**Chapter 24: The Origin of Species *Notes***

**Must Knows:**

1. the biological concept of species
2. prezygotic and postzygotic barriers that maintain reproductive isolation in natural populations
3. a description of similar species that are maintained separate by each type of isolating barrier
4. how allopatric and sympatric speciation are similar and different
5. how a change in chromosome number can lead to sympatric speciation
6. why speciation rates are often rapid in situations when adaptive radiation occurs or during times of ecological stress
7. the connection between a change in gene frequency, a change in the environment, natural selection or genetic drift, and speciation
8. how punctuated equilibrium and gradualism describe two different tempos of speciation

**24.1 - The biological species concept emphasizes reproductive selection**

biological species concept: a species is a group of populations whose members have the potential to interbreed in nature and produce viable, fertile offspring – but do not produce viable, fertile offspring with members of other such groups

reproductive isolation: the existence of biological factors (barriers) that impede members of two species from interbreeding and producing viable, fertile offspring

hybrids: offspring that result from an interspecific mating

prezygotic barriers: (before the zygote) blocks fertilization from occurring

postzygotic barriers: (after the zygote) contribute to reproductive isolation

morphological species concept: characterizes a species by body shape and other structural features

ecological species concept: views a species in terms of its ecological niche, which is the sum of how members of the species interact with the nonliving and living parts of the environment

phylogenetic species concept: defines a species as the smallest group of individuals that share a common ancestor, forming one branch on the tree of life

**24.2 - Speciation can take place with or without geographical separation** (Trevor)

Allopatric Speciation is when gene flow is interrupted because a population is divided into geographically isolated subpopulations. Allopatric Speciation is important because regions that are more subdivided or isolated by barriers typically have more species than do otherwise similar regions that lack such features.

Sympatric Speciation is when populations that live in the same geographic area form reproductive barriers creating new species. This is less common than allopatric speciation. Sympatric Speciation can occur when gene flow is reduced by such factors as polyploidy, habitat differentiation, and sexual selection.

Polyploidy occurs in both plants and animals but is more common in plants and it is when there is an accident is cell division that results in an extra set of chromosomes.

An autopolyploid is an individual that has more than two chromosome sets that are derived from a single species. In plants, for example, a failure of cell division could could double a cell’s chromosome number from diploid (2n) to a tetraploid (4n).

A tetraploid can produce fertile tetraploid offspring by self-pollinating or by mating with other tetraploids and is reproductively isolated from diploid plants of the original species.

An allopolyploid is creating after various mechanisms change a sterile hybrid into a fertile polyploid which cannot interbreed with either parent species.

Habitat Differentiation is when genetic factors enable a subpopulation to exploit a habitat or resource that is not being used by the parent population.

Sexual Selection can cause populations to have things like a certain color to attract a mate.

**24.3 - Hybrid zones reveal factors that cause reproductive selection** (Kamran)

1. **Hybrid Zone:** A region in which members of different species meet and mate producing at least some offspring of mixed ancestry.
   1. Figure 24.13: The yellow-bellied toads and the fire-bellied toads in the genus *Bombina* show a narrow hybrid zone. The individuals with intermediate allele frequencies are considered hybrids while toads with frequencies close to 1.0 are yellow-bellied toads and the toads with frequencies close to 0.0 are fire-bellied toads.
2. **Formation of a Hybrid Zone and the Possible Outcomes:**
   1. Figure 24.14:

* Three populations of a species are connected by gene flow
* A barrier to gene flow is established
* A population begins to diverge from the other two populations
* Gene flow is re-established in a hybrid zone
  1. **Reinforcement:**
* Occurs when hybrids are less fit than members of their parent species (Strengthening reproductive barriers)
* Figure 24.15: The barriers to reproduction seem to be stronger in birds from sympatric population than birds from allopatric populations.
  1. **Fusion:**
* If hybrids are as fit as parents, substantial gene flow between the species occurs. Parent species can fuse into a single species. (Weakening reproductive barriers)
* Figure 24.16: Because of the cloudy water, *Pundamilia nyererei* and *Pundamilia pundamilia* have hybridized into a single species.
  1. **Stability:**
* Occurs when hybrids survive/reproduce similarly or better than members of their parent species (Continued formation of hybrid individuals)
* Most hybrid zones are stable

**24.4 - Speciation can occur rapidly or slowly and can result from changes in few or many genes** (Niveen and Mario)

**Fast**

* Faster speciation happens when something clears a large majority of a population and leaves a random, and small gene pool
* The small gene pool leaves little room for deviation and if left for not too many generations it will likely result in speciation
* Happens (relatively) quick

**Slow**

* This is the more typical evolution, goes by natural selection
* Is very gradual and will take a long time for speciation to occur

Speciation- an evolutionary process in which one species splits in two or more species





