

Chapter 15 Theory of Evolution

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Chapter 15 Section 1 History of Evolutionary Thought

Objectives

- **Define** the biological process of evolution.
- **Summarize** the history of scientific ideas about evolution.
- **Describe** Charles Darwin's contributions to scientific thinking about evolution.
- **Analyze** the reasoning in Darwin's theory of evolution by natural selection.
- **Relate** the concepts of adaptation and fitness to the theory of natural selection.



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Chapter 15 Section 1 History of Evolutionary Thought

The Idea of Evolution

- **Evolution** is the process of change in the inherited characteristics within populations over generations such that new types of organisms develop from preexisting types.



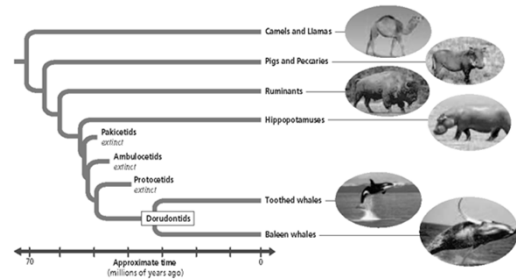
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Chapter 15 Section 1 History of Evolutionary Thought

Evolutionary Relationships Between Whales and Hoofed Mammals



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The Idea of Evolution, *continued*

- **Ideas of Darwin's Time**
 - Scientific understanding of evolution began to develop in the 17th and 18th centuries as geologists and naturalists compared geologic processes and living and fossil organisms around the world.



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The Idea of Evolution, *continued*

- **Ideas about Geology**
 - Among geologists, Cuvier promoted the idea of *catastrophism*, and Lyell promoted *uniformitarianism*.



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Section 1 History of Evolutionary Thought

The Idea of Evolution, *continued*

• Lamarck's Ideas on Evolution

- Among naturalists, Lamarck proposed the *inheritance of acquired characteristics* as a mechanism for evolution.



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Section 1 History of Evolutionary Thought

Darwin's Ideas

• Descent with Modification

- Darwin wrote *On the Origin of Species*, in which he argued that *descent with modification* occurs, that all species descended from common ancestors, and that **natural selection** is the mechanism for evolution.



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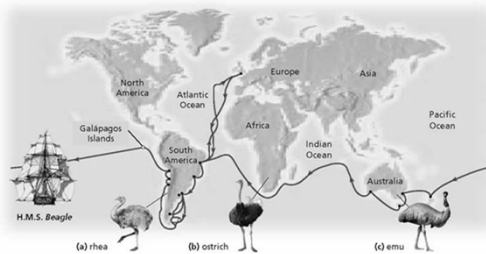
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Darwin's Voyage



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Darwin's Ideas, *continued*

• Natural Selection

- Organisms in a population adapt to their environment as the proportion of individuals with genes for favorable traits increases.
- Those individuals that pass on more genes are considered to have greater **fitness**.



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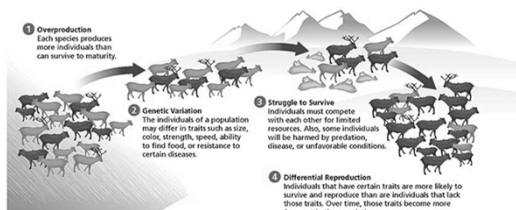
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Section 1 History of Evolutionary Thought

Natural Selection



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Section 2 Evidence of Evolution

Objectives

- **Relate** several inferences about the history of life that are supported by evidence from fossils and rocks.
- **Explain** how biogeography provides evidence that species evolve adaptations to their environments.
- **Explain** how the anatomy and development of organisms provide evidence of shared ancestry.
- **Compare** the use of biological molecules with other types of analysis of evolutionary relationships.
- **Describe** the ongoing development of evolutionary theory.



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Section 2 Evidence of Evolution

The Fossil Record

- Evidence of evolution can be found by comparing several kinds of data, including the fossil record, biogeography, anatomy and development, and biological molecules.
- Evolutionary theories are supported when several kinds of evidence support similar conclusions.



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Section 2 Evidence of Evolution

The Fossil Record, *continued*

- The Age of Fossils
 - Geologic evidence supports theories about the age and development of Earth.



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Section 2 Evidence of Evolution

The Fossil Record, *continued*

- The Distribution of Fossils
 - The fossil record shows that the types and distribution of organisms on Earth have changed over time.



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The Fossil Record, *continued*

- Transitional Species
 - Fossils of *transitional species* show evidence of descent with modification.



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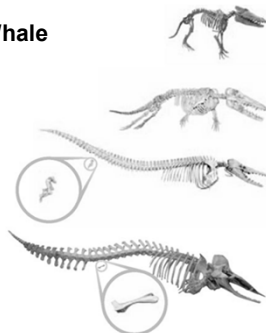
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Evidence of Whale Evolution



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Biogeography

- **Biogeography**, the study of the locations of organisms around the world, provides evidence of descent with modification.



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Section 2 Evidence of Evolution

Anatomy and Physiology

- In organisms, **analogous structures** are similar in function but have different evolutionary origins.
- **Homologous structures** have a common evolutionary origin.



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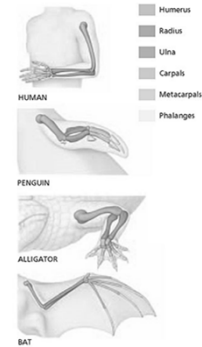
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Section 2 Evidence of Evolution

Forelimbs of Vertebrates



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Anatomy and Physiology, *continued*

- A species with a **vestigial structure** probably shares ancestry with a species that has a functional form of the structure.



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Anatomy and Physiology, *continued*

- Related species show similarities in embryological development.



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Section 2 Evidence of Evolution

Hemoglobin Comparison

Species	Amino Acid Differences from Human Hemoglobin Protein
Gorilla	1
Rhesus monkey	8
Mouse	27
Chicken	45
Frog	67
Lamprey	125

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Section 2 Evidence of Evolution

Developing Theory

- Modern scientists integrate Darwin's theory with other advances in biological knowledge.
- Theories and hypotheses about evolution continue to be proposed and investigated.



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Section 3 Evolution in Action

Objectives

- **Describe** how convergent evolution can result among different species.
- **Explain** how divergent evolution can lead to species diversity.
- **Compare** artificial selection and natural selection.
- **Explain** how organisms can undergo coevolution.



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Section 3 Evolution in Action

Case Study: Caribbean Anole Lizards

- Ongoing examples of evolution among living organisms can be observed, recorded, and tested.
- In **convergent evolution**, organisms that are not closely related resemble each other because they have responded to similar environments.



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Section 3 Evolution in Action

Case Study: Caribbean Anole Lizards, continued

- **Divergence and Radiation**
 - In **divergent evolution**, related populations become less similar as they respond to different environments.
 - **Adaptive radiation** is the divergent evolution of a single group of organisms in a new environment.



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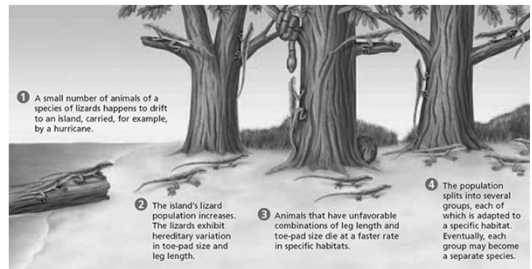
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Section 3 Evolution in Action

Natural Selection of Anole Lizard Species



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Artificial Selection

- The great variety of dog breeds is an example of **artificial selection**.



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Coevolution

- The increasing occurrence of antibiotic resistance among bacteria is an example of **coevolution** in progress.



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