

PowerLecture:

Chapter 19

Evolutionary Patterns, Rates, and Trends

Section 19.0: Weblinks and InfoTrac

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Impacts, Issues: **Last of Honeycreepers?**

- Hawaiian Honeycreeper evolved in the Hawaiian archipelago
  
- The Honeycreeper's descendents populated the different islands

Impacts, Issues: **Last of Honeycreepers?**

- Isolation on islands lead to specialization, such as beak shape
  
- Isolation left birds vulnerable to environmental changes, both natural and artificial
  
- Half of the known species that once populated the Hawaiian Islands are now extinct

Section 19.1: Weblinks and InfoTrac

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Asteroid Impacts

- Many past catastrophic impacts altered the course of evolution
- K–T boundary
- 2.3 million years ago in southern Pacific Ocean

Macroevolution

The large-scale patterns, trends,  
and rates of change among  
families and other more inclusive groups of species

Biological Species Concept

“Species are groups of interbreeding natural populations that are reproductively isolated from other such groups.”

Ernst Mayr

Morphology & Species

- Morphological traits may not be useful in distinguishing species
  - Members of same species may appear different because of environmental conditions
  - Morphology can vary with age and sex
  - Different species can appear identical

Morphology & Species

## **Morphological differences within a species**

### **Reproductive Isolation**

- Cornerstone of the biological species concept
- Speciation is the attainment of reproductive isolation
- Reproductive isolation arises as a by-product of genetic change

### **Reproductive Isolation**

#### **Temporal isolation among cicadas**

### **Reproductive Isolation**

#### **Albatross courtship**

### **Genetic Divergence**

- Gradual accumulation of differences in the gene pools of populations
- Natural selection, genetic drift, and mutation can contribute to divergence
- Gene flow counters divergence

### **Genetic Divergence**

#### **Genetic Divergence in**

#### **Snail Populations**

#### **Snail Speciation?**

- Will the time come when the snails from opposite sides of the street are so different that they can no longer interbreed?

- If so, then they will have become two distinct species

### **Isolating Mechanisms**

#### **Reproductive isolating mechanisms**

## **Section 19.2: Weblinks and InfoTrac**

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### **Mechanisms of Speciation**

- Allopatric speciation
- Sympatric speciation
- Parapatric speciation

#### **Allopatric Speciation**

- Speciation in geographically isolated populations
- Some sort of barrier arises and prevents gene flow
- Effectiveness of barrier varies with species

#### **Allopatric Speciation**

##### **in Wrasses**

- Isthmus of Panama arose and separated wrasses in Atlantic and Pacific
- Since separation, genes for certain enzymes have diverged in structure
- Divergence may be evidence of speciation in progress

### Extensive Divergence Prevents Inbreeding

- Species separated by geographic barriers will diverge genetically
- If divergence is great enough it will prevent inbreeding even if the barrier later disappears

### Archipelagos

- Island chains some distance from continents
  - Galapagos Islands
  - Hawaiian Islands
- Colonization of islands followed by genetic divergence sets the stage for speciation

### Speciation on an Archipelago

### Hawaiian Islands

- Volcanic origins, variety of habitats
- Adaptive radiations:
  - Honeycreepers - In absence of other bird species, they radiated to fill numerous niches
  - Fruit flies (*Drosophila*) - 40% of fruit fly species are found in Hawaii

### Hawaiian Honeycreepers

### Models of Speciation

### Models of speciation

### Models of Speciation

### Allopatric speciation on an archipelago

### Section 19.3: Weblinks and InfoTrac

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Videos: CNN

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➤ Biology, 2002, Vol. 6, *Mystery Ape* (3:07)

**Speciation without a Barrier**

➤ Sympatric speciation

- Species forms within the home range of the parent species

➤ Parapatric speciation

- Neighboring populations become distinct species while maintaining contact along a common border