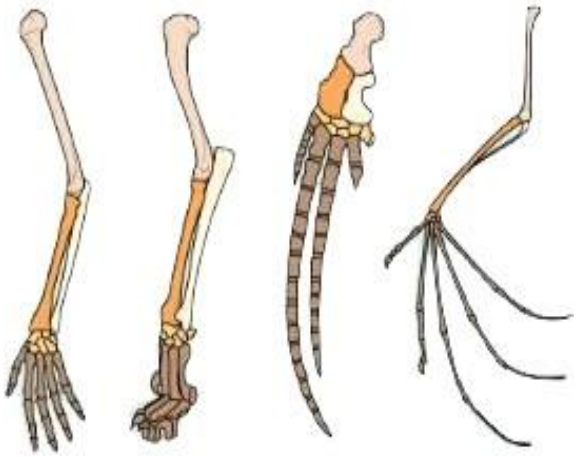
What is the one type of Marsupial found on other continents?

3 . Anatomical Evidence

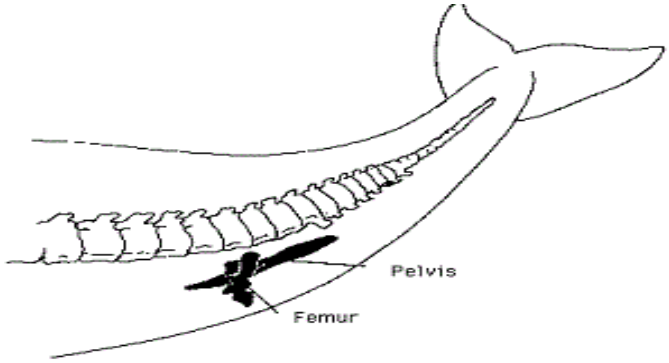
A. Organisms have _____ similarities when they are closely related because of _____ descent.

--- _____ structures in different organisms are inherited from a common ancestor.
--- _____ structures are inherited from unique ancestors and have come to resemble each other because they serve a similar function.

B. Vertebrate _____ contain the same sets of bones organized in similar ways, despite their dissimilar functions.



C. _____ structures are remains of a structure that was functional in some ancestors but is no longer functional in the organism in question.
--- Most birds have well-developed wings; some bird species have reduced _____ and do not _____.
--- Humans have a tailbone but no _____.



4. Embryological development

A. During development, all vertebrates have a post-anal _____ and paired _____ pouches.

-- In fishes and amphibian larvae, the pouches become _____.
-- In humans, the pouches becomes the middle _____; tonsils, and glands

5. Biochemical Evidence

a. Almost all living organisms use the same basic biochemical molecules, e.g., _____, _____ and _____.
b. Organisms utilize the same DNA _____ code and the same _____ amino acids in their proteins.
c. These similarities can be explained by descent from a _____ancestor.

d. Life's vast diversity has come about by only a slight _____ in the same genes.

Pace of Evolution

1. _____ gradualism - _____ process with many transitional forms
2. _____ equilibrium - speciation occurs rapidly, transitional links not evident, explains lack of fossils
3. Living fossils (horseshoe crab, coelacanth) support _____ equilibrium

Summary

Because it is supported by so many lines of evidence, evolution is no longer considered a _____-.

Evolution is one of the great _____ _____ of biology, similar in status to the germ theory of disease in medicine.

In science, a theory is supported by a large number of _____ or a large amount of _____evidence

Chapter 15 Review Questions

1. What scientific observations and research influenced Darwin?

2. List the steps involved in natural selection. How does a population change over time? What environmental factors push these changes?

3. Summarize the various kinds of evidence for evolution (i.e., that all living organisms descended from a common ancestor)

4. In terms of evolution, what does "fitness" mean?

5. In science, an important part of a theory is that it is falsifiable

What observations could refute the hypothesis that an adaptation evolved by natural selection?

What observations could refute the theory of evolution?