

# *Population Change*

- Speciation is the outcome of isolation and divergence.
  - Isolation is created by reductions in gene flow.
  - Divergence is created when mutation, genetic drift, and selection act on populations separately.

## *Defining and Identifying Species*

- Species are distinct types of organisms because they represent evolutionarily independent groups.
- Lack of gene flow makes a species independent.

# *Defining and Identifying Species*

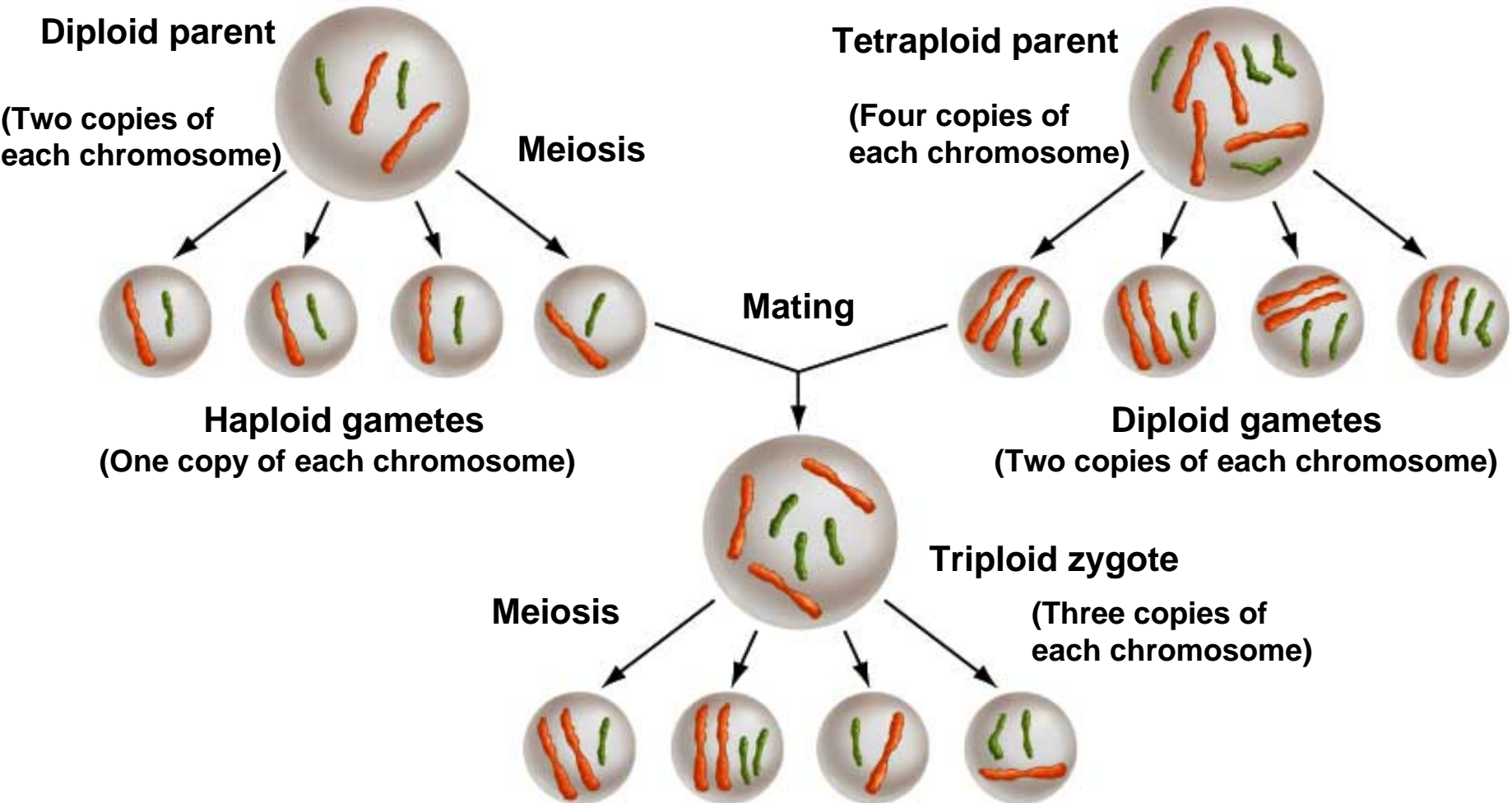
- Species are defined based on several different concepts:
  - The biological species concept is based on reproductive isolation.
  - The morphospecies concept is based on identifying evolutionarily independent lineages.
  - The phylogenetic species concept is based on reconstructing the evolutionary history of populations. (Table 23.1)

**TABLE 23.1 A Summary of Species Concepts**

<b>Species Concept</b>	<b>Criterion for Recognizing Species</b>	<b>Advantages</b>	<b>Disadvantages</b>
Biological	Reproductive isolation between populations (they don't breed and produce viable offspring)	Reproductive isolation = evolutionary independence	Not applicable to asexual or fossil species; difficult to assess if populations do not overlap geographically
Morphospecies	Populations are morphologically distinct	Widely applicable	Subjective (researchers often disagree about how much morphological distinction = speciation)
Phylogenetic	Smallest monophyletic group on evolutionary tree	Widely applicable; based on testable criteria	Few well-estimated phylogenies are currently available

## *Isolation and Divergence in Sympatry*

- Sympatric speciation occurs in populations that occupy the same geographic area. Gene flow is occurring.
  - Natural selection can cause this to occur in spite of gene flow.
  - Polyploidy, a type of mutation, can also cause sympatric speciation.
- Sympatric speciation is relatively common and quick to occur.



**When these gametes combine, most offspring have incorrect number of chromosomes.**

## *Isolation and Diversion in Allopatry*

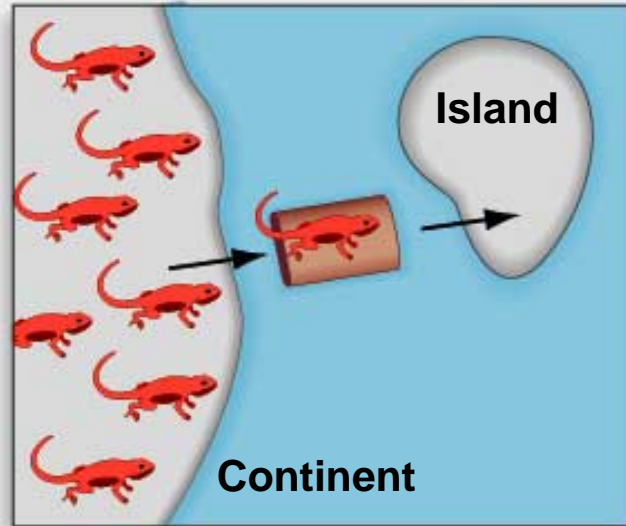
- Allopatric speciation occurs when populations become physically separated from each other.
  - A population can colonize a new habitat.
  - A new physical barrier can split a widespread population into two or more isolated groups.

## *Isolation and Diversion in Allopatry*

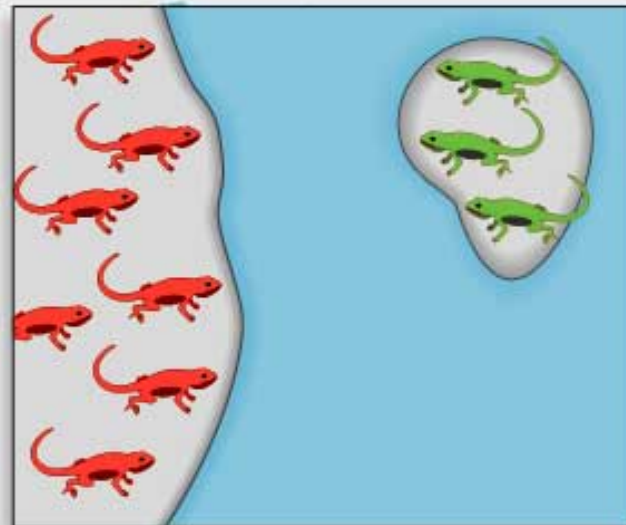
- Colonization events are more common on islands.
- When a physical barrier separates a population, a vicariance event is said to occur.



## DISPERSAL AND COLONIZATION

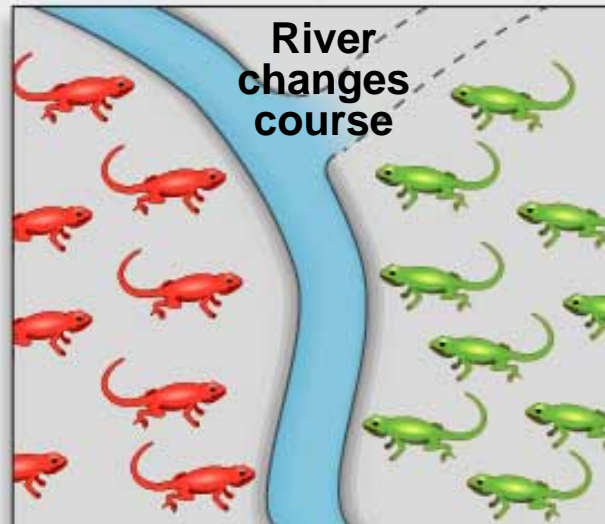
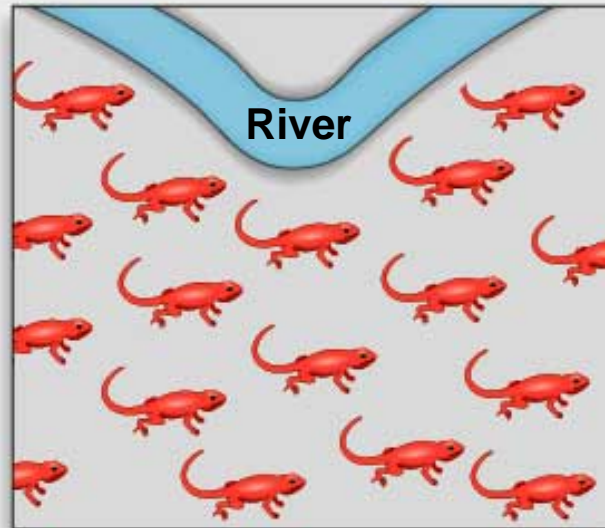


**1. Start with one continuous population. Then, a colonist floats to an island on a raft.**



**2. Finish with two populations isolated from one another.**

## VICARIANCE



**1. Start with one continuous population. Then a chance event occurs that changes the landscape (river changes course).**

**2. Finish with two populations isolated from one another.**

## *Secondary Contact*

- These are mechanisms that keep two or more species reproductively isolated after they come back in contact with each other following isolation and divergence.
  - Prezygotic mechanisms make it very unlikely that interbreeding will even take place.
  - Postzygotic mechanisms cause hybrids to become sterile or to fail to develop properly.

## *Secondary Contact*

- Hybrid zones are areas where interbreeding occurs and hybrid offspring are common.
- New species may also arise through the hybridization process.