How do animals adapt to their environment?

Adaptations

How do living things adapt?

- **Adaptation –** adjustments made by animals in response to their environments.
  1. The adjustments may occur by natural selection, as individuals with favorable genetic traits breed more prolifically than those lacking these traits (genotypic adaptation),
  2. or they may involve non-genetic changes in individuals, such as physiological modification (e.g. acclimatization) or learned behavioral changes (phenotypic adaptation).

Adaptations to desert environments

- Examples of Adaptations:

- Use Burrows, Caves , other forms of Shade
- Evaporative Cooling
- Activity Period
- Food Storage

NAME SOME OTHERS

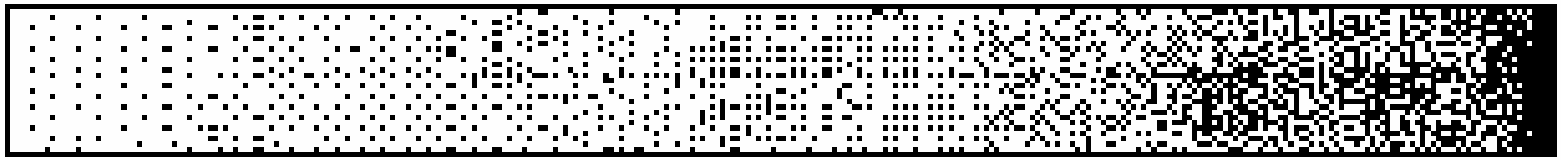
Adaptation

- Adjustments within a species range of tolerances is not evolution
- Range of toleration
  - The range of values of a particular biotic or abiotic factor within which members of a species can survive
- Various Factors require special efforts by organisms to survive and prosper
  - Abiotic= nonliving (ex. temperature, light, moisture, pressure, oxygen concentration, soil chemistry, water chemistry, pH, nutrient concentration, salinity, wind, currents, waves, etc.)
  - Biotic= living (ex. competition, predation, disease, symbiosis)

Abiotic factors

- Can include Gradients = Gradual change over a distance
  - Ex. Temperature with latitude (global scale)
  - Ex. Temperature with altitude (regional scale)
  - Ex. Moisture with altitude (regional scale)
  - Ex. Soil texture down a desert hillside (local scale)
  - Ex. Moisture along a desert wash (local scale)

Environmental Gradient



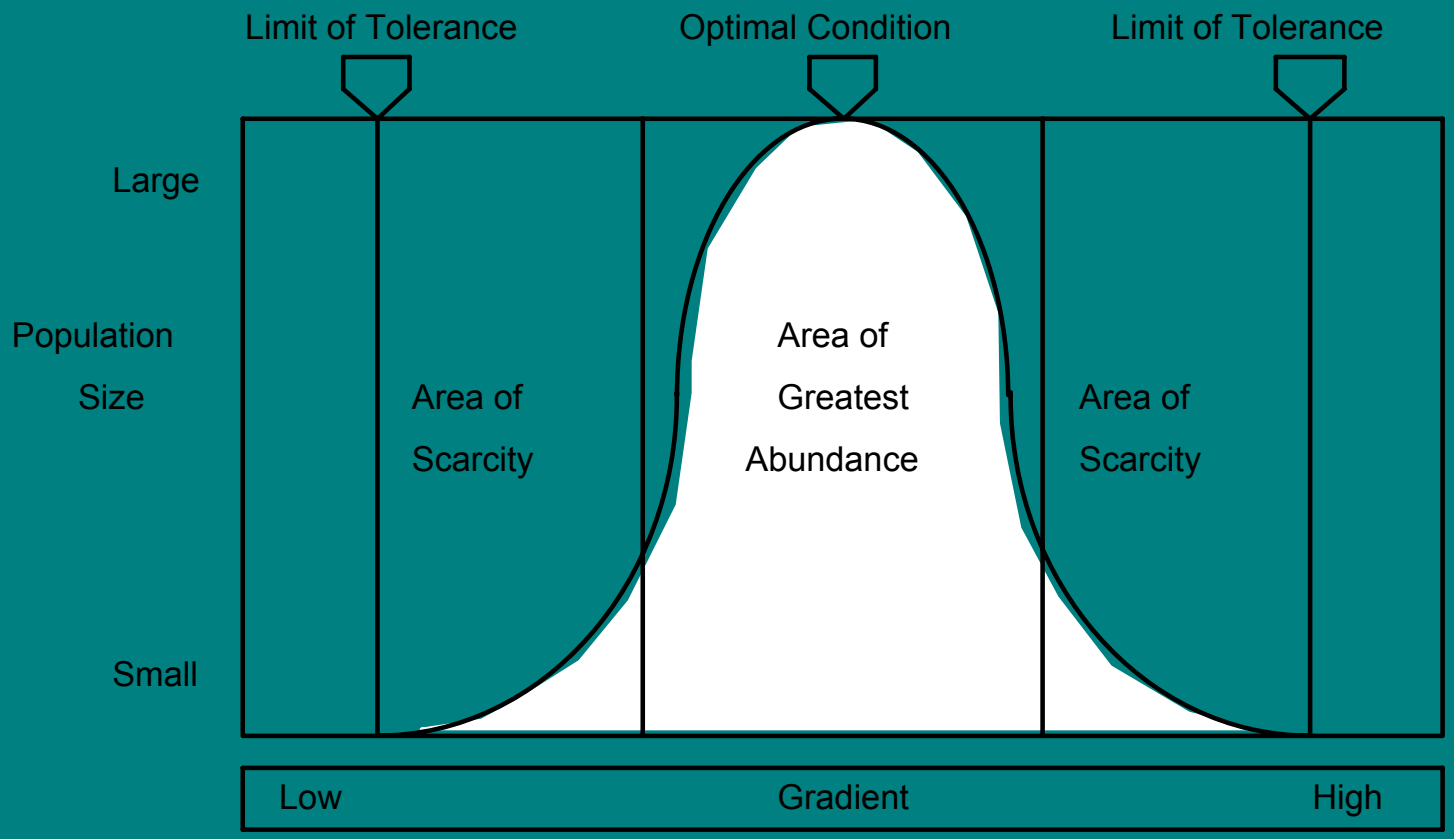
Low Medium High

Gradient

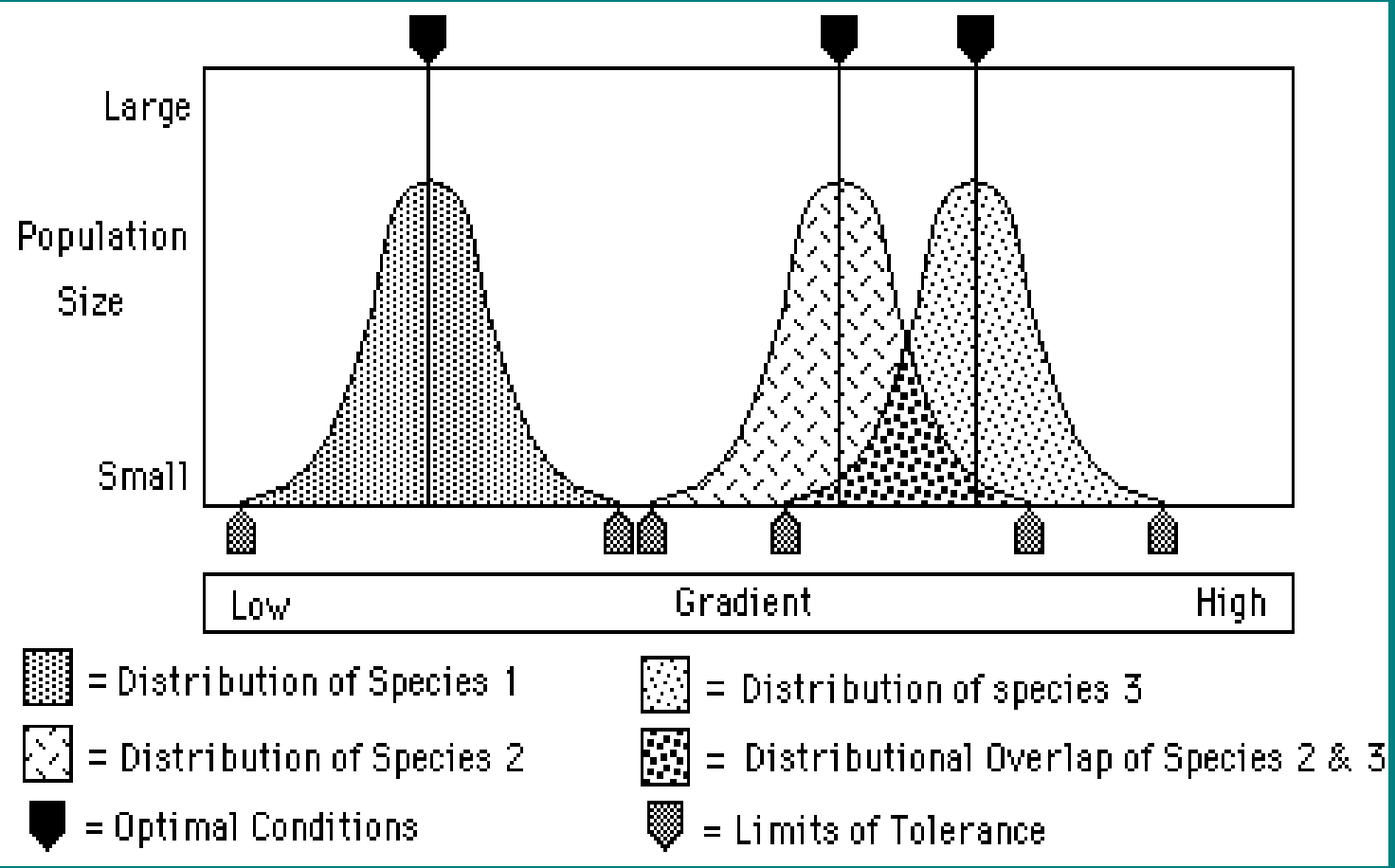
Effects of Environmental Gradients on Populations

- Toleration and Populations
- Area of Greatest Abundance

Distribution Along a Gradient



Species Along a Gradient



Evolution and tolerances

- In the marginal environments, the populations' range of tolerance may change due to natural selection.

- What is natural selection?

Remember Charles Darwin and his Theory of Evolution and Natural Selection

Evolution & Natural Selection

- The theory of natural selection was proposed by Charles Darwin in 1858 to explain how living things become adapted to their environment. How evolution happens.

- What is natural selection?
  - Often referred to as “survival of the fittest”

Reproductive Barriers Between Species

- Pre-zygotic barriers impede mating between species or hinder fertilization of eggs
- Post-zygotic barriers impede hybrids from reproducing
- Define: gamete, zygote, hybrid

- Pre-zygotic barriers include
  - Temporal isolation: Mating or flowering occurs at different seasons or times of day
  - Habitat isolation: Populations live in different habitats and do not meet
  - Mechanical isolation: Structural differences in genitalia or flowers prevent copulation or pollen transfer
  - Gametic isolation: Female and male gametes fail to unite in fertilization

– Behavioral isolation

Figure 14.6

- Post-zygotic barriers

  Are backup mechanisms that operate should interspecies mating actually occur and produce hybrid zygotes

  – Hybrid inviability: Hybrid zygotes fail to develop or fail to reach sexual maturity

  – Hybrid sterility: Hybrids fail to produce functional gametes

- Post-zygotic barriers include
  - Hybrid inviability
  - Hybrid sterility

Horse

Mule (hybrid)

Donkey

Figure 14.7

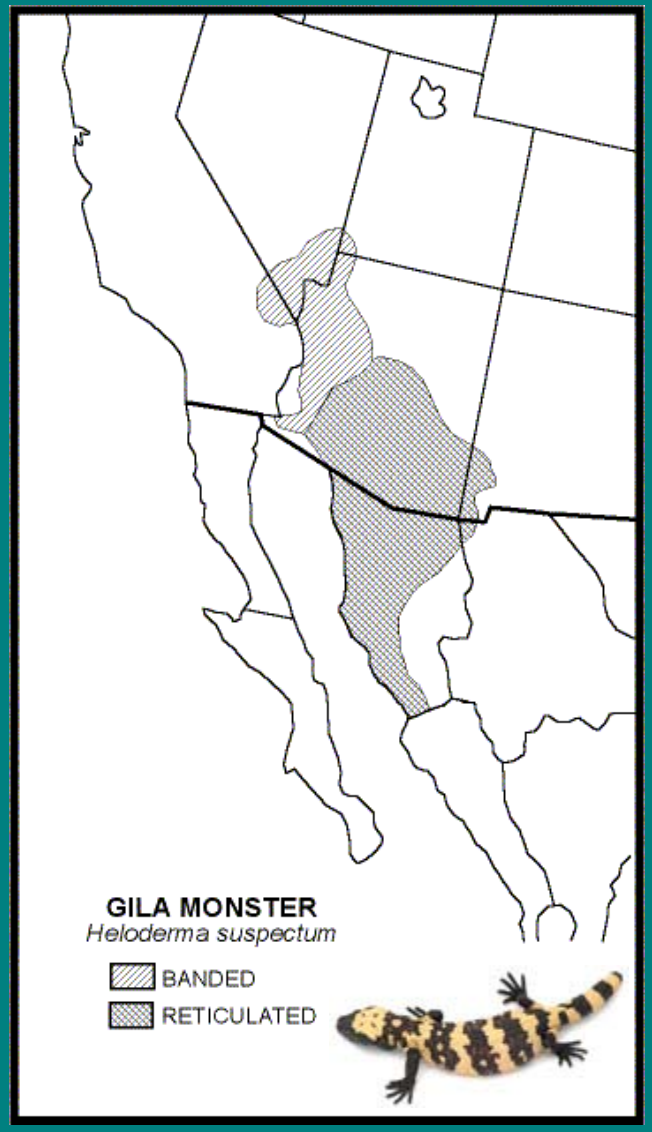
Speciation

= Species giving rise to new species

Why don't all species live everywhere?

Each species is adapted to living in a limited range of environmental conditions

Geographic Range

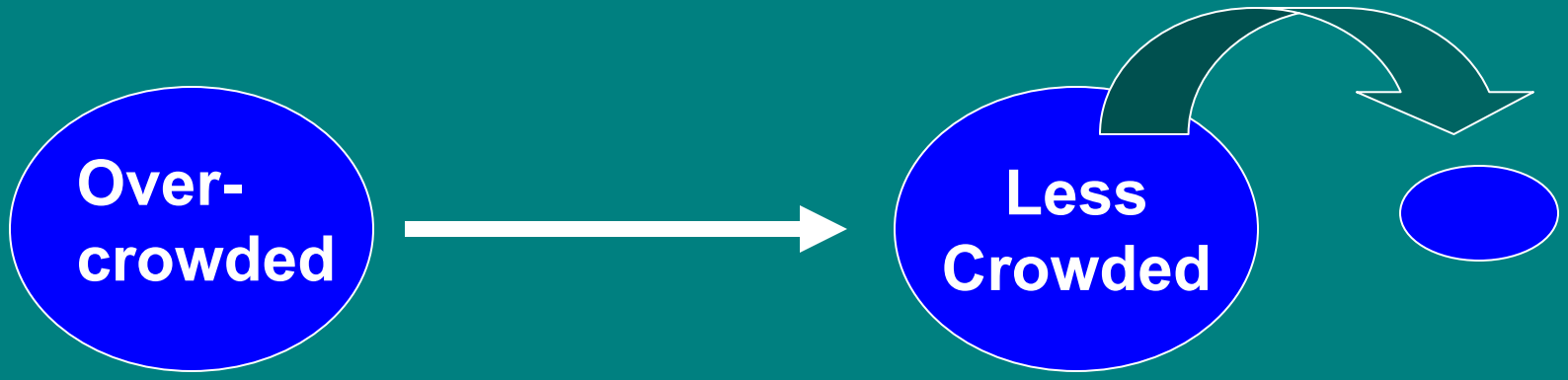


Speciation

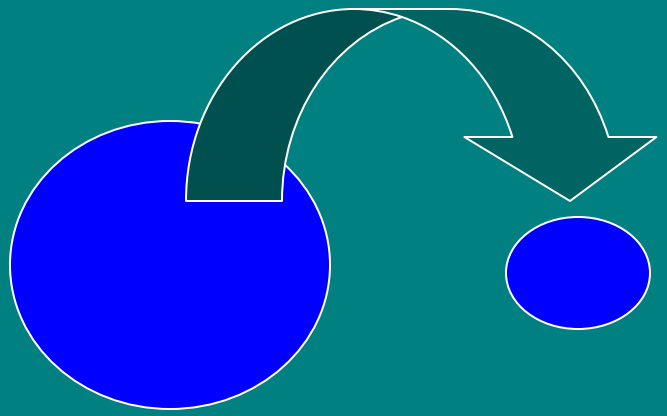
Within a species' geographic range, populations rise in number.

- overcrowding
- food and water becomes more limited

Overflow into area previously uninhabited



Speciation



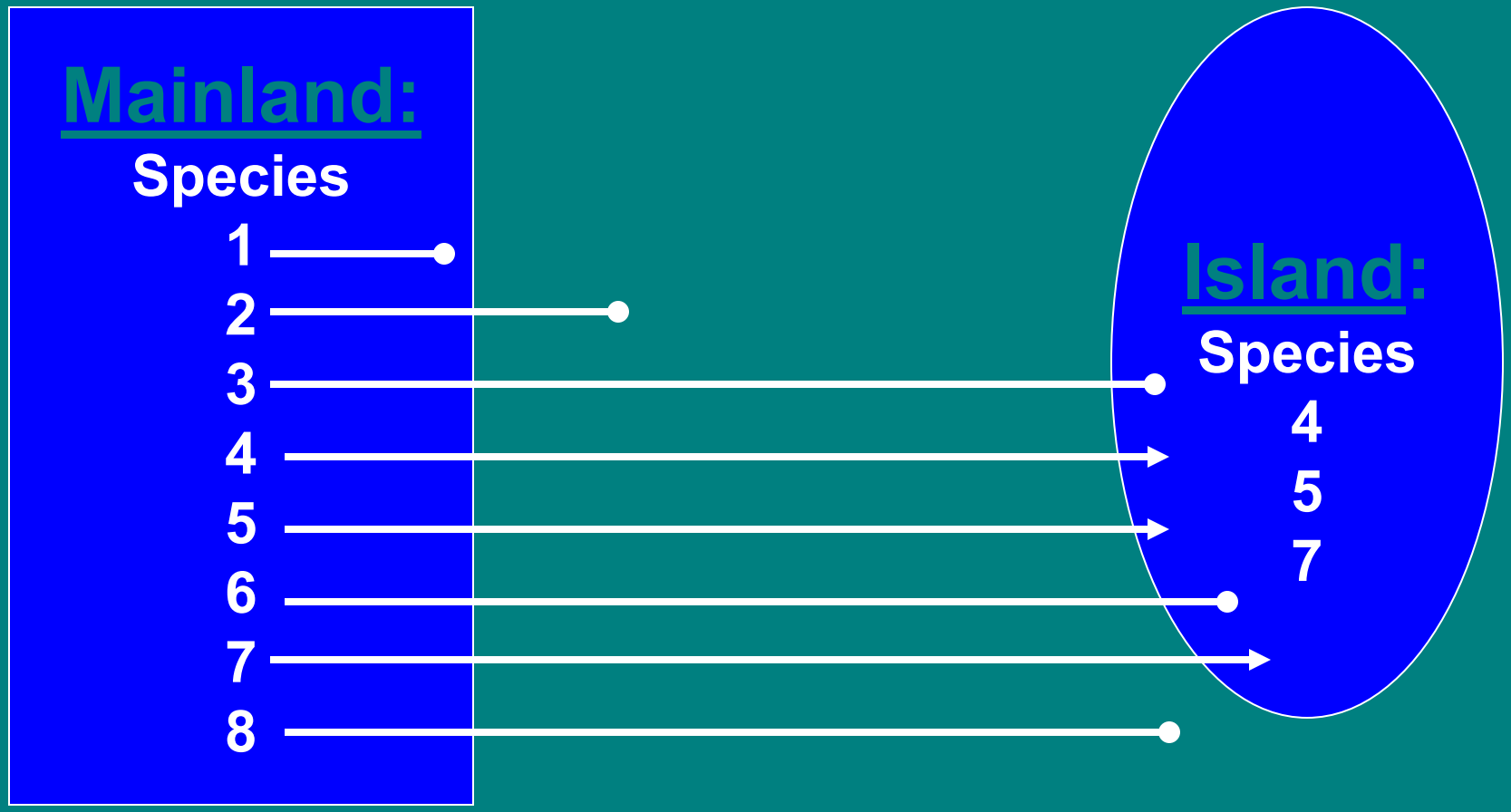
- There is variation within populations.

- Individuals that can better tolerate the different conditions have an advantage.

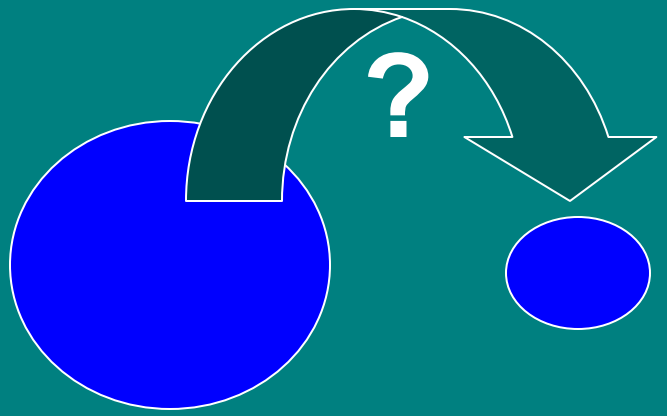
- Those that can move to and survive in someplace else have the potential to become new species.

Maybe overcrowding is not the issue

Speciation and Opportunity



Speciation



Opportunity: 3 Stages

1. Geographic opportunity
2. Physiological opportunity
3. Ecological Opportunity

Speciation

If all three opportunities occur, then a species can expand its' range.

If conditions are slightly different, natural selection may act differently on the different populations.

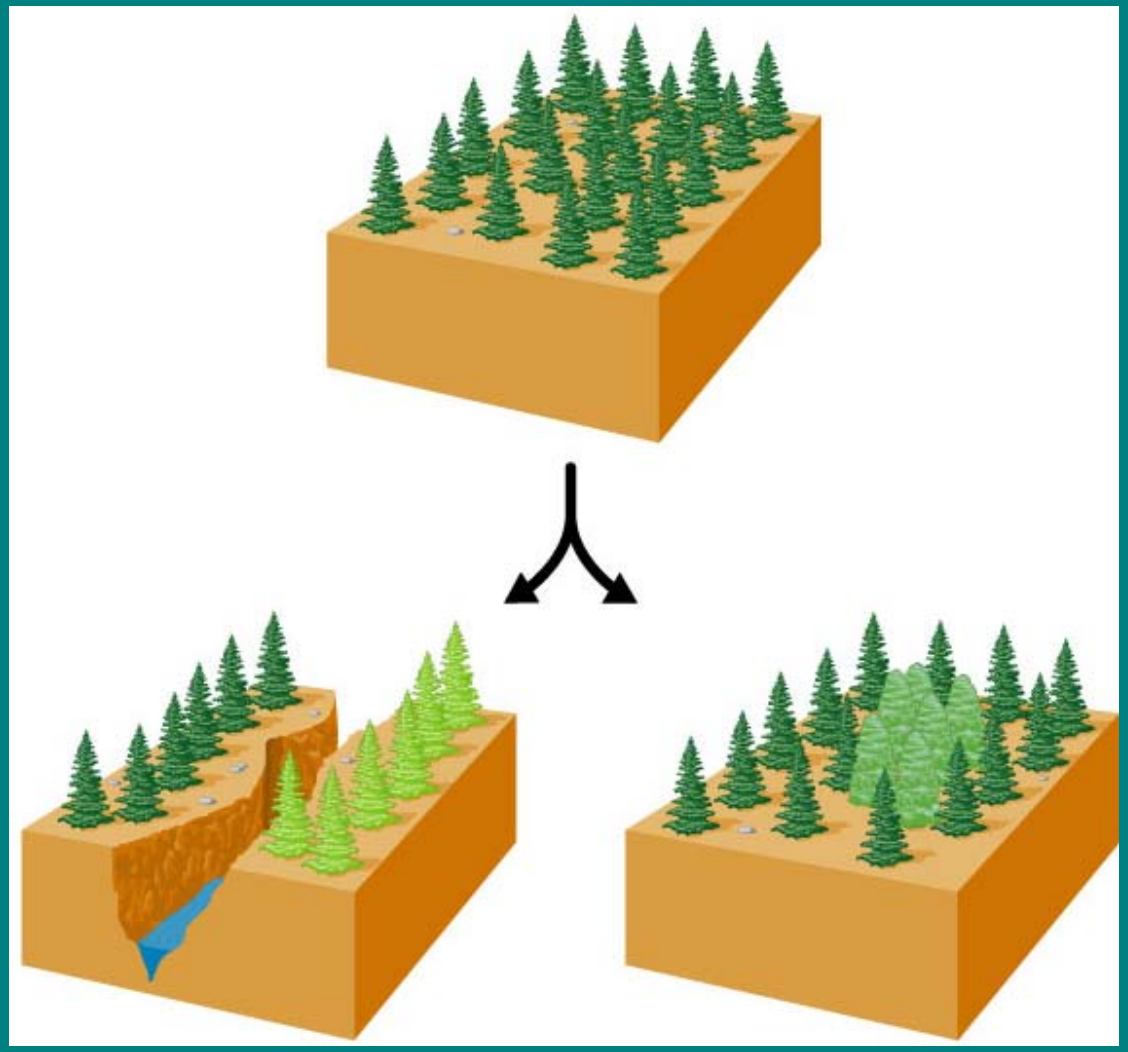
- Peppered moth activity.
- http://www.biologycorner.com/worksheets/pepperedmoth.html

When will they be different species? How much time does it take?

Mechanisms of Speciation

- A key event in the potential origin of species occurs when a population is somehow severed from other populations of the parent species

- The two modes of speciation are
  - Allopatric speciation
  - Sympatric speciation



(a) Allopatric speciation (b) Sympatric speciation

Figure 14.8

Allopatric Speciation

- Geological processes
  - Can fragment a population into two or more isolated populations
  - Can contribute to allopatric speciation

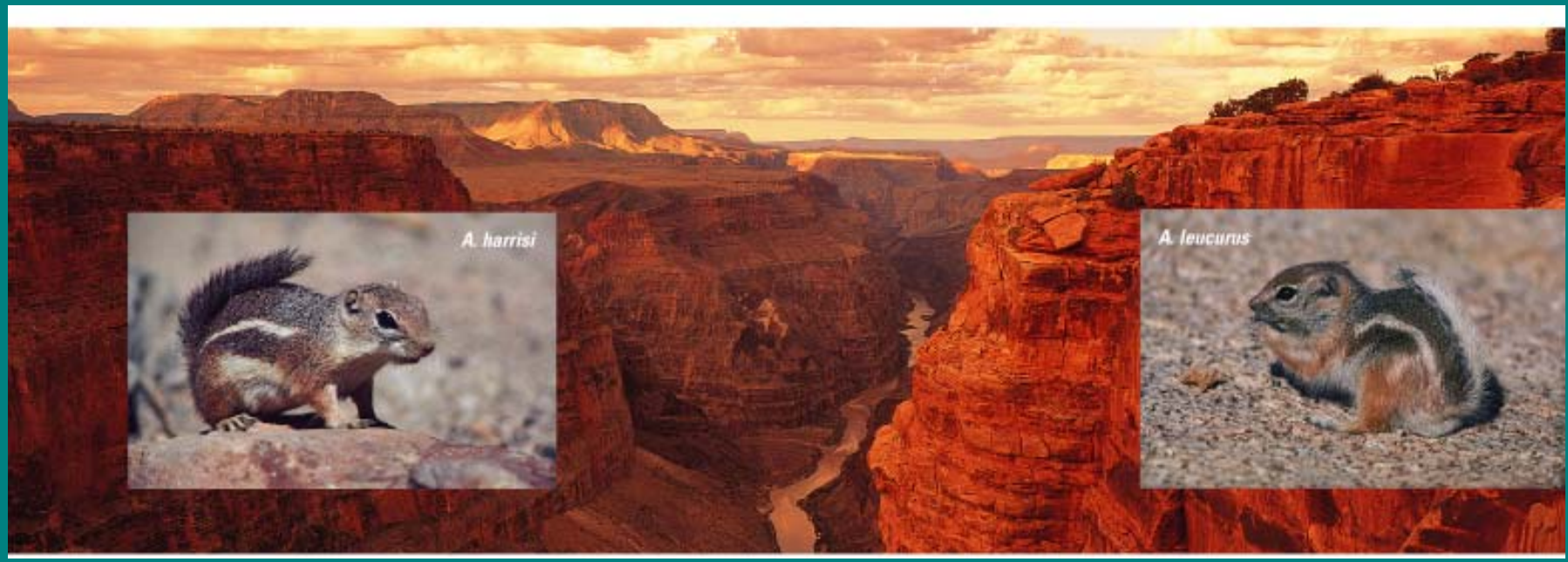
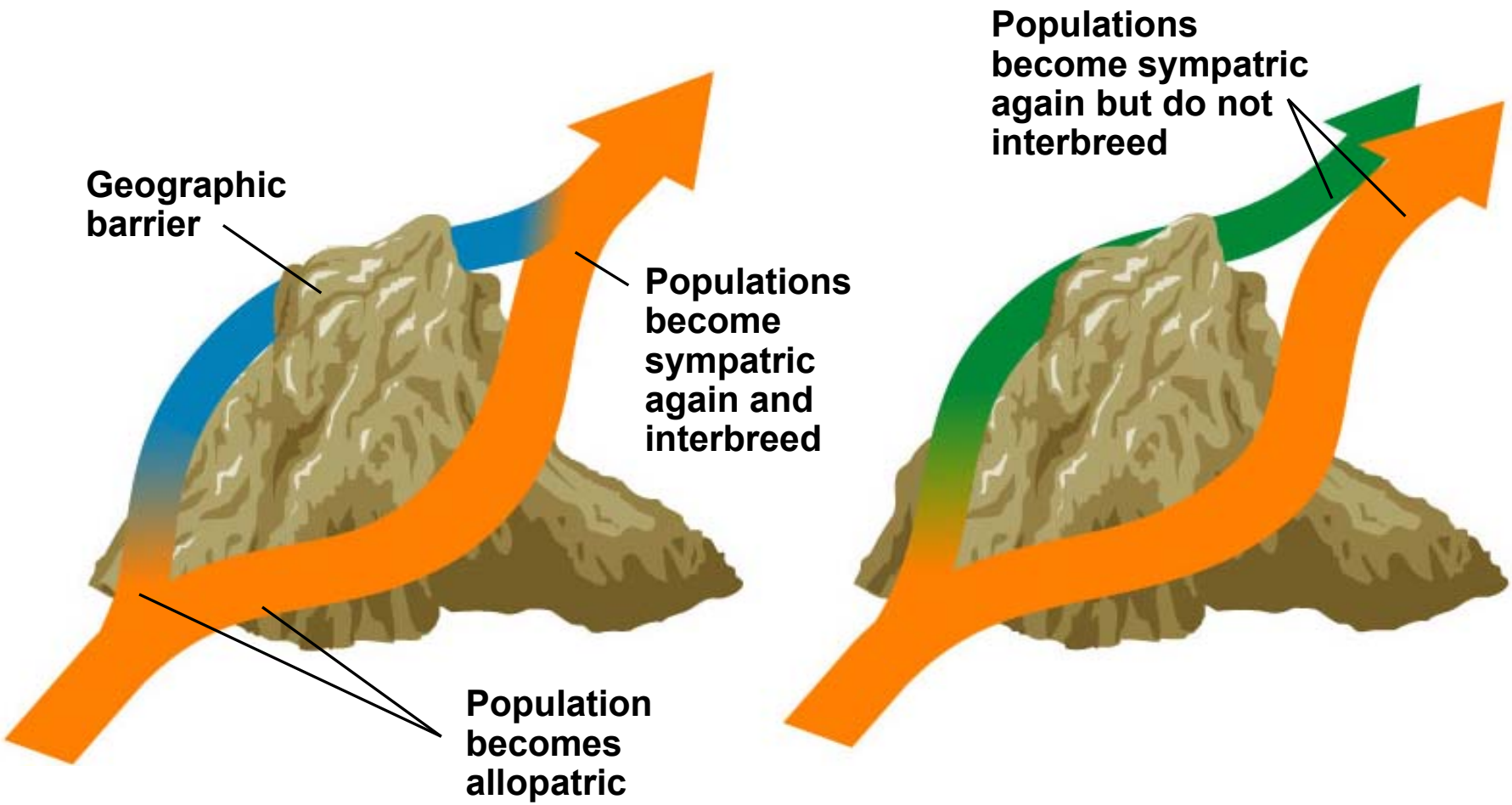


Figure 14.9

- Speciation occurs only with the evolution of reproductive barriers between the isolated population and its parent population



(a) Speciation has not occurred

(b) Speciation has occurred

Figure 14.10