II. Reproductive Isolation
   A. Prezygotic mechanisms
      1. ecological
      2. behavioral
      3. mechanical
      4. gametic
   B. Postzygotic Mechanisms
      1. developmental
      2. hybrid inviability
      3. hybrid infertility
      4. selection against hybrids

III. Modes of Speciation
   A. Mechanisms of instantaneous speciation
   B. Mechanisms of gradual speciation
   C. Geographic Patterns of speciation
Fig. 24.5
Summary of RIM

PREZYGOTIC BARRIERS
- Habitat isolation: populations live in different habitats and do not meet
- Behavioral isolation: little or no sexual attraction between males and females
- Temporal isolation: mating or flowering occurs at different seasons or times of day

Mating

Mechanical isolation: structural differences in genitalia or flowers prevent copulation or pollen transfer

Gametic isolation: female and male gametes fail to attract each other or are inviable

Fertilization

POSTZYGOTIC BARRIERS
- Reduced hybrid viability: hybrid zygotes fail to develop or fail to reach sexual maturity
- Reduced hybrid fertility: hybrids fail to produce functional gametes
- Hybrid breakdown: offspring of hybrids have reduced viability or fertility

Viable, fertile offspring

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Selection against hybrids in Ranunculus

One parent species is adapted to wet habitats

Other parent is adapted to dry habitats

Hybrid between these has intermediate traits that are not as well adapted to wet conditions as the wet adapted parent and not as well adapted to dry conditions as the dry adapted parent
A cartoon of the evolution of species diversity

Present

Multi-cell Organisms

Eukaryotes

Prokaryotes

Earth formed

One species

Millions of species
Instantaneous speciation by hybridization followed by polyploidy

Hybridization:

Species A
Diploid
n=2
Meiosis

Species B
Meiosis

Hybridization followed by polyploidy

Hybrid (Diploid) w/unpaired c'somes

Polyplody = doubling of c'somes

Tetraploid (4n)
Meiosis
Fertile

Diploid w/unpaired c'somes: cannot complete meiosis
Sterile
Some estimate that nearly 50% of plant species are polyploid.
A single gene pool can become divided by a geological event.
Allopatric speciation: Polar bears and Brown bears

White, streamlined, carnivorous, non-hibernating

Brown, less streamlined, omnivorous, hibernating
Finches of the Galápagos Islands

(b) The Galápagos finches

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Sympatric speciation ??