Modern Synthesis

- What is the modern synthesis?
- How do we define evolution?

Questions

- What are the four forces of evolution?
- How does each change gene frequencies within and between populations?
- What is a population?

The four forces

- What is genetic drift?
  - When is genetic drift most effective?
- Why is mutation so important?
- What is the role of gene flow in maintaining species?
- What are the different ways in which Natural selection works?

Genetic Drift

- The random factor
- Greatest effect in small populations
- Founder effect
Genetic Drift - Bottleneck

Genetic bottleneck

Natural selection

- differential reproductive success over multiple generations
- some variations are more successful than others, leading to a change in the entire population over time

Natural Selection
Pepper Moths

Four Forces and Populations

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MICROEVOLUTION = the small changes in gene frequencies in a population from generation to generation

MACROEVOLUTION = the cumulative effect of these small changes over a long period of time - may lead to SPECIATION
What is a species?

What is speciation?

What is a species?

- an interbreeding group of animals or plants that are reproductively isolated though anatomy, ecology, behavior, or geographic distribution from all other such groups

Reproductive Isolating Mechanisms

- Premating RIMs
  - Habitat isolation
  - Temporal isolation
  - Behavioral isolation
  - Mechanical incompatibility

- Postmating RIMs
  - Sperm-egg incompatibility
  - Zygote inviability
  - Embryonic or fetal inviability

**Theridon grallator**
Pan
Common Chimpanzee  Bonobo

Gorilla
Mountain  Eastern lowland  Western lowland

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Species Concepts

- **Biological species concept:** Defines species as interbreeding populations reproductively isolated from other such populations.
- **Evolutionary species concept:** Defines species as evolutionary lineages with their own unique identity.
- **Ecological species concept:** Defines species based on the uniqueness of their ecological niche.
- **Recognition species concept:** Defines species based on unique traits or behaviors that allow members of one species to identify each other for mating.

Modes of Evolutionary Change

![Diagram showing modes of evolutionary change: Cladogenesis and Anagenesis](image)

Cladogenesis
Speciation creates clades
- clades are evolutionarily related groups
- Classification is the naming of these groups
- Started with Linnaeus
  - tried to group organisms together based on relationship
  - based on similarity

Tempo of Speciation?
- Gradualism?
- Punctuated Equilibrium?