Section 17.3
Darwin’s Theory: Natural Selection
Standards

• **LS 4.1** Evaluate scientific data collected from analysis of molecular sequences, fossil records, biogeography, and embryology. Identify chronological patterns of change and communicate that biological evolution is supported by multiple lines of empirical evidence that identifies similarities inherited from a common ancestor (homologies).

• **LS 4.2** Using a model that demonstrates the change in allele frequencies resulting in evolution of a population over many generations, identify causative agents of change.
Key Questions

1. Under what conditions does natural selection occur?
2. What does evolutionary theory suggest about the unity and diversity of life?
Vocabulary

- Adaptation
- Fitness
- Natural selection
Evolution by Natural Selection

• Darwin wrote a complete draft of his ideas, but did not publish it for another 20 years.

• He wanted to gather as much evidence as he could to support his theory.

• 1858- Darwin reviewed an essay by naturalist Alfred Russell Wallace
  • His thoughts about evolution were almost identical to Darwin’s
  • This prompted Darwin to publish *On the Origin of Species* in 1859
  • Wallace had the right idea, but Darwin had data and observations to support his hypotheses.
Evolution by Natural Selection

1. The Struggle for Existence
2. Variation and Adaptation
3. Survival of the Fittest
4. Natural Selection
1. The Struggle for Existence

• If all populations have the potential to produce more offspring than can survive, members of that population will compete for a finite supply of environmental resources.

• *Struggle for existence*- competition between members of a population

• Which individuals would succeed in surviving and reproducing?
2. Variation and Adaptation

• Darwin hypothesized that individuals with certain types of inherited variation are better suited for, or adapted to, life in their environments than others.

• Examples:
  • Predators that are faster or have longer claws or sharper teeth can catch more prey.
  • Prey that are faster or better camouflaged can avoid being caught.
2. Variation and Adaptation

- **Adaptation** - any heritable characteristic that increases an organism’s ability to survive and reproduce in its environment

- **Examples:**
  - Body parts or structures - (tiger’s claws)
  - Colors - (camouflage)
  - Physiological - (the way a plant photosynthesizes, or an animal hibernating during winter)
  - Behaviors - (social behaviors, prey avoiding predators)
3. Survival of the Fittest

- Differences in adaptations affect an individual’s fitness.
- **Fitness** - how well an organism can survive and reproduce in its environment
- High fitness = individuals with adaptations that are well suited to their environment and survive and reproduce
- Differential reproductive success = survival of the fittest
- In evolutionary terms, *survival* means surviving, reproducing, and passing adaptations to the next generation.
4. Natural Selection

• Darwin’s mechanism for evolution

• Natural selection- the process by which organisms in nature with variations most suited to their local environment survive and leave more offspring

• In natural selection, the environment influences fitness.

• Natural selection occurs in any situation in which more individuals are born than can survive (the struggle for existence), natural heritable variation affects the ability to survive and reproduce (variation and adaptation), and fitness varies among individuals (differential reproductive success).
4. Natural Selection

• Natural selection does not make organisms “better”.
• Adaptions just need to be good enough to enable an organism to pass its genes to the next generation.
• Natural selection does not move in a fixed direction, because environments change.
• This can lead to great diversity.
• If environmental conditions change faster than a species can adapt, the species may become extinct.
Reproduction

White moths lay many eggs, which develop into caterpillars and then adults.

Variation

A moth might be born with a variation that makes it brown in color.

Competition and Predation

Predators are able to find white moths more easily than brown ones. The brown moths survive to reproduce, while many white moths do not.

Selection

Eventually, moths with brown coloration make up a larger part of the moth population than white moths.
Common Ancestry

• Darwin proposed that living species are descended, with changes over time, from common ancestors—an idea called descent with modification.

• Different sets of changing environmental conditions could lead to adaptations that could cause a single species to split into two or more new species.

• According to the principle of common descent, all species—living and extinct—are united by descent from ancient common ancestors, and exhibit diversity due to natural selection and adaptation.
1. What three conditions are necessary for natural selection to occur?
2. How does evolution explain both the unity and diversity of living things?
The End 😊