

Chapter Review



29

Study Outline

29–1 Early Theories of Evolution

- Lamarck's theory of evolution was based on the law of use and disuse and the inheritance of acquired characteristics.
- The modern theory of evolution is based partially on Darwin's concept of natural selection.
- The six main points of Darwin's theory involve the concepts of overproduction, competition, variation, adaptation, natural selection, and speciation.

29–2 The Synthetic Theory of Evolution

- The modern, or synthetic, theory of evolution proposes that evolution is the change in allele frequency within a population over time.
- Genetic variation occurs as a result of gene mutations, genetic recombination, migration, and genetic drift.
- The Hardy-Weinberg law states that the frequency of alleles within a population remains constant if the population is large, reproduction is random, there are no mutations, and there is no migration.

29–3 Adaptations and Natural Selection

- Adaptations are inherited traits that improve an organism's chance of survival and reproduction in a given environment.
- Natural selection can favor an extreme phenotype (directional selection), the average phenotype (stabilizing selection), or two opposite phenotypes (disruptive selection).

29–4 Speciation

- Speciation, the development of new species, can take place by means of geographic and reproductive isolation, polyploidy, or adaptive radiation.
- Convergent evolution results in increased resemblance between unrelated species. Coevolution occurs when two or more species evolve in response to each other.

29–5 Observed Natural Selection

- Studies of industrial melanism in the peppered moth show that natural selection can act in favor of certain adaptations over short periods of time.
- Resistance of bacteria to antibiotics and of insects to DDT arises from genes that are already present in the population of bacteria or insects.

Vocabulary Review

natural selection (602)	camouflage (610)
variations (602)	warning coloration (610)
adaptation (603)	mimicry (611)
speciation (603)	directional selection (612)
gradualism (604)	stabilizing selection (613)
punctuated equilibrium (604)	disruptive selection (613)
synthetic theory (605)	range (614)
population (605)	geographic isolation (614)
population genetics (605)	reproductive isolation (615)
gene pool (605)	adaptive radiation (615)
evolution (606)	convergent evolution (616)
genetic recombination (607)	coevolution (616)
genetic drift (607)	industrial melanism (618)
genetic equilibrium (608)	
Hardy-Weinberg law (608)	

A. Matching—Select the vocabulary term that best matches each definition.

1. The study of the changes in the genetic makeup of populations
2. A type of natural selection in which the extreme phenotype is the favorable adaptation
3. A change in the gene pool of a small population that is brought about by chance
4. An adaptation allowing an organism to blend visually into the environment

Chapter Review

5. Process in which there is increased resemblance between unrelated species because of natural selection

6. The formation of new species

7. The total of all the alleles in a population

B. Definition—Replace the italicized definition with the correct vocabulary term.

8. Some *characteristics that differ from the typical characteristics of a species* may help individuals to survive.

9. Darwin proposed that new species are formed by a *process whereby organisms with favorable variations are better able to survive and reproduce than organisms with unfavorable variations*.

10. *The gradual change of allele frequencies* changes the genetic makeup of the whole population over time.

11. *The theory that populations, rather than individuals within a population, evolve* is the modern theory of evolution.

12. The finches that Darwin observed on the Galapagos Islands are an example of the result of a *process by which one species evolves into a number of different species, each occupying a specific environment*.

13. *The proposal that species remain the same for a long period of time and then evolve rapidly during a short time interval* is a new theory regarding the rate of evolutionary change.

14. *The principle that sexual reproduction by itself does not affect genetic equilibrium in a population* enables us to determine whether evolution is occurring in a population.

Content Review

15. Describe Lamarck's theory of evolution.

16. Describe three basic types of observations supporting the idea of evolution that Darwin made during his voyage on the *Beagle*.

17. Describe Darwin's theory of evolution by natural selection.

18. What were the weaknesses in Darwin's theory of evolution?

19. Explain how gradualism and punctuated equilibrium differ.

20. How is evolution defined, according to the synthetic theory?

21. Explain the statement: Individuals do not evolve.

22. How did De Vries explain the appearance of new traits within a species?

23. Why is genetic drift less likely to affect large populations than small ones?

24. In what way is the Hardy-Weinberg law useful?

25. What are adaptations that involve the metabolism of an organism called?

26. What is the difference between camouflage and warning coloration?

27. How does mimicry protect the viceroy butterfly from predators?

28. What type of natural selection might occur as the result of extreme climate change?

29. Describe disruptive selection.

30. When are two groups of organisms considered two different species?

31. What are polyploids?

32. Explain why Darwin's finches may be said to represent an example of adaptive radiation.

33. What is convergent evolution?

34. What general conclusions were drawn from studies of the peppered moth in England?

35. How do antibiotic-resistant bacteria develop?

36. How did insect populations become resistant to DDT?

Graphic Organizing

For information on graphic organizers, see Appendix G at the back of this text.

37. **Line Graph:** Construct a line graph, using the data in the chart at the top of the next page. The data represent the number of trilobite fossils of various lengths found at two different depths of sedimentary rock. In constructing your graph, plot the number of fossils on the vertical axis and the length of the fossil on the horizontal axis. Then, refer to Figure 29–14 to decide which type of natural selection the trilobites underwent as they evolved.

Length of Fossil (cm)	Number of Fossils (Lower Depth)	Number of Fossils (Higher Depth)
3.0	0	0
3.5	0	4
4.0	2	12
4.5	5	18
5.0	12	23
5.5	18	24
6.0	22	23
6.5	24	19
7.0	22	11
7.5	19	6
8.0	13	2
8.5	4	0
9.0	0	0

Critical Thinking


38. Using the evolution of the modern giraffe as an example, compare Darwin's theory with Lamarck's theory of evolution. (*Comparing and Contrasting*)

39. If Lamarck's theory of evolution were correct, what characteristic might you expect in the offspring of two cats whose food was always placed at the top of a tall, smooth, wooden post? (*Predicting*)


40. Classify the following adaptations as examples of camouflage, warning coloration, or mimicry: (a) a chameleon's ability to take on the colors of its background; (b) an edible fish's resemblance to an inedible one; (c) the bright color of a bad-tasting insect. (*Classifying*)

Creative Thinking

41. The dinosaurs, which were successful on earth for millions of years, are now extinct. What factors might have led to their extinction?

 42. Write a short story, set thousands of generations in the future, showing some changes that have taken place as a result of evolution.

Problem Solving

 43. A biologist is studying industrial melanism. Five hundred red ground beetles and 500 white ground beetles are placed on red clay in a mesh cage

containing insect-eating birds. After five days, 475 red beetles and 123 white beetles remain. Calculate the percentage of each type of beetle that survived. What conclusion can be drawn from these results?


44. A botanist identifies two distinct species of violets growing in a field. Also in the field are several other types of violets that, although somewhat similar to the two known species, appear to be different enough in leaf type to be classified as new species. (See the figure below.) Develop a hypothesis as to the origin of these other types of violets. Then design an experiment to determine whether they represent new species.




45. An experiment was performed to determine the resistance of two species of *Anopheles* mosquitoes to the insecticides Malathion and Dieldrin. Ten thousand insects of each species were sprayed with each insecticide. The data from the experiment are presented in the table below. Calculate the percentage of each species that survived. What do the results show about resistance of the insects to each insecticide? Predict what might happen if the offspring of the surviving insects are sprayed with the same concentration of each insecticide.

Insect Species	Insecticide	Number of Surviving Insects
<i>A. culifacies</i>	Malathion	17
	Dieldrin	78
<i>A. stephensi</i>	Malathion	28
	Dieldrin	30

Projects

 46. Observe the feeding habits, beak structure, and coloration of the birds in your area. Write a report on the birds' adaptations.

47. Prepare a chart that illustrates the general evolution of marsupial and placental mammals.

 48. Prepare a report on one of these career opportunities: cytotechnologist; geographer; environmental engineer.

Unit 6

Biology and Problem Solving

Where did dinosaurs spend the winter?

Bones, teeth, footprints—these are the fossils from which scientists can infer the size and shape of dinosaurs, what they ate, and even how fast they moved. But what about the life style of these huge animals? Did they live individually, in families, or in large groups? Did they remain in one place, roam in a small territory, or travel across great distances? The geographic distribution of fossils suggests some answers to these questions.

Centrosaurus apertus was a dinosaur that lived in the late Cretaceous period, about 75 million years ago. With a horn on its nose and a thick neck frill, it looked something like a rhinoceros. In 1977, a large bed of dinosaur bones, almost entirely those of *Centrosaurus*,

was discovered in Dinosaur Provincial Park in southern Alberta, Canada. The bed contained bones of both male and female animals of all ages—perhaps as many as 250 dinosaurs lay buried there. Scientists believe that all of the animals may have died at the same time.

- 1. What does this fossil finding suggest about the social organization of *Centrosaurus*?**
- 2. What might have been the advantage of this kind of social organization?**
- 3. List some possible causes for the death of so many animals at the same time.**

Fossils of more than 35 other species of dinosaurs, all dating from about the same period, have also been found in other deposits in Dinosaur Provincial Park.

