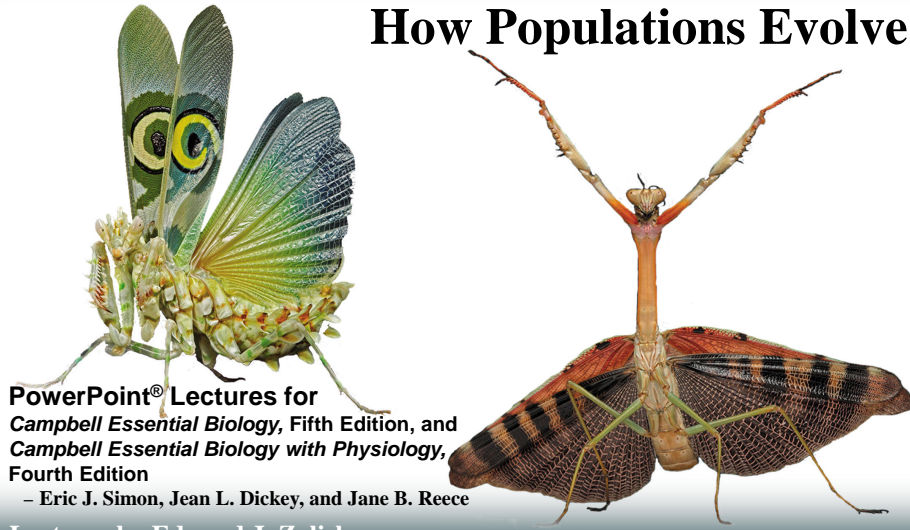


Chapter 13

1

How Populations Evolve



PowerPoint® Lectures for
Campbell Essential Biology, Fifth Edition, and
Campbell Essential Biology with Physiology,
Fourth Edition
– Eric J. Simon, Jean L. Dickey, and Jane B. Reece

Lectures by Edward J. Zalisko

© 2013 Pearson Education, Inc.

ALWAYS LEARNING

PEARSON

CHARLES DARWIN AND *THE ORIGIN OF SPECIES*

2

- Biology came of age on November 24, 1859. Charles Darwin published *On the Origin of Species by Means of Natural Selection*, an assemblage of facts about the natural world.

© 2013 Pearson Education, Inc.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES*

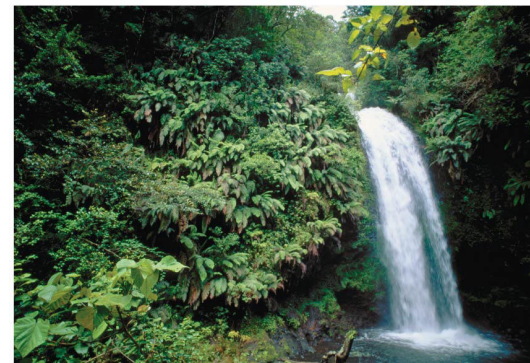
3

- Darwin made three observations from these facts.
 1. Life shows rich diversity.
 2. There are similarities in life that allow the classification of organisms into groups nested within broader groups.
 3. Organisms display many striking ways in which they are suited for their environments.

© 2013 Pearson Education, Inc.

Figure 13.1

4



(a) The diversity of life



(b) Patterns of similarities



(c) An insect suited to its environment

© 2013 Pearson Education, Inc.



(c) An insect suited to its environment

© 2013 Pearson Education, Inc.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES*

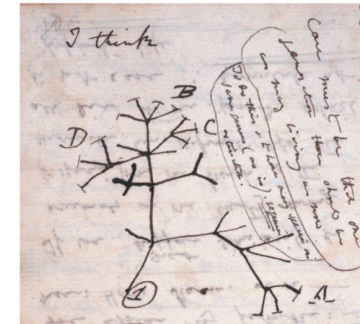
- In *The Origin of Species*, Darwin
 - proposed a hypothesis, a scientific explanation for his observations,
 - used hundreds of pages in his book to describe the evidence supporting his hypothesis,
 - made testable predictions, and
 - reported the results of numerous experiments he had performed.

© 2013 Pearson Education, Inc.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES*

- Darwin hypothesized that
 - present-day species are the descendents of ancient ancestors that they still resemble in some ways and
 - change occurs as a result of “descent with modification,” with natural selection as the mechanism.

Figure 13.2



© 2013 Pearson Education, Inc.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES* 9

- **Natural selection** is a process in which organisms with certain inherited characteristics are more likely to survive and reproduce than are individuals with other characteristics.
- As a result of natural selection, a **population**, a group of individuals of the same species living in the same place at the same time, changes over generations.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES* 10

- Natural selection leads to **evolutionary adaptation**, a population's increase in the frequency of traits suited to the environment.
- Natural selection thus leads to **evolution**, seen either as
 - a change in the genetic composition of a population over time or
 - on a grander scale, the entire biological history, from the earliest microbes to the enormous diversity of organisms that live on Earth today.

CHARLES DARWIN AND *THE ORIGIN OF SPECIES* 11

- Natural selection leads to
 - a **population** (a group of individuals of the same species living in the same place at the same time) changing over generations and
 - evolutionary adaptation.
- In one modern definition of **evolution**, the genetic composition of a population changes over time.

Darwin's Cultural and Scientific Context 12

- *The Origin of Species* was fundamentally different from the prevailing scientific and cultural views of Darwin's time.
- Let's place Darwin's ideas in their historical context.

The Idea of Fixed Species

13

- The Greek philosopher Aristotle held the belief that species are fixed and do not evolve.
- The Judeo-Christian culture fortified this idea with
 - a literal interpretation of the biblical book of Genesis and
 - the suggestion that Earth may only be 6,000 years old.
- Naturalists were grappling with the interpretation of **fossils**, imprints or remains of organisms that lived in the past.

© 2013 Pearson Education, Inc.

Figure 13.3

14



(a) "Snakestone"

© 2013 Pearson Education, Inc.



(b) Ichthyosaur skull and paddle-like forelimb

Lamarck and Evolutionary Adaptations

15

- Naturalists compared fossil forms with living species and noted patterns of similarities and differences.
- In the early 1800s, French naturalist Jean Baptiste Lamarck suggested that life evolves, and explained this evolution as the refinement of traits that equip organisms to perform successfully in their environment.

© 2013 Pearson Education, Inc.

Lamarck and Evolutionary Adaptations

16

- Lamarck suggested a mechanism that we now know is wrong.
- Lamarck proposed that by using or not using its body parts, an individual may develop certain traits that it passes on to its offspring, thus, acquired traits are inherited.
- Lamarck helped set the stage for Darwin by proposing that species evolve as a result of interactions between organisms and their environment.

© 2013 Pearson Education, Inc.

The Voyage of the Beagle

17

- Darwin was born on February 12, 1809, the same day that Abraham Lincoln was born.
- In December 1831, Darwin left Great Britain on the HMS *Beagle* on a five-year voyage around the world.

Figure 13.4

18



© 2013 Pearson Education, Inc.

© 2013 Pearson Education, Inc.

The Voyage of the Beagle

19

- On his journey on the *Beagle*, Darwin
 - collected thousands of specimens and
 - observed various adaptations in organisms.

The Voyage of the Beagle

20

- Darwin was intrigued by
 - the geographic distribution of organisms on the Galápagos Islands and
 - similarities between organisms in the Galápagos and those in South America.

© 2013 Pearson Education, Inc.

© 2013 Pearson Education, Inc.

-
- Darwin was strongly influenced by the writings of geologist Charles Lyell.
 - Lyell suggested that Earth
 - is very old and
 - was sculpted by gradual geological processes that continue today.

-
- Darwin reasoned that the extended time scale would allow for gradual changes to occur
 - in species and
 - in geologic features.

-
- Darwin made two main points in *The Origin of Species*.
 1. Organisms inhabiting Earth today descended from ancestral species.
 2. Natural selection is the mechanism for descent with modification.