Evolution Unit Review (also use for Midterm)

Read the passage and answer the questions that follow.

The Voyage of the Beagle

In 1831, when Darwin was just 22 years old, he set sail on a scientific expedition on a ship called the HMS Beagle. He was the naturalist on the voyage. As a naturalist, it was his job to observe and collect specimens of plants, animals, rocks, and fossils wherever the expedition went ashore.

Darwin was fascinated by nature, so he loved his job on the Beagle. He spent more than 3 years of the 5-year trip exploring nature on distant continents and islands. While he was away, a former teacher published Darwin’s accounts of his observations. By the time Darwin finally returned to England, he had become famous as a naturalist.

Darwin’s Observations

During the long voyage, Darwin made many observations that helped him form his theory of evolution. For example:

- He visited tropical rainforests and other new habitats where he saw many plants and animals he had never seen before. This impressed him with the great diversity of life.
- He experienced an earthquake that lifted the ocean floor 2.7 meters (9 feet) above sea level. He also found rocks containing fossil sea shells in mountains high above sea level. These observations suggested that continents and oceans had changed dramatically over time and continue to change in dramatic ways.
- He visited rock ledges that had clearly once been beaches that had gradually built up over time. This suggested that slow, steady processes also change Earth’s surface.
- He dug up fossils of gigantic extinct mammals, such as the ground sloth. This was hard evidence that organisms looked very different in the past. It suggested that living things — like Earth’s surface — change over time.

The Galápagos Islands

Darwin’s most important observations were made on the Galápagos Islands. This is a group of 16 small volcanic islands 966 kilometers (600 miles) off the west coast of South America.

Individual Galápagos Islands differ from one another in important ways. Some are rocky and dry. Others have better soil and more rainfall. Darwin noticed that the plants and animals on the different islands also differed. For example, the giant tortoises on one island had saddle-shaped shells, while those on another island had dome-shaped shells. People who lived on the islands could even tell the island a turtle came from by its shell. This started Darwin thinking about the origin of species. He wondered how each island came to have its own type of tortoise.

Questions

1. What was Darwin's role on the Beagle?
2. What was significant about the new habitats Darwin visited?
3. What was significant about the rocks Darwin found in the mountains?
4. What was significant about the fossils Darwin found?
5. What did Darwin notice about life on the Galápagos Islands?
**Match the vocabulary word with the proper definition.**

1. Change in species over time
2. One of the first scientists to propose that species change over time
3. Ship on which Darwin served as naturalist
4. His theory of evolution unifies all of biology
5. The process by which evolution occurs
6. Argued that human populations grow faster than the resources they depend on
7. Small volcanic islands where Darwin made many important observations
8. Selecting for plants and animals with useful traits
9. Argued that gradual geological processes have gradually shaped Earth’s surface
10. States that traits an organism develops during its own life time can be passed on to offspring
11. Developed a theory of evolution at the same time as Darwin
12. An organism’s relative ability to survive and produce fertile offspring

**Terms**

a. artificial selection
b. Darwin
c. evolution
d. fitness
e. Galápagos Islands
f. HMS Beagle
g. inheritance of acquired characteristics
h. Lamarck
i. Lyell
j. Malthus
k. natural selection
l. Wallace
Read the passage and answer the questions that follow.

Evidence from Biogeography

Biogeography is the study of how and why plants and animals live where they do. It provides more evidence for evolution. Let’s consider the camel family as an example.

Biogeography of Camels: An Example

Today, the camel family includes different types of camels. All of today’s camels are descended from the same camel ancestors. These ancestors lived in North America about a million years ago.

Early North American camels migrated to other places. Some went to East Asia. They crossed a land bridge during the last ice age. A few of them made it all the way to Africa. Others went to South America. They crossed the Isthmus of Panama. Once camels reached these different places, they evolved independently. They evolved adaptations that suited them for the particular environment where they lived. Through natural selection, descendants of the original camel ancestors evolved the diversity they have today.

Island Biogeography

The biogeography of islands yields some of the best evidence for evolution. Consider the birds called finches that Darwin studied on the Galápagos Islands. All of the finches probably descended from one bird that arrived on the islands from South America. Until the first bird arrived, there had never been birds on the islands. The first bird was a seed eater. It evolved into many finch species. Each species was adapted for a different type of food. This is an example of adaptive radiation. This is the process by which a single species evolves into many new species to fill available niches.

Eyewitness to Evolution

In the 1970s, biologists Peter and Rosemary Grant went to the Galápagos Islands. They wanted to re-study Darwin’s finches. They spent more than 30 years on the project. Their efforts paid off. They were able to observe evolution by natural selection actually taking place.

While the Grants were on the Galápagos, a drought occurred. As a result, fewer seeds were available for finches to eat. Birds with smaller beaks could crack open and eat only the smaller seeds. Birds with bigger beaks could crack and eat seeds of all sizes. As a result, many of the small-beaked birds died in the drought. Birds with bigger beaks survived and reproduced. Within 2 years, the average beak size in the finch population increased. Evolution by natural selection had occurred.

1. What is biogeography and what does it provide?

2. Where do all camels come from?

3. Why did camels evolve?

4. What is adaptive radiation? Give an example.

5. What did the Grants study? What did they observe?
Write true if the statement is true or false if the statement is false.

1. Fossils provide clear evidence that evolution has occurred.
2. Embryos of many different vertebrates look much more similar than the adult organisms.
3. Early horses were about the size of a fox.
4. Darwin's comparison of DNA sequences provided strong evidence of evolution.
5. Today's scientists compare the anatomy, embryos, and DNA of modern organisms to understand how they evolved.
6. Homologous structures are structures that are different in related organisms because they were inherited from a common ancestor.
7. Comparative anatomy is the study of the similarities and differences in the structures of different species.
8. Analogous structures are structures that are similar in related organisms.
9. Peter and Rosemary Grant were actually able to observe evolution by natural selection taking place.
10. The wings of bats and birds serve the same function and are homologous structures.
11. Adaptive radiation is when one species evolves into a new species to fill an available niche.
12. Biogeography is the study of how and why plants and animals live where they do.
13. The Galápagos finches have provided a tremendous amount of information about evolution.
14. DNA sequence similarities are the strongest evidence for evolution from a common ancestor.
Fill in the blank with the appropriate term.

1. Humans and apes are evolutionarily closely related, based on analysis of their ____________ sequences.

2. Wings of bats and butterflies serve the same function and are ____________ structures.

3. Comparative ____________ is the study of the similarities and differences in the structures of different species.

4. ____________ demonstrate that during the evolution of the whale, the whale moved from land into the sea.

5. The human tail bone and appendix are ____________ structures.

6. ____________ structures are structures that are similar in related organisms because they were inherited from a common ancestor.

7. Comparative ____________ is the study of the similarities and differences in the embryos of different species.

8. Early North American camels migrated to other places, some crossing a land bridge during the last ____________.

9. A ____________ is a scientist who finds and studies fossils.

10. The study of the similarities and differences in the embryos of different species is referred to as ________________

11. Peter and Rosemary Grant studied Darwin’s ____________ in the Galápagos Islands.

12. A ____________ shows how organisms are related by descent from common ancestors.

13. The finches going from one species into ____________ different species is an example of ________________

14. ________________ is the study of how and why plants and animals live where they do.

Terms

a. speciation
b. analogous structure
c. biogeography
d. cladogram
e. anatomy
f. embryology
g. DNA
h. fossils
i. homologous structure
j. paleontologist
k. vestigial structures
l. finches
Questions: Answer on a separate sheet of paper.

Chapter 10

1. What were the contributions of Linnaeus, Buffon, Hutton, Erasmus Darwin, Cuvier, Lamarck, Lyell, and Charles Darwin (in your journal)?
2. Which scientist influenced Darwin the most and helped him develop his theory of natural selection?
3. Compare and contrast Lamarck and Darwin’s theories.
4. What is the correct order for the steps of evolution by natural selection?
5. What factor made the finches evolve?
6. How does the field of genetics contribute to the study of evolution today?
7. Using the jaguar as an example, describe the four principles of natural selection: overproduction, adaptation, variation, and descent with modification.
8. Describe how the following pieces of evidence support evolution: fossils, embryology, comparative anatomy, biogeography, and molecular DNA.
9. Provide an example for each piece of evidence in question 8.
10. What is the difference between homologous, analogous, and vestigial structures? Provide an example for each one.
11. Explain the Grants research and what they observed in the Galapagos.
12. What is DNA?
13. DNA allows us to look at different organisms DNA sequence and see if they share a ____________________________.
14. What is a nucleotide made up of?
15. List the four nitrogenous bases for DNA. Which ones pair up?
16. List the four nitrogenous bases for RNA. Which ones pair up?
17. Explain how DNA and RNA work together.
18. What are amino acids? How many are there?
19. List the functions of proteins.
20. Define phenotype, genotype, alleles, traits, mutations, recombination, dominant, recessive, homozygous, and heterozygous.

Chapter 11

21. Antibiotic resistance develops in bacteria, explain how that happens? What develops?
22. What is variation?
23. The ___________ always determines the ________________
24. Individuals do not evolve, __________ do.
25. Why do we have two alleles for each trait? Where do they come from?
26. What is fitness? What determine it?
27. What are two examples of fitness?
28. Define gene pool. What is stored in a gene pool?
29. What does allele frequency mean?
30. __________________ measure genetic variation.
31. What were the two sources we talked about in class where genetic variation comes from?
32. What is recombination?
33. Define hybridization and provide an example.
34. Why do hybrids happen?
35. What is gene flow and provide an example?
36. What is genetic drift? What is one effect of genetic drift on evolution?
37. Define and draw the three types of selection: disruptive, stabilizing, and directional.
38. If there is low gene flow, what does that mean?
39. Explain the Bottleneck Effect and the Founders Effect. Why do they happen and what does it result in?
40. What is sexual selection and why is it important for the female to be “picky?”
41. What is the difference between intrasexual and intersexual selection?
42. What are the five conditions that need to be met in order for Hardy Weinberg equilibrium to be met?
43. Within a population of butterflies, the color brown (B) is dominant over the color white (b). And, 40% of all butterflies are white. Given this simple information, which is something that is very likely to be on an exam, calculate the following:
   A. The percentage of butterflies in the population that are heterozygous.
B. The frequency of homozygous dominant individuals.

44. What are the five factors that can lead to evolution and provide an example for each one (this is the sheet where we colored all the circles)?

**Chapter 17 and 12**

45. List the eight levels of classification in order from the most broad to the most specific.

46. Why did Linnaeus develop a scientific name for a species consisting of the genus and species, italicized, and in Latin?

47. Why are protists considered to be unique when trying to classify them?

48. The Greeks use to group organisms based on their structural similarities, what are the modern classification systems based on?

49. List the three domains and tell me if it is prokaryotic or eukaryotic.

50. Compare and contrast prokaryotes and eukaryotes.

51. List the six kingdoms and provide an example for each.

52. Among the three domains, what is the main way in which nutrition is gathered?

53. Describe each kingdom. See chart in notes.

54. List the five ways in which kingdoms are grouped.

55. What are the three modes of nutrition? Describe each one and provide an example.

56. Are there any limitations to Linnaeus’ classification system?

57. What is classification based on?

58. Explain what phylogeny is and why we use them.

59. Explain what a cladogram is and what it shows us.

60. How do you interpret a cladogram? Use derived characteristics, node, and clade to explain your answer.

61. What are molecular clocks and why are they important?

62. Compare and contrast mutation rates in mitochondrial DNA, nuclear DNA, and ribosomal DNA.

63. Define speciation.

64. What effect could separation of populations have on speciation?

65. At what point are two organisms considered to be separate species?

66. What are the four types of isolation? Describe and provide an example for each one.

67. Why is natural selection not random?

68. Explain the difference between convergent and divergent evolution, provide examples to support your answer.

69. Define coevolution. Provide an example.

70. Why does an organism become extinct?

71. Compare and contrast background extinctions and mass extinctions.

72. Speciation often occurs in patterns: describe punctuated equilibrium and adaptive radiation and how they contribute to speciation.

73. What do the primordial soup model and the bubble model have in common as far as how life began on earth? Explain the theory behind each one.

74. Explain the Miller-Urey Experiment.

75. What crucial fact did they not have when they conducted their experiment?

76. What is endosymbiosis and what does the theory propose?

77. Why is biological diversity so important and how do we get it?

78. What do the scientific names mean: *Homo erectus*, *Homo habilis*, and *Homo sapiens*?

79. How do hominids differ from other primates?

80. What would be the advantage of bipedalism?

**Diagrams / other things to Study:**

Dichotomous Key Activity

Five factors that can lead to evolution notes

Cladogram in notes DNA molecule in notebook

Hardy Weinberg Equilibrium equations Finches’ lab

Molecular clock lab (Honors only) Look over your vocabulary

Chapter 17 guided reading review packet
Read the passage and answer the questions.

**Forces of Evolution**

The conditions for Hardy-Weinberg equilibrium are unlikely to be met in real populations. The Hardy-Weinberg theorem also describes populations in which allele frequencies are not changing. By definition, such populations are not evolving. How does the theorem help us understand evolution in the real world?

From the theorem, we can infer factors that cause allele frequencies to change. These factors are the forces of evolution. There are four such forces: mutation, gene flow, genetic drift, and natural selection.

**Mutation**

Mutation creates new genetic variation in a gene pool. It is how all new alleles first arise. In sexually reproducing species, the mutations that matter for evolution are those that occur in gametes. Only these mutations can be passed to offspring. For any given gene, the chance of a mutation occurring in a given gamete is very low. Thus, mutations alone do not have much effect on allele frequencies. However, mutations provide the genetic variation needed for other forces of evolution to act.

**Gene Flow**

Gene flow occurs when people move into or out of a population. If the rate of migration is high, this can have a significant effect on allele frequencies. Both the population they leave and the population they enter may change.

During the Vietnam War in the 1960s and 1970s, many American servicemen had children with Vietnamese women. Most of the servicemen returned to the United States after the war. However, they left copies of their genes behind in their offspring. In this way, they changed the allele frequencies in the Vietnamese gene pool. Was the gene pool of the American population also affected? Why or why not?

**Genetic Drift**

Genetic drift is a random change in allele frequencies that occurs in a small population. When a small number of parents produce just a few offspring, allele frequencies in the offspring may differ, by chance, from allele frequencies in the parents.

This is like tossing a coin. If you toss a coin just a few times, you may by chance get more or less than the expected 50 percent heads or tails. In a small population, you may also by chance get different allele frequencies than expected in the next generation. In this way, allele frequencies may drift over time.

Genetic drift occurs under two special conditions. They are called bottleneck effect and founder effect.

1. Bottleneck effect occurs when a population suddenly gets much smaller. This might happen because of a natural disaster, such as a forest fire. By chance, allele frequencies of the survivors may be different from those of the original population.
2. Founder effect occurs when a few individuals start, or found, a new population. By chance, allele frequencies of the founders may be different from allele frequencies of the population they left.

**Questions**

1. What are the forces of evolution?
2. Describe the type of mutations that affect evolution. Why?
3. Was the gene pool of the American population also affected by the gene flow described above? Why or why not?
4. What is genetic drift?
5. Describe one special condition under which genetic drift occurs.
**Definitions**

1. consists of all the genes of all the members of the population
2. creates new genetic variation in a gene pool
3. occurs over geologic time above the level of the species
4. occurs when one of two extreme phenotypes is selected for
5. refers to differences between the phenotypes of males and females of the same species
6. occurs when phenotypes in the middle of the range are selected against
7. occurs when people move into or out of a population
8. occurs over a relatively short period of time within a population or species
9. occurs when phenotypes at both extremes of the phenotypic distribution are selected against
10. how often an allele occurs in a gene pool relative to the other alleles for that gene
11. the science that focuses on evolution within populations
12. shows that allele frequencies do not change in a population if certain conditions are met

**Terms**

a. allele frequency
b. directional selection
c. disruptive selection
d. gene flow
e. gene pool
f. Hardy-Weinberg theorem
g. macroevolution
h. microevolution
i. mutation
j. population genetics
k. sexual dimorphism
l. stabilizing selection
Read these passages from the text and answer the questions that follow.

Introduction

Macroevolution is evolution over geologic time above the level of the species. One of the main topics in macroevolution is how new species arise. The process by which a new species evolves is called speciation. How does speciation occur? How does one species evolve into two or more new species?

Origin of Species

To understand how a new species forms, it’s important to review what a species is. A species is a group of organisms that can breed and produce fertile offspring together in nature. For a new species to arise, some members of a species must become reproductively isolated from the rest of the species. This means they can no longer interbreed with other members of the species. How does this happen? Usually they become geographically isolated first.

Allopatric Speciation

Assume that some members of a species become geographically separated from the rest of the species. If they remain separated long enough, they may evolve genetic differences. If the differences prevent them from interbreeding with members of the original species, they have evolved into a new species. Speciation that occurs in this way is called allopatric speciation.

Sympatric Speciation

Less often, a new species arises without geographic separation. This is called sympatric speciation. The following example shows one way this can occur.

1. Hawthorn flies lay eggs in hawthorn trees. The eggs hatch into larvae that feed on hawthorn fruits. Both the flies and trees are native to the U.S.
2. Apple trees were introduced to the U.S. and often grow near hawthorn trees. Some hawthorn flies started to lay eggs in nearby apple trees. When the eggs hatched, the larvae fed on apples.
3. Over time, the two fly populations — those that fed on hawthorn trees and those that preferred apple trees — evolved reproductive isolation. Now they are reproductively isolated because they breed at different times. Their breeding season matches the season when the apple or hawthorn fruits mature.
4. Because they rarely interbreed, the two populations of flies are evolving other genetic differences. They appear to be in the process of becoming separate species.

Questions

1. What is a species?
2. What is speciation?
3. How do new species arise?
4. Describe allopatric speciation.
5. Describe sympatric speciation. Provide an example.

The readings and vocabulary are modified from:

http://www.ck12.org/workbook/CK-12-Biology-Workbook/section/10.0/