15.3- Shaping Evolutionary Theory

Mechanisms of Evolution

Natural selection is not the only mechanism of evolution.

Population genetics

Hardy-Weinberg principle states that when allele frequencies remain constant, a population is in **genetic equilibrium**.

Genetic equilibrium has five conditions:

1. No genetic drift
2. No gene flow
3. No mutation
4. Mating must be random
5. No natural selection

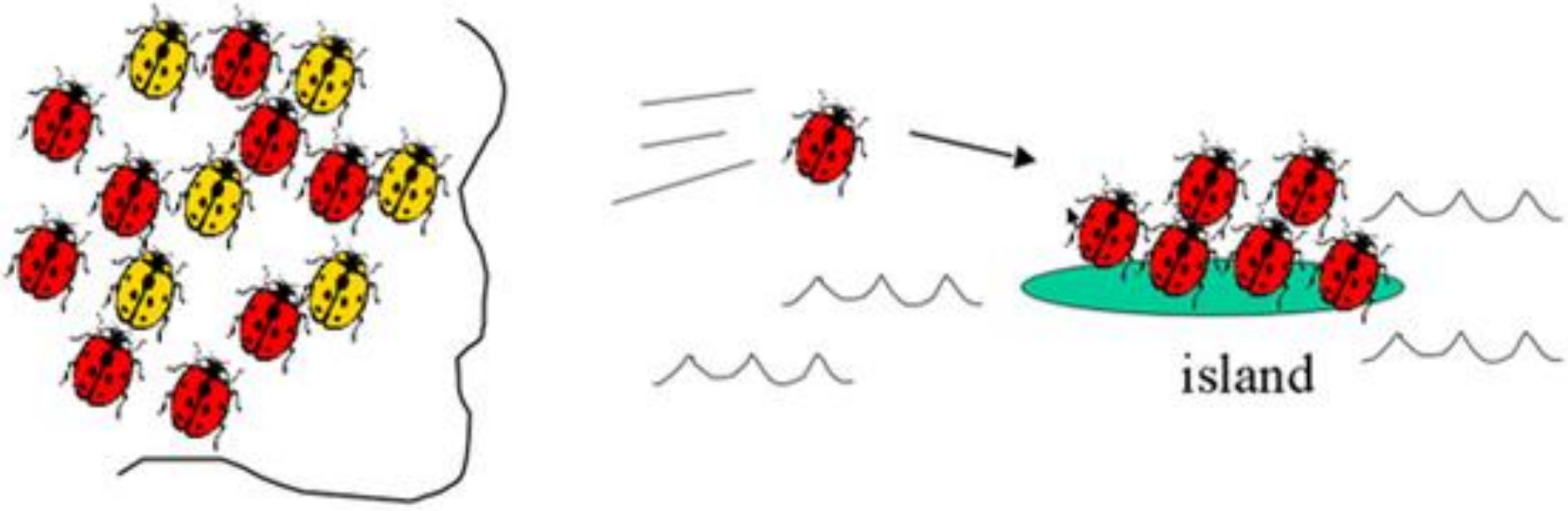
These five conditions are the mechanisms of evolutionary change.

genetic drift- random change in allele frequency

In smaller populations, the chance of losing an allele becomes greater.

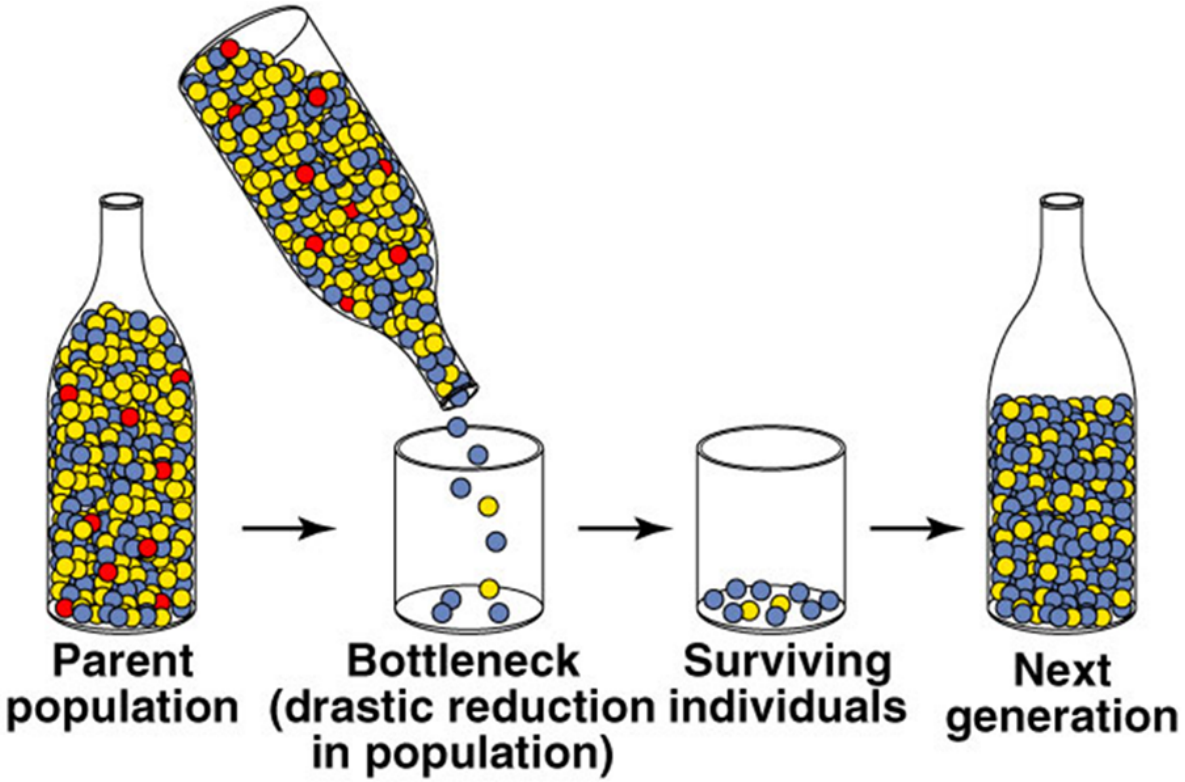
Genetic drift

founder effect a few individuals form a new population with a different allele frequency.

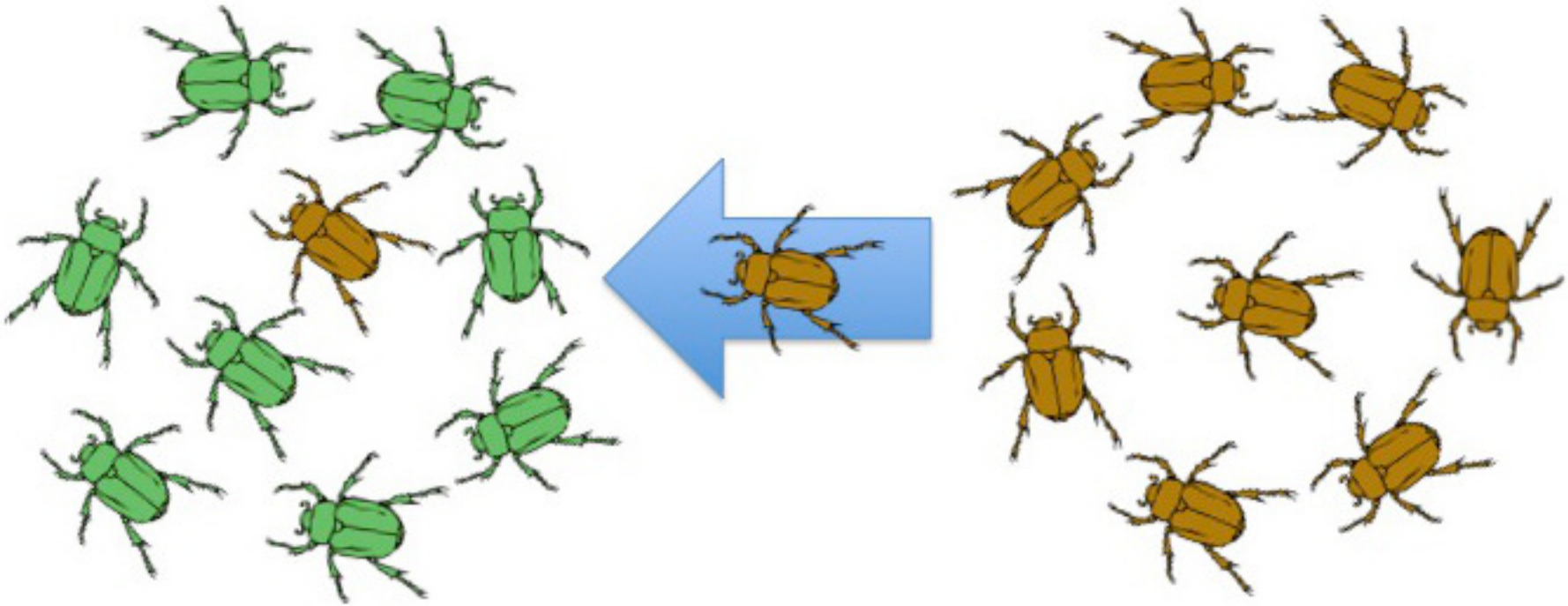


Genetic drift

Bottleneck- a population declines and then rebounds, reduces genetic diversity



Gene flow- organisms migrate/ move between populations



Nonrandom mating- individuals select mates

(don't just mate with whoever shows up.)

The Zoo's Panda breeding program was still getting nowhere.

Mutation- a random change in genetic material.

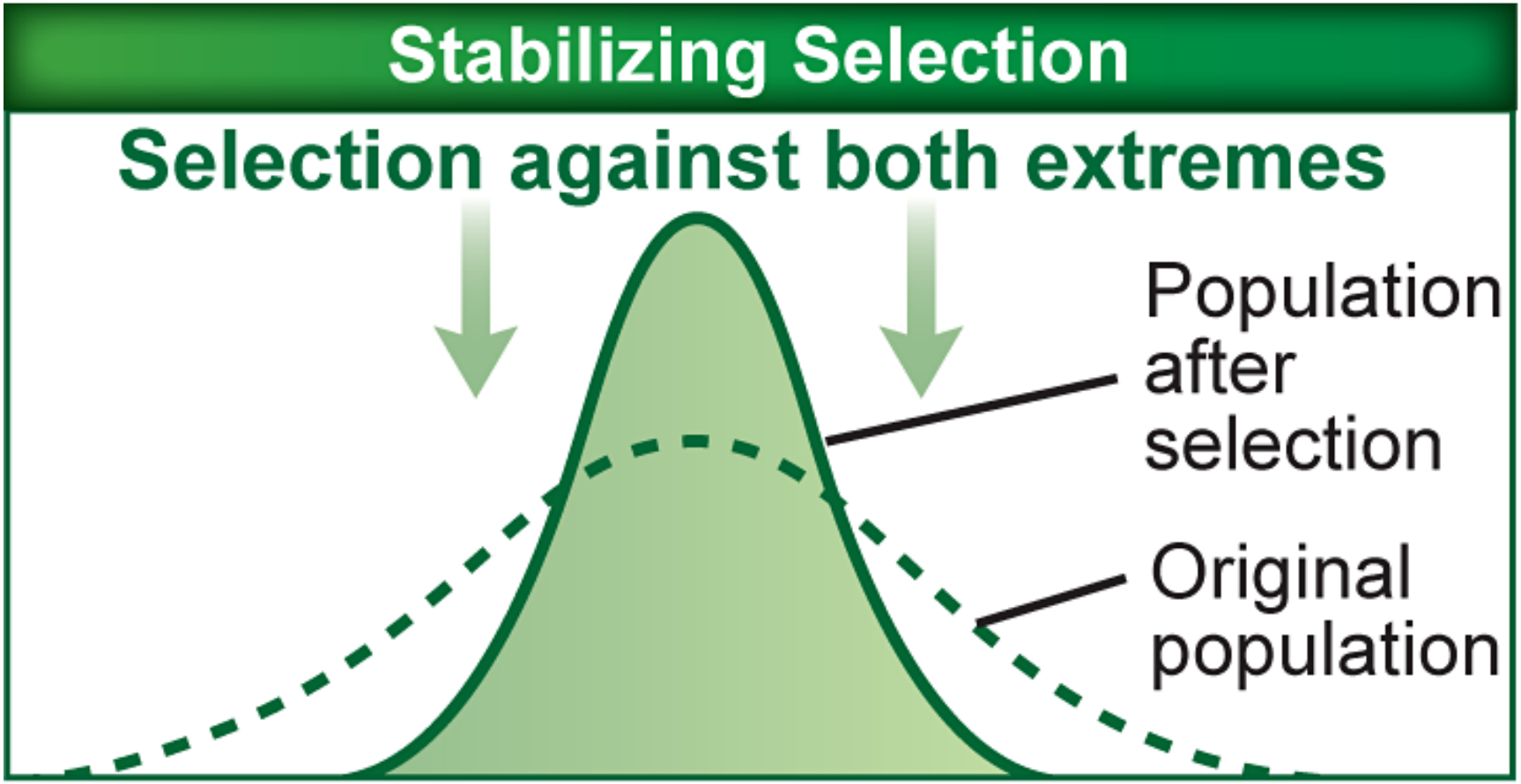
Most mutations are harmful, but some may be beneficial and become more common.

Natural selection- best adapted will survive and reproduce

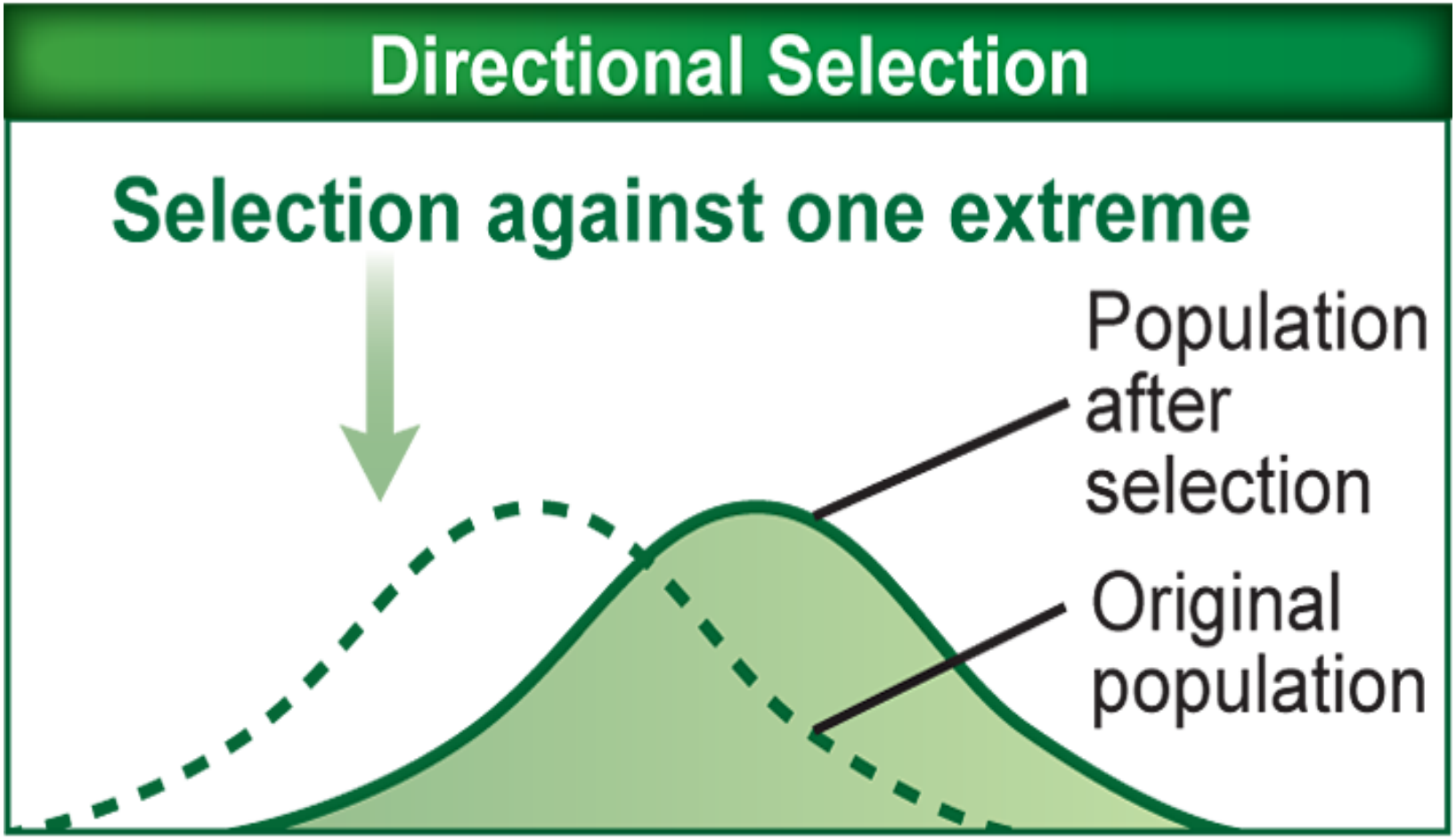
Three types of natural selection:

- Stabilizing
- Directional
- Disruptive

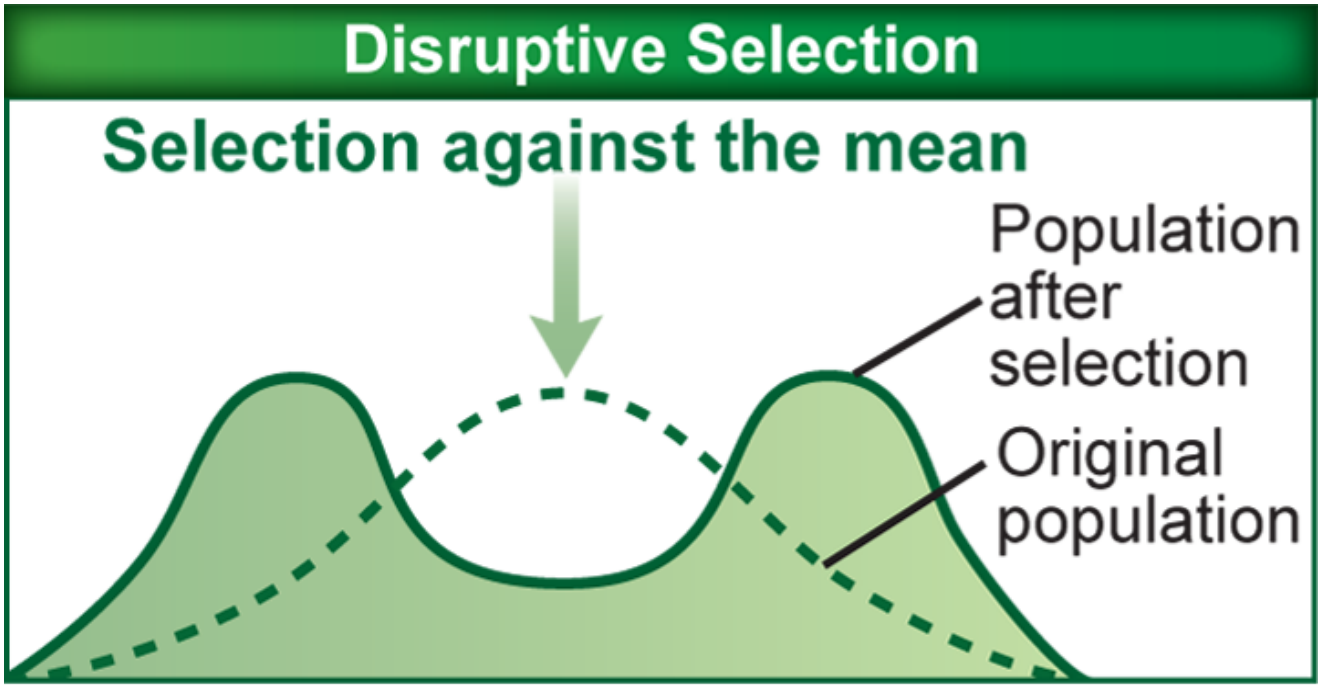
Stabilizing selection average individuals have higher fitness.



Directional selection one extreme of a trait increases fitness.



Disruptive selection removes average individuals, both extremes survive.



Sexual selection change in a trait based on ability to attract a mate.

- Some qualities that enhance mating success reduce odds of survival.

Two types of **reproductive isolation** prevent gene flow:

- Prezygotic
- Postzygotic

Prezygotic isolating mechanisms before fertilization occurs.

- geographic, ecological, or behavioral differences

Postzygotic isolating mechanisms
after fertilization, produce infertile hybrid

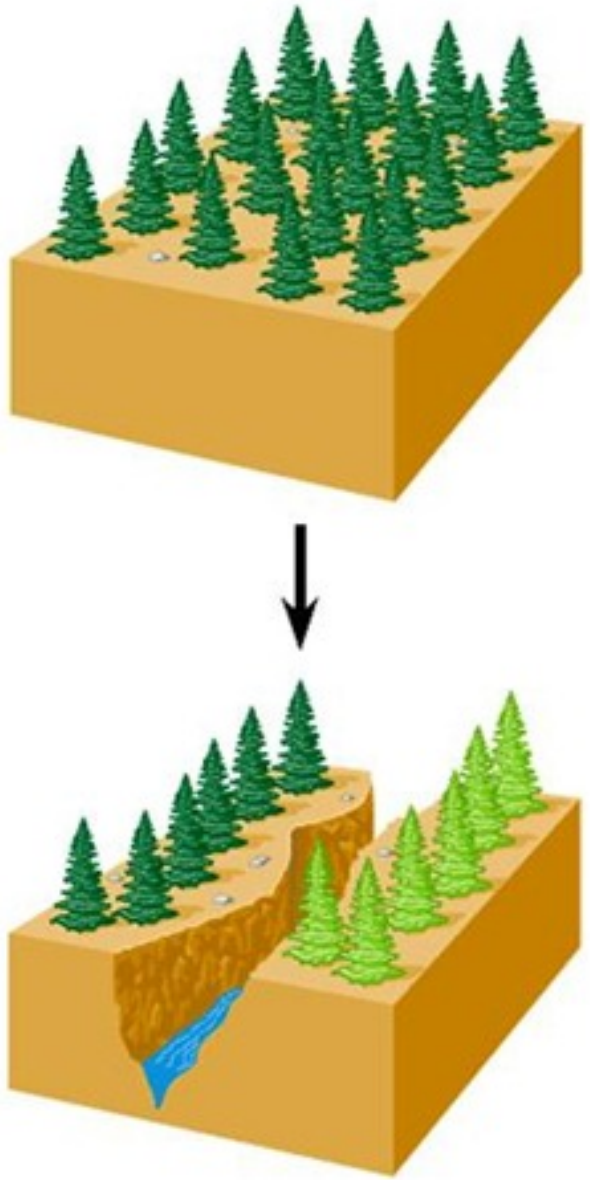
Speciation when a population changes so much that it can no longer produce fertile offspring

Two types of speciation:

allopatric and sympatric.

Allopatric speciation when populations are divided by a physical barrier.

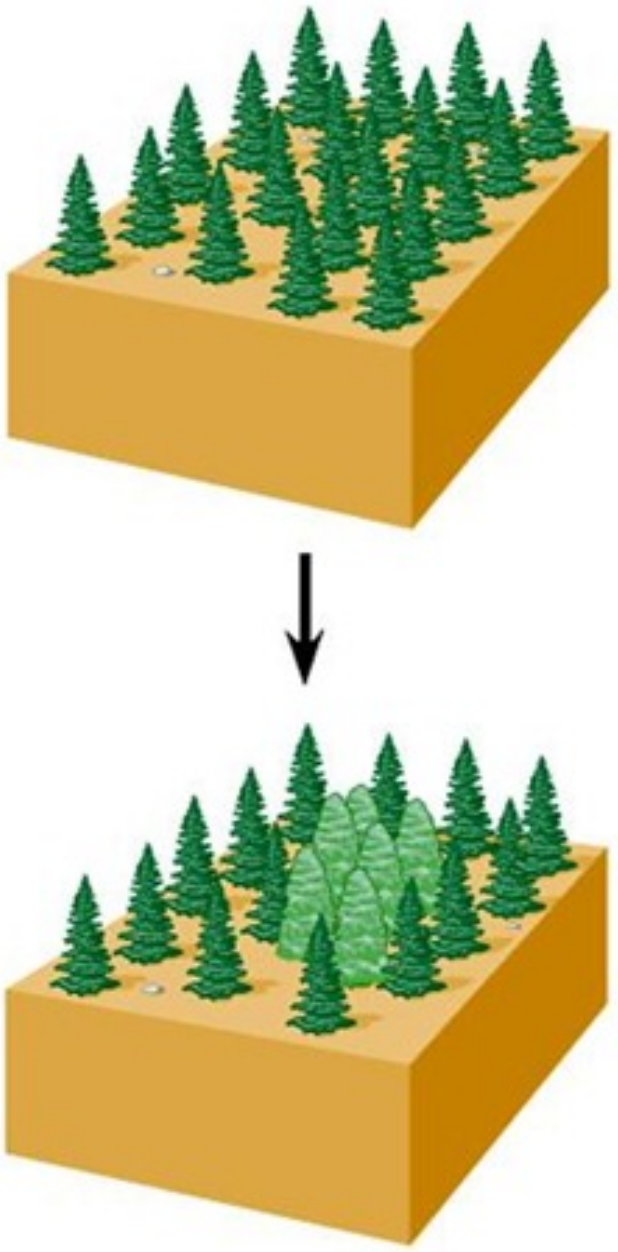
the most common type of speciation.



(a) Allopatric speciation

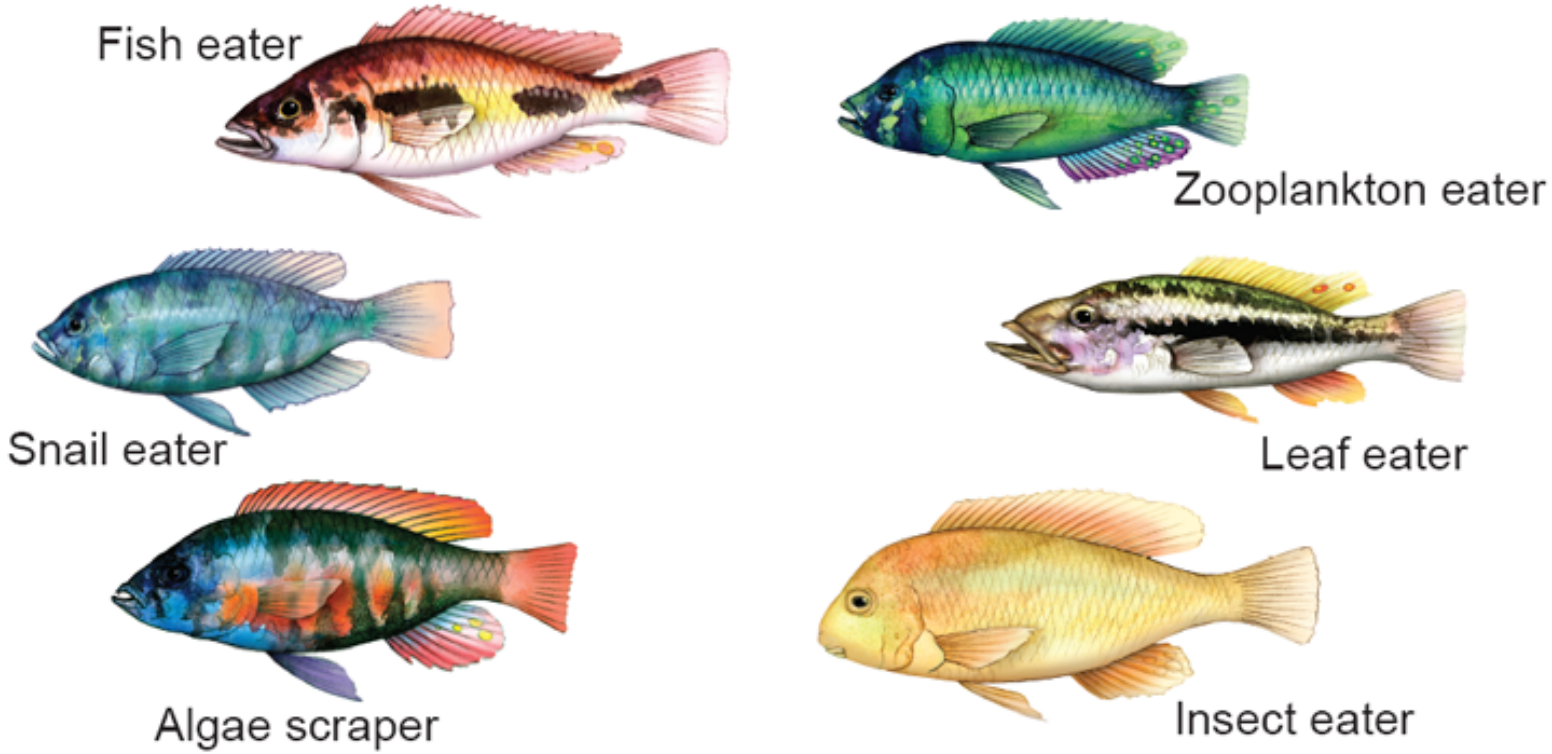
Sympatric speciation occurs without a physical barrier

Common in plants due to polyploidy



(b) Sympatric speciation

Adaptive radiation large number of species arise from a single common ancestor in response to an ecological opportunity.



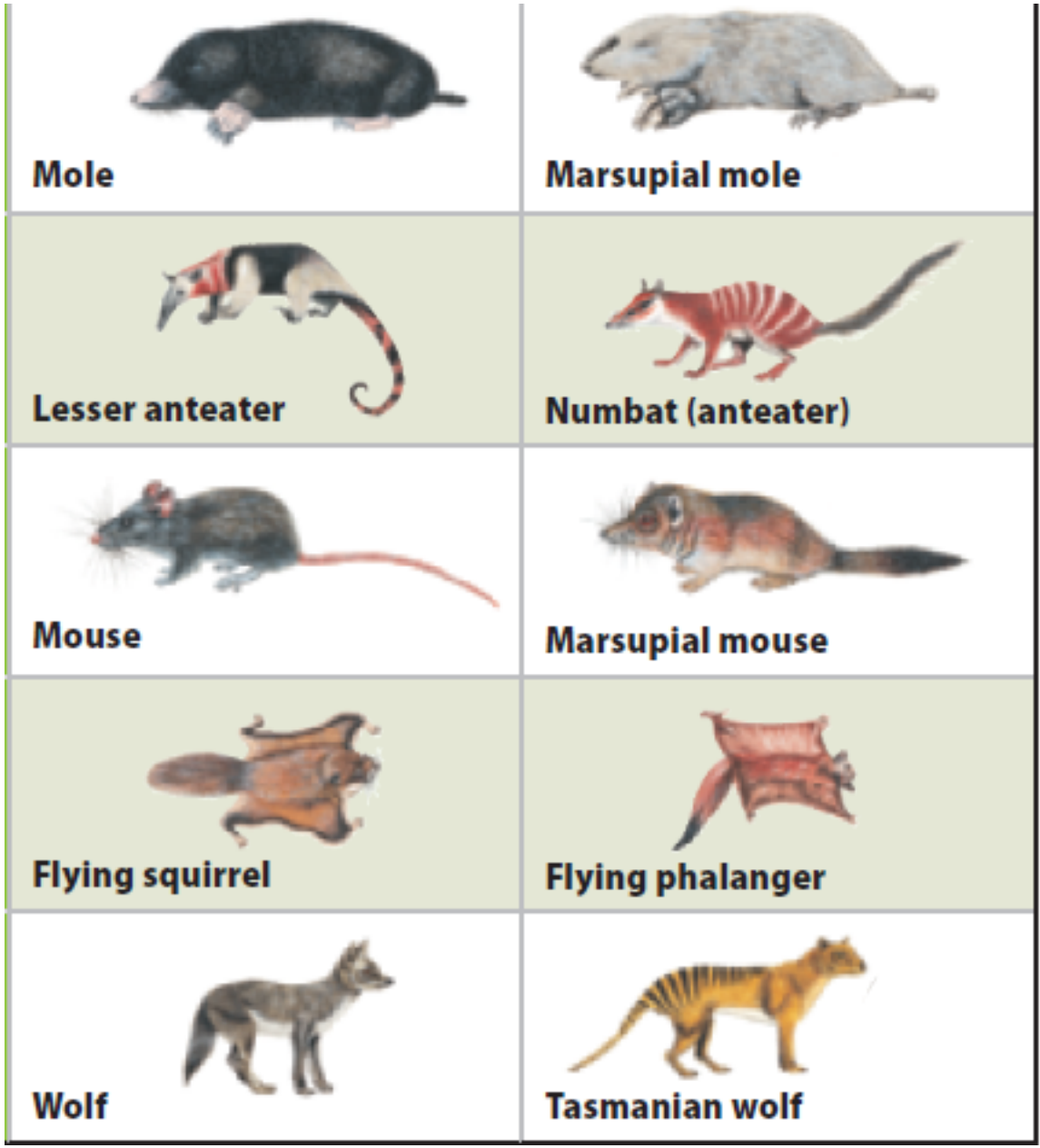
Coevolution- when species influence each other's evolution.

- **Mutualism** – both species benefit
- **Coevolutionary arms race** – parasitic or predatory relationship

Convergent evolution

Unrelated species evolve similar traits

- Occurs where environments are ecologically similar



Rate of speciation

- **Gradualism** Evolution in small, gradual steps
- **Punctuated equilibrium** rapid spurts followed by periods of little change.