CHAPTER 2: THE DEVELOPMENT OF EVOLUTIONARY THEORY

Chapter Outline

I. Introduction

a) Evolution is often denigrated as being "only" a theory.
   i) Evolution is, in fact, a scientific theory that has a wealth of support, and is the unifying theory of the biological sciences.

b) Evolution is of central importance to physical anthropology, and evolutionary thought has had a long history of development.
   i) The earliest human ancestors evolved from a species that lived some 6 to 8 million years ago.
   ii) All living species are the current result of processes that go back millions of year.
   iii) We see microevolutionary changes in many species including humans.
   iv) Some religious views hold that evolutionary statements run counter to biblical teachings.

II. A Brief History of Evolutionary Thought

a) The discovery of evolutionary principles date back to the sixteen century.

b) Charles Darwin was the first person to explain the basic mechanics of the evolutionary process, although Alfred Russel Wallace independently duplicated Darwin's ideas.

c) Just as technological change is based on past achievements, scientific knowledge builds on previously developed theories.

d) The predominant European worldview throughout the Middle Ages was one of stasis and the fixity of the species.
   i) Christian teachings that God created all life were taken literally.
   ii) The universe was perceived as being part of the Grand Design.
      (1) Archbishop James Ussher calculated that the world had been created in 4004 B.C.
   iii) The belief that the earth was very young, coupled with the notion of fixity of the species was a significant obstacle to the development of evolutionary thought.

e) **The Scientific Revolution-** the development of evolutionary theory came about as a result of a series of discoveries that led to major paradigms shifts.
   i) As Europeans began to explore the "New World" encountering plants and animals they had never seen before, their awareness of biological diversity expanded.
      (1) In 1514, Copernicus challenged Aristotle's idea that the earth was the center of the universe by arguing that the solar system was heliocentric.
      (2) In the early 17th century, an Italian mathematician named Galileo Galilei supported Copernicus's views and stated that the earth was a place of motion.
      (3) The discovery of the principles of physics and the invention of a number of scientific instruments made it possible to investigate many previously misunderstood natural phenomena.

f) Precursors to the Theory of Evolution
   i) John Ray (1627-1705) proposed the concept of species, he was first to recognize that groups of plants and animals could be distinguished from other groups by their ability to mate with one another and produce offspring.
      (1) These groups were termed species.

(2) Ray also coined the term genus, recognizing that similar species could be grouped together.

ii) Carolus Linnaeus (1707-1778), a Swedish naturalist and believer in the fixity of species, developed the binomial system of classification plants in his publication, *Systema Naturae* (1735).
   (1) He added the taxonomic levels class and order and classified humans as *Homo sapiens*.

iii) Georges-Louis Leclerc de Buffon (1707-1788) a French naturalist (a.k.a. Comte de Buffon) stressed the importance of change in the universe and the dynamics between nature and living forms in *Natural History* (1749).

iv) Erasmus Darwin (1731-1802), Charles Darwin's grandfather, was a freethinking physician who wrote about evolutionary ideas composed in verse but the degree to which he influenced his grandson's ideas is unclear.

v) Jean-Baptiste Lamarck (1744-1829) was the first to propose an explanation of the evolutionary process.
   (1) He proposed a theory of the inheritance of acquired characteristics in which an animal's body parts are altered through use or disuse and these altered characteristics are transmitted to their offspring.
      (a) Although this is biologically impossible, he nevertheless is credited with being the first to recognize the importance of the interaction between organisms and their environment in the evolutionary process.

vi) Georges Cuvier (1769-1832), a French vertebrate paleontologist, was an opponent of Lamarck's evolutionary ideas.
   (1) Cuvier introduced the concept of extinction to explain the existence of hitherto unknown fossil forms.
   (2) Cuvier was a proponent of catastrophism, the idea that the earth's geological features are a result of catastrophic events, the most recent being the biblical flood.
      (a) These events destroyed old life forms, and the newer forms were the result of creation events.

vii) Thomas Malthus (1766-1834), an English clergyman and economist wrote *An Essay on the Principles of Population* (1798).
   (1) He noted that population sizes increase exponentially but food supplies remain stable.
      (a) This concept inspired both Charles Darwin and Alfred Wallace.

viii) Charles Lyell (1797-1875), author of *Principles of Geology* (1830-1833), is considered the founder of modern geology.
   (1) He demonstrated that uniform processes (uniformitarianism) could account for present geological features.
   (2) His ideas provided the time depth necessary for biological evolution to have occurred.

ix) Alfred Russel Wallace (1823-1913) developed his own theory of natural selection after collecting bird and insect specimens in Southeast Asia.
   (1) He first published some of his ideas in 1855, and then in 1858 Wallace wrote "On the Tendency of Varieties to Depart Indefinitely from the Original Type".

x) Mary Anning (1799-1847), an amateur geologist and famous "fossilist", unknowingly contributed significantly to the field of paleontology by discovering hundreds of fossils including the first complete fossil of an *Ichthyosaurus*.

III. The Discovery of Natural Selection

a) Charles Darwin (1809-1882) proposed the first credible mechanism for evolutionary change, natural selection, in *On the Origin of the Species* (1859).
   i) After graduating from Christ's College, where he studied theology, but also cultivated his interests in natural science and geology, he was recommended to join the five-year expedition of the HMS *Beagle*.
      (1) Darwin began the voyage as a believer in the fixity of species, but his observations of, among other things, fossils of giant ancient versions of living animals and varieties of Galápagos finches eventually convinced him to the contrary.

(2) After his return to England in October 1836, he began to formulate his theory of natural selection.
(a) He wrote summaries of his ideas in 1842 and 1844, but felt he needed more evidence before he published. He was sent both of Wallace's papers, and Darwin was spurred to put all of his ideas in writing.
(b) Initial reaction to *On the Origin of Species* was mostly negative, but scientific opinion gradually shifted to Darwin's favor.

b) **In Darwin's Shadow** unlike Darwin, Alfred Russell Wallace was born to a family of modest means.
i) In 1855 Wallace an article suggesting that current species were descendant of older species and that the appearance of new ones were influenced environmental factors played a role in their evolution.
(1) This article caused Lyell and others to urge Darwin to publish his findings but he continued to hesitate.
(2) In 1858 Wallace sent Darwin another paper, the title was "On the tendency of varieties to depart indefinitely from the original type" where he described evolution as a process driven by competition in natural selection.
(3) Darwin realized that unless he published his work, Wallace would get credit for the theory he had been working on for many years. In December 1859, Darwin completed and published his greatest work "On the Origin of Species."

IV. Natural Selection

a) Darwin envisioned it as a process in which individuals with favorable variations survive and reproduce at a higher rate than those with unfavorable variations. The key elements in Darwin's formulation include:
i) The potential for reproductive rates that outpace the rate of increase of food supplies.
ii) The presence of biological variation within all species.
iii) Constant competition among individuals for survival.
iv) Individuals with favorable traits are more likely to survive and reproduce.
v) The environment "determines" which traits are favorable.
vi) Favorable traits are passed on to offspring at a higher rate than non-favorable traits, thus increasing in frequency through time and eventually producing new species.
vii) Geographical isolation may lead to the formation of new species.

V. Natural Selection in Action

a) Natural selection is an empirically studied phenomenon.
i) Industrial melanism is a documented case of evolutionary shifts in frequencies of pigmentation patterns in peppered moth populations near Manchester, England.
(1) Evolutionary shifts in response to the environment are called adaptations.
ii) Natural selection has been demonstrated on the (Galápagos) island of Daphne Major.
(1) Measurements of beak thickness changes through time among the medium ground finch indicate that thicker-beaked individuals had greater reproductive success during droughts.
iii) Natural selection, through the use of antibiotics, is responsible for the increased number of antibiotic-resistant strains of microorganisms.

b) These examples of natural selection in action indicate that certain common principles apply:
i) A trait must be inherited to have importance in natural selection.
ii) Natural selection cannot occur without variation in inherited characteristics.
iii) Fitness is a relative measure that will change as the environment changes.
iv) Natural selection can act only on traits that affect reproduction.

c) Natural selection can act through not only differential death rates, but also through differential fertility rates.

VI. Constraints on Nineteenth Century Evolutionary Theory

a) Darwin argued that natural selection acts on variation within species, yet no one could explain the source of this variation.

b) Darwin also didn't know how favorable traits were passed from generation to generation.

i) The laws of heredity were unknown, and most believed that parental traits were blended in the offspring.
ii) Gregor Mendel had worked out the modern principles of heredity, but his work was not recognized until the beginning of the 20th century.

VII. Opposition to Evolution Today

a) Darwin's formulation of evolution was offensive to Christians because it was in conflict with biblical versions of the creation.
b) The debate over evolution is far from over, especially in the U.S. and increasingly in several Muslim countries.
c) The mechanisms of evolution are complex, and many people do not understand them.
   i) Many are not comfortable with the principles of biology and genetics and have little scientific background.
   ii) Most Americans are raised in belief systems that do not emphasize the biological continuity between life forms.
d) Yet, evolutionary theories are accepted, in part, by the Catholic Church and most mainstream Protestants.
e) **A Brief History of Opposition to Evolution in the United States** reveals why most fundamentalists reject all scientific explanations of evolution.
   (1) After World War I, conservative Christians sought a revival of what they considered to be traditional values.
   (2) Historically, religious fundamentalists opposed the teaching of evolution in public schools at the pre-baccalaureate level, and some states prohibited any mention of evolution until 1968.
      (a) Proponents of *creation science* now prefer to use the term *intelligent design*.
      (b) Many attempts to legislate the teaching of evolution have been overturned, such as the attempted takeover of the Dover Area School Board that was thwarted when none of the eight members of the School Board were reelected in 2004.
   (3) The state and federal courts have consistently ruled that laws that require the teaching of ID violate the First Amendment of the Constitution.

Learning Objectives

After reading Chapter 2, the student should be able to:

1. Trace the major developments in scientific thinking that led to the discovery of evolutionary processes.
2. Compare Darwin's and Wallace's theory of natural selection to earlier explanations of how species came to exist.
3. Understand how natural selection operates on biological variation in species to cause evolutionary change over time.
4. Define the term fitness as it relates to reproductive success.
5. Explain how science and religion differ in their explanations of natural phenomena.
6. Discuss the history of opposition to the teaching of evolution in the United States.

Key Terms and Concepts

Binomial nomenclature	p. 29	Natural selection	p. 26
Biological continuity	p. 43	Paradigm shift	p. 28
Catastrophism	p. 30	Reproductive success	p. 39
Christian fundamentalists	p. 44	Reproductively isolated	p. 29
Fertility	p. 41	Selective pressures	p. 39
Fitness	p. 39	Taxonomy	p. 29
Fixity of species	p. 27	Uniformitarianism	p. 32
Genome	p. 42		

Student Activities

Activities and Assignments

1. Visit PBS Evolution website and watch some of the videos related to Darwin and then practice with some of the web exercises available at (http://www.pbs.org/wgbh/evolution/darwin/index.html)
2. From Jurmain *et al. Basic Genetics for Anthropology* CD: Have students go through section I, *Evolution and Natural Selection*, and complete the quiz.
3. From J. Kappelman's *Virtual Laboratories for Physical Anthropology* CD: Students should complete Section I of Lab 2*: Evolution and Natural Selection* to reinforce their conceptual understanding of natural selection. From Jurmain *et al. Basic Genetics for Anthropology* CD: Use the animations of evolution and natural selection to introduce these concepts for your lecture.
4. Use the Anthropology Resource Center and use the resources available there, including the Video Exercises on Natural Selection (www.cengagebrain.com).
5. Learn more about the complex person Charles Darwin was by watching one of the following films, many of these are available free at www.topdocumentaryfilms.com
   A. http://topdocumentaryfilms.com/charles-darwin-tree-life/
   B. http://topdocumentaryfilms.com/darwins-dangerous-idea/
   C. http://topdocumentaryfilms.com/darwins-secret-notebooks/
   D. http://topdocumentaryfilms.com/darwin-struggle-evolution-origin-species/
   E. The video *Charles Darwin: Evolution's Voice* from A & E's *Biography* series is particularly relevant.

Media Suggestions

1. The Discovery Channel has a series of short scientific video clips which explain the processes of evolution, available at http://topdocumentaryfilms.com/100-greatest-discoveries-origins-and-evolution/
2. Visit the National Center for Science Education's website, http://www.ncseweb.org/, and read about creationist attempts to teach "creation science" in public schools. First click on "Links" and then the "Critiques of Creationism" link and write a paragraph summarizing one of the critiques.
3. One historical figure that vehemently opposed Darwin's ideas was Louis Agassiz (1807-1873). Go to the University of California - Berkeley's Museum of Paleontology website for information on Agassiz (http://www.ucmp.berkeley.edu/history/agassiz.html) and write a brief paragraph on his life and ideas.
4. Visit Berkeley's website on Evolution (http://www.ucmp.berkeley.edu/history/evolution.html)

Multiple Choice Questions

1. In Europe during the Middle Ages, it was believed that
   a. all species had evolved from a common ancestor.
   b. evolution was the result of natural selection acting upon genetic variation.
   c. all forms were created by God and did not change over time.
   d. most species had become extinct over time.
   e. life was created slowly, over millions of years.

   ANS: C REF: 26 DIF: Factual OBJ: 5 MSC: Pickup

2. The belief that species do not change but are the same as when first created is known as
   a. fixity of species.
   b. the Great Chain of Being.
   c. heliocentric.
   d. uniformitarianism.
   e. natural selections.

   ANS: A REF: 27 DIF: Factual OBJ: 5 MSC: Pickup

3. Just as technological change is based on past achievements, scientific knowledge builds on previously developed
   a. hypothesis.
   b. ideas.
   c. technology.
   d. theories.
   e. beliefs.

   ANS: D REF: 26 DIF: Factual OBJ: 5 MSC: New

4. The plan of the entire universe was viewed as
   a. the binomial system.
   b. natural selection.
   c. uniformitarianism.
   d. God's design.
   e. Lamarckism.

   ANS: D REF: 27 DIF: Factual OBJ: 5 MSC: Pickup

5. How did the discovery of the Americas (New World) impact European understanding of biological diversity?
   A. It exposed them to plants and animals they had never seen.
   B. It proved the validity of biblical texts.
   C. It demonstrated fixity of species.
   D. It supported standing notions of the Great Chain of Beings.
   E. It had no impact on notions of biological diversity.

   ANS: A REF: 28 DIF: Factual OBJ: 1 MSC: New

6. The fact that anatomical structures appear to be uniquely fitted to the functions they serve was the basis for the
   a. theory of uniformitarianism.
   b. theory of natural selection.
   c. theory of the inheritance of acquired characteristics.
   d. theory of catastrophism.
   e. argument from design.

   ANS: E REF: 27 DIF: Factual OBJ: 5 MSC: Pickup

7. Which 16th century Polish mathematician was credited with removing the earth as the center of all things (heliocentric)?
   a. John Ray
   b. Copernicus
   c. Galileo Galilei
   d. Aristotle
   e. Charles Lyell

   ANS: B REF: 28 DIF: Factual OBJ: 1 MSC: New

8. Who first recognized that species were groups of organisms that were distinguished from other such groups by their ability to reproduce?
   A. John Ray
   B. Charles Darwin
   C. Carolus Linnaeus
   D. Alfred Russel Wallace
   E. Jean-Baptiste Lamarck

   ANS: A REF: 29 DIF: Factual OBJ: 1 MSC: Pickup

9. Who developed the binomial system of classifying biological organisms?
   a. Jean-Baptiste Lamarck
   b. Georges Cuvier
   c. Carolus Linnaeus
   d. Charles Lyell
   e. Erasmus Darwin

   ANS: C REF: 29 DIF: Factual OBJ: 5 MSC: Pickup

10. Carolus Linnaeus
   a. developed a binomial system of classification for plants and animals.
   b. was a proponent of evolutionary change.
   c. opposed all notions of fixity of species.
   d. was a supporter of Charles Darwin.
   e. developed theories of natural selection.

   ANS: A REF: 29 DIF: Factual OBJ: 1 MSC: Pickup

11. _was an 18th century thinker who believed that living forms changed in response to theenvironment. Although he did not think nature was perfect or had a grand purpose, he still rejectedthe idea that one species could give rise to another.
    a. Alfred Russel Wallace
    b. Georges-Louis Leclerc de Buffon
    c. Erasmus Darwin
    d. John Ray
    e. Georges Cuvier

    ANS: B REF: 29 DIF: Factual OBJ: 1 MSC: Pickup

12. Which naturalist attempted to explain the evolutionary process by suggesting a dynamic relationship between species and the environment?
    a. Jean Baptiste Lamarck.
    b. Erasmus Darwin.
    c. Georges-Louis Leclerc de Buffon.
    d. Galileo Galilei.
    e. Charles Lyell.

    ANS: A REF: 30 DIF: Factual OBJ: 1 MSC: New

13. Who was the first to offer a scientific explanation for how species changed?
    a. Carolus Linnaeus
    b. Jean-Baptiste Lamarck
    c. Charles Lyell
    d. Charles Darwin
    e. Erasmus Darwin

    ANS: B REF: 30 DIF: Factual OBJ: 1 MSC: Pickup

14. The theory that the frequent use of an organ caused it to be enhanced was developed by
    a. Charles Darwin.
    b. Carolus Linnaeus.
    c. Georges Cuvier.
    d. Charles Lyell.
    e. Jean-Baptiste Lamarck.

    ANS: E REF: 30 DIF: Factual OBJ: 1 MSC: Pickup

15. The role of the environment as a significant factor in evolutionary change was first recognized and stated by
    a. Jean-Baptiste Lamarck.
    b. Georges Cuvier.
    c. Thomas Malthus.
    d. Charles Darwin.
    e. Charles Lyell.

    ANS: A REF: 30 DIF: Factual OBJ: 1 MSC: Pickup

16. The term “biology” was coined by
    a. Jean-Baptiste Lamarck.
    b. Georges Cuvier.
    c. Thomas Malthus.
    d. Charles Darwin.
    e. Charles Lyell.

    ANS: C REF: 30 DIF: Factual OBJ: 2 MSC: Pickup

17. The theory that characteristics acquired during the lifetime of an individual could be passed on to that individual’s offspring is termed
    a. natural selection.
    b. catastrophism.
    c. the inheritance of acquired characteristics.
    d. uniformitarianism.
    e. fixity of species.

    ANS: C REF: 30 DIF: Factual OBJ: 1 & 2 MSC: Pickup

18. The view that the extinction and the subsequent appearance of more modern forms could be explained by a series of disasters and creations is known as
    a. natural selection.
    b. catastrophism.
    c. use-disuse theory.
    d. uniformitarianism.
    e. descent with modification.

    ANS: B REF: 30 DIF: Factual OBJ: 1 & 2 MSC: Pickup

19. The opponent of Jean-Baptiste Lamarck who proposed the theory of catastrophism was
    a. Charles Lyell.
    b. Alfred Russel Wallace.
    c. Thomas Malthus.
    d. Erasmus Darwin.
    e. Georges Cuvier.

    ANS: E REF: 30 DIF: Factual OBJ: 1 & 2 MSC: Pickup

20. Thomas Malthus
    a. proposed that population size is kept in check by the limited availability of resources.
    b. wrote the theory of catastrophism
    c. wrote the theory of uniformitarianism
    d. had no influence on the development of Darwin’s and Wallace’s theories of natural selection.
    e. was a 16th century mathematician

    ANS: A REF: 31 DIF: Factual OBJ: 1 MSC: New

21. Who proposed that population size increases at a faster rate than food supplies?
    a. Erasmus Darwin
    b. Alfred Russel Wallace
    c. Thomas Malthus
    d. Charles Lyell
    e. Jean-Baptiste Lamarck

    ANS: C REF: 31 DIF: Factual OBJ: 1 MSC: Pickup

22. Who wrote *Principles of Geology* and emphasized the principle of uniformitarianism?
    a. Charles Darwin
    b. Charles Lyell
    c. Alfred Russel Wallace
    d. Jean-Baptiste Lamarck
    e. Thomas Malthus

    ANS: B REF: 32 DIF: Factual OBJ: 1 MSC: Pickup

23. The principle of uniformitarianism
    a. stated that the geological processes that operated in the past are still occurring in the present.
    b. was a problem for the development of evolutionary theories.
    c. proposed that the earth was only a few thousand years old.
    d. was the same as the theory of catastrophism.
    e. was first proposed by Georges Cuvier.

    ANS: A REF: 31 DIF: Factual OBJ: 1 MSC: Pickup

24. Which concept, proposed by Charles Lyell, was to have a profound effect on 19th century scientific thought?
    A. recent origins for earth
    B. the role of catastrophic events in producing geological phenomena
    C. natural selection
    D. the immense age of the earth and uniform processes
    E. the inheritance of acquired characteristics

    ANS: D REF: 32 DIF: Factual OBJ: 1 MSC: Pickup

25. Mary Anning is credited with
    a. the principle of uniformitarianism.
    b. being the co discoverer of natural selection.
    c. became known as one of the world's leading "fossilists."
    d. being married to Charles Darwin.
    e. writing the book *Principles of Geology*.

    ANS: C REF: 32 DIF: Factual OBJ: 1 MSC: New

26. Charles Darwin
    a. grew up in modest circumstances.
    b. began to doubt the fixity of species during a voyage around the world in the 1830s.
    c. received no formal education.
    d. spent two years in Africa where he developed the theory of natural selection.
    e. was a physician who studied natural history as a hobby.

    ANS: B REF: 34-35 DIF: Factual OBJ: 1 & 2 MSC: Pickup

27. Although Darwin went aboard the *HMS Beagle* believing on the fixity of species, what discovery changed his beliefs?
    a. the people he met on the ship.
    b. the discovery of fossils of ancient giant animals similar to contemporary species.
    c. the distance from church and society.
    d. the death of his child.
    e. the discovery of savages which looked more like apes.

    ANS: B REF: 34 DIF: Factual OBJ: 1 MSC: New

28. Charles Darwin
    a. was reluctant to publish his theories.
    b. wrote his theory of natural selection while still on board the *Beagle*.
    c. published his theories as soon as he returned from his voyage on the *Beagle*.
    d. was not concerned with public opinion and did not mind if his theories were criticized.
    e. knew his friends and colleagues would not be affected by the publication of his theory.

    ANS: A REF: 37 DIF: Factual OBJ: 1 MSC: Pickup

29. Which contemporary of Charles Darwin also developed a theory of evolution by means of natural selection?
    a. Charles Lyell
    b. Jean-Baptiste Lamarck
    c. Erasmus Darwin
    d. Alfred Russel Wallace
    e. Georges Cuvier

    ANS: D REF: 37 DIF: Factual OBJ: 1 & 2 MSC: Pickup

30. The fact that individuals who possess favorable traits are more likely to survive and reproduce than those who possess less favorable traits is the basis for the theory of
    a. uniformitarianism.
    b. natural selection.
    c. the inheritance of acquired characteristics.
    d. catastrophism.
    e. the fixity of species.

    ANS: B REF: 36 DIF: Factual OBJ: 3 MSC: Pickup

31. Which of the following concepts DID NOT influence Darwin in developing his theory of evolution?
    a. Population size increases more rapidly than food supplies.
    b. There is competition among individuals for resources.
    c. Species are unchanging types, and individual variation within a species is not important.
    d. There is biological variation in all members of a species.
    e. Favorable variations are passed on and accumulate in populations over time.

    ANS: C REF: 35-36 DIF: Factual OBJ: 1 & 3 MSC: Pickup

32. Which species in the Galapagos islands was fundamental to Darwin's evolutionary ideas?
    a. The boobies
    b. The seals
    c. The tortoises
    d. The finches
    e. The iguanas

    ANS: D REF: 35-36 DIF: Factual OBJ: 1 & 3 MSC: New

33. Selective pressures
    A. remain constant, regardless of the environment.
    B. are unimportant in the evolutionary process.
    C. can change if environmental conditions change.
    D. are directionless and random.
    E. are not related to adaptation.

    ANS: C REF: 39 DIF: Factual OBJ: 2 MSC: Pickup

34. "Fitness", in an evolutionary sense, refers to an individual's
    a. strength.
    b. reproductive success.
    c. aggressiveness.
    d. size.
    e. age at death.

    ANS: B REF: 39 DIF: Factual OBJ: 4 MSC: Pickup

35. Which of the following is true about Alfred Russel Wallace?
    a. He was born into a very wealthy family.
    b. He joined expeditions to the Amazon and Southeast Asia.
    c. He was a very close friend of Charles Lyell.
    d. He published an article titled *Principles of Geology*.
    e. In 1858, he received Darwin's paper titled *On the Origin of Species.*

    ANS: B REF: 38 DIF: Factual OBJ: 2 MSC: New

36. Natural selection operates on_____, but it is the population that evolves.
    a. animals
    b. environment
    c. individuals
    d. populations
    e. finches

    ANS: C REF: 39 DIF: Factual OBJ: 3 MSC: New

37. Creationist have been promoting laws that mandate teachings of creationism in public school, yet which U.S. Constitution Amendment has overruled these laws?
    a. the 18th Amendment
    b. the 3rd Amendment
    c. the 1st Amendment
    d. the 13th Amendment
    e. these laws have not been overruled.

    ANS: C REF: 44 DIF: Factual OBJ: 6 MSC: New

38. Religious groups who believe in an absolutely literal interpretation of the Bible are called
    a. scientists
    b. Muslims
    c. shamans
    d. messiahs
    e. fundamentalists

    ANS: E REF: 43 DIF: Factual OBJ: 6 MSC: New

True/False Questions

1. Evolution is a theory that has little scientific support.

   ANS: False REF: 26 DIF: Factual OBJ: 6 MSC: Pickup

2. The "argument from design" was only authored and proposed by Charles Darwin.

   ANS: False REF: 27 DIF: Factual OBJ: 2 MSC: Pickup

3. Erasmus Darwin was probably an important influence in Charles Darwin's evolutionary thinking.

   ANS: True REF: 30 DIF: Conceptual OBJ: 1 MSC: New

4. Use-disuse theory has recently displaced natural selection as mainstream science's most accepted theory of evolutionary change.

   ANS: False REF: 30 DIF: Factual OBJ: 1 MSC: Pickup

5. Georges Cuvier, author of *Principles of Geology*, is considered the founder of modern geology.

   ANS: False REF: 30 DIF: Factual OBJ: 1 MSC: Pickup

6. Charles Darwin formulated his theory of natural selection while visiting the Galápagos Islands and observing its finches.

ANS: False REF: 34-37 DIF: Factual OBJ: 1 MSC: Pickup

7. Charles Darwin acknowledged the importance of sexual reproduction when formulating his theory of natural selection.

ANS: True REF: 36 DIF: Factual OBJ: 3 & 4 MSC: Pickup

8. Charles Darwin refrained from immediately publishing his theory of natural selection because he was aware of its controversial nature.

ANS: True REF: 37 DIF: Factual OBJ: 3 MSC: Pickup

9. There are no well-documented examples of natural selection operating in natural populations.

ANS: False REF: 39-40 DIF: Factual OBJ: 3 MSC: Pickup

10. Intelligent Design is not science because creationists insist that their view is absolute and infallible.

ANS: True REF: 44 DIF: Factual OBJ: 6 MSC: New

11. Some surveys show that about half of all Americans do not believe evolution occurs.

ANS: True REF: 43 DIF: Factual OBJ: 6 MSC: New

12. Proponents of "creation science" hold that their ideas are absolute and infallible.

ANS: True REF: 44 DIF: Factual OBJ: 5 MSC: Pickup

Short Answer Questions

1. Explain how traditionally held views prevented wide acceptance of evolutionary theories in 19th century Europe and America. Give specific examples.
ANS: Answer not provided REF: 25-26 DIF: Conceptual OBJ: 5 & 6
MSC: Pickup

2. Explain what is the period called the Scientific Revolution and its importance to the development of evolutionary theory.
ANS: Answer not provided REF: 26-29 DIF: Factual OBJ: 1
MSC: New

3. Describe the work of John Ray and Carolus Linnaeus and how it served as precursors to the theory of evolution.
ANS: Answer not provided REF: 29 DIF: Factual OBJ: 1
MSC: New

4. Outline Lamarck's theory of inheritance of acquired characteristics. According to this theory, what was the environment's role in biological change?
ANS: Answer not provided REF: 30 DIF: Factual OBJ: 2
MSC: Pickup

5. Discuss the ideas of two individuals who significantly affected Darwin's formulation of the theory of natural selection.
ANS: Answer not provided REF: 34-35 DIF: Factual OBJ: 1 & 2
MSC: Pickup

6. Explain who Alfred Russel Wallace was and how he influential to the theory of natural selection.
ANS: Answer not provided REF: 37-38 DIF: Factual OBJ: 2 & 3
MSC: New

7. How did the expedition on the HMS Beagle influence Darwin's development of evolutionary theory?
ANS: Answer not provided REF: 34-36 DIF: Conceptual OBJ: 1
MSC: New

8. Explain how the study of the finches from the Galapagos Islands of Ecuador influenced Darwin's understanding of natural selection.
ANS: Answer not provided REF: 35-36 DIF: Factual OBJ: 3
MSC: New

9. How is natural selection related to environmental factors? How can selective pressures change? Give an example.
ANS: Answer not provided REF: 39 DIF: Factual OBJ: 3
MSC: Pickup

10. Explain how the peppered moth in England is a very good example of natural selection and adaptation.
ANS: Answer not provided REF: 39 DIF: Conceptual OBJ: 3
MSC: New

11. Describe the four fundamental of evolutionary change and the importance of fertility.
ANS: Answer not provided REF: 40-41 DIF: Factual OBJ: 3 & 4
MSC: New

12. Discuss the definition of fitness as it pertains to natural selection.
ANS: Answer not provided REF: 39 DIF: Factual OBJ: 4
MSC: Pickup

13. Explains the various factors that pose opposition to evolution today.
ANS: Answer not provided REF: 42-43 DIF: Factual OBJ: 5 & 6
MSC: New

14. Provide a brief history of opposition to evolution in the United States.
ANS: Answer not provided REF: 43-44 DIF: Factual OBJ: 6
MSC: New

15. Explain why creationists oppose evolution and how they continue to attack its teachings.
ANS: Answer not provided REF: 44-45 DIF: Conceptual OBJ: 6
MSC: New

Essay Questions

1. Many people argue that evolution is "only a theory". Define *theory* and then describe how evolution does or does not fit the definition.
ANS: Answer not provided

2. Discuss the role of differential fertility in natural selection.
ANS: Answer not provided

3. Many people in the United States believe in the biblical creation. What factors may account for the fact that many people do not accept evolution as an explanation for the origins and diversity of life?
ANS: Answer not provided

4. Explain why Charles Lyell's principle of uniformitarianism was important to Charles Darwin and Alfred Russel Wallace as they developed their theories of biological evolution. ANS: Answer not provided