- **ecological species concept** defines species in terms of its ecological niche, the sum of how members of the species interact with the nonliving and living parts of their environment
  - EX- two species of oak tree might differ in their size or in their ability to tolerate dry conditions, yet still occasionally interbreed — they are different niches but are still connected by gene flow
- **phylogenetic species concept** defines a species as the smallest group individuals that share a common ancestor, forming one branch on the tree of life
  - EX- biologists trace the phylogenetic history of species by comparing its characteristics, such as morphology or molecular sequences, with those of other organisms
  - groups of organisms that are sufficiently different to be considered separate species

24.2 Speciation can take place with or without geographic seperation

- **allopatric speciation,** gene flow is interrupted when a population is divided into geographically isolated subpopulations
  - ex- water level in a lake may subside, resulting in two or more smaller lakes that are now home to separated populations

The Process of Allopatric Speciation

- one geographic separation has occurred, the separated gene pools may diverge
- different mutations arise, the natural selection and genetic drift may alter allele frequencies in different ways in the separated populations

Polypoloidy

- a species may originate from an accident during cell division that results in extra sets of chromosomes, a condition called **polyploidy**
- polyploid speciation occasionally occurs in animals
- two distinct forms of polyploidy have been observed in plant populations
- **autopolyploid** is an individual that has more than two chromosomes sets that are all derived from a single species
  - ex- a failure of cell division could double a cell's chromosome number from the original number (2*n*) to a tetraploid number (4*n*)
- a tetraploid offspring can produce fertile tetraploid offspring by self-pollinating or by mating with other tetraploids — reproductively isolated from 2n plants of the original populations, because the triploid (3n) offspring of such unions have reduced fertility
- a second form of polyploidy can occur when two different species interbreed and produce hybrid offspring
- in subsequent generations, various mechanisms can change a sterile hybrid into a fertile polyploid called an **allopolyploid**, fertile when mating with each other but cannot interbreed with either parent species; thus, they represent a new biological species

Habitat Differentiation

- sympatric speciation can occur when a subpopulation exploits a habitat or resource not used by the parent population