UNIT V

Chapter 16

Evolution of Populations

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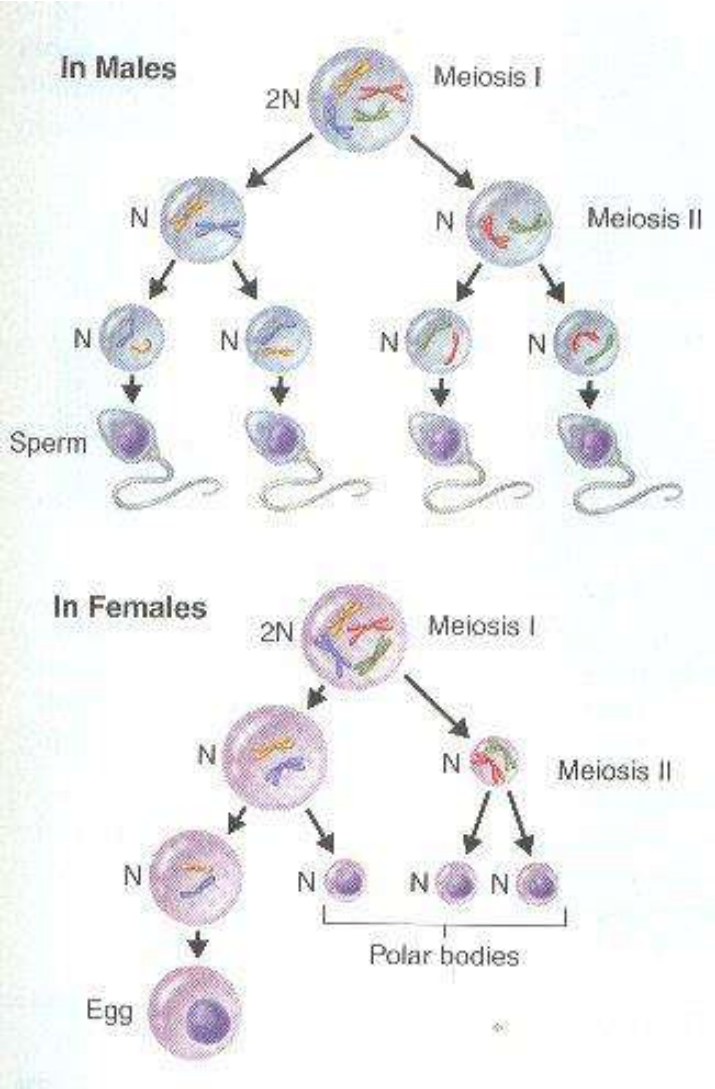
Evolution of Populations

Is about….

- **Changes in the Gene Pool = combined genetic information of all the members of a particular population** &
- Changes in the **Relative Frequency of an allele =** how often a particular allele occurs in a gene pool compared to the other contrasting alleles for that trait (as a %)
  - Ex. Color of Rats in a population

Natural Selection *affects Populations by Changing Allele Frequency which results in Evolution!*



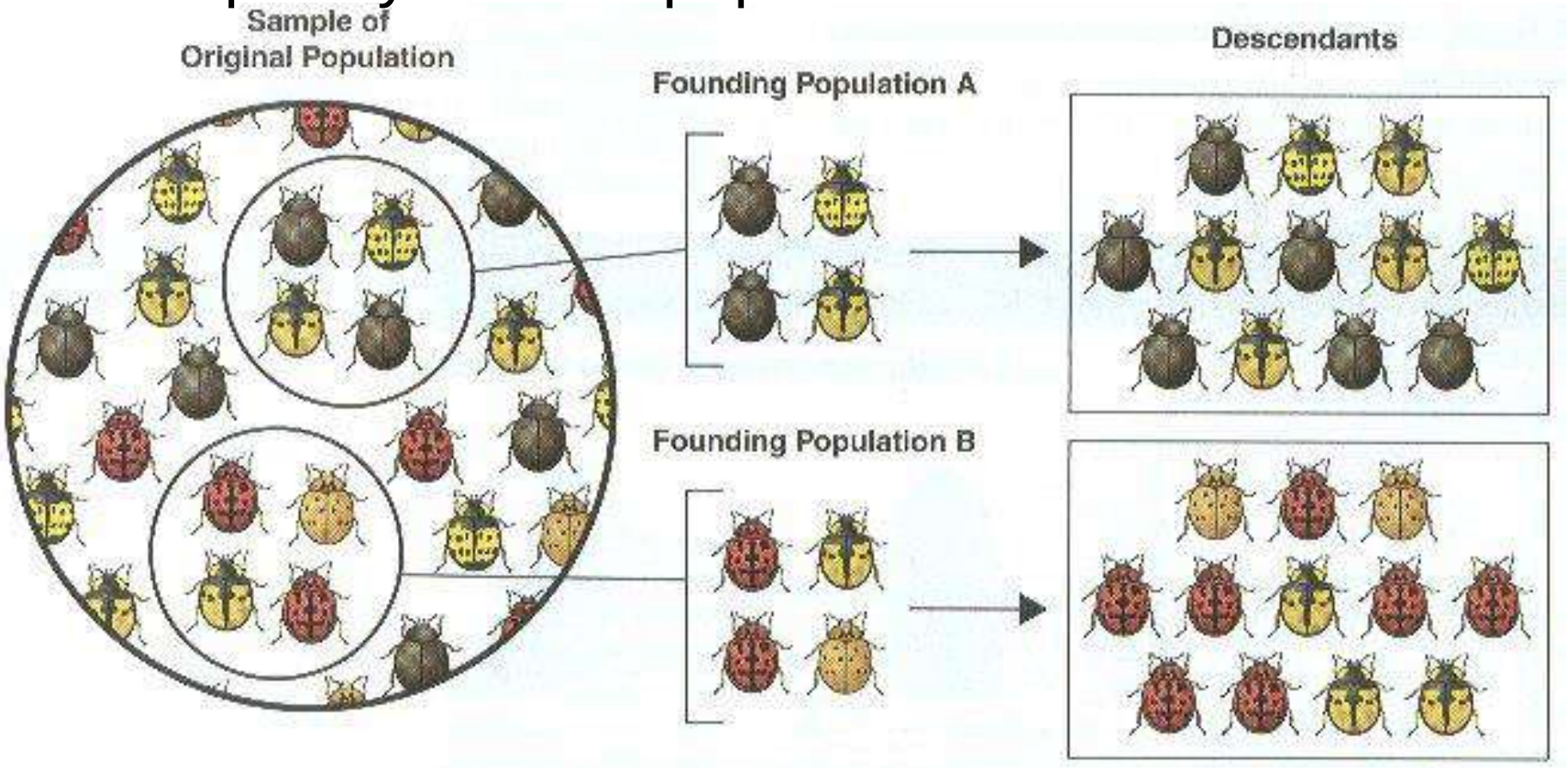
- **Genetic Variation exists and is caused by:**
  - Mutations (insertions, deletions, substitution, inversions)
- **Gene shuffling- Crossing over in Prophase I of Meiosis and Fertilization of Egg by Sperm**

Natural Selection ***works on genetic variation by allowing more of one phenotype to survive than another, thus changing allele frequency (genotype affected when a phenotype survives) as a result!***

- ***Ex. Insect Resistance to pesticides***
- ***Bacterial Resistance to antibiotics***

Genetic Drift- affects Populations by Changing Allele Frequency which results in Evolution!

- Genetic Drift = a random change of allele frequency in small populations



Genetic Drift – How it Happens.

- Some individuals that carry a particular allele may leave more descendants than others, just by chance
  - (In spite of what a Punnett square might predict.)

Genetic Drift – continued

- ***Result-Over time***, a series of these chance occurrences may cause an allele to become more common in the population, with a resulting change in phenotype frequency in the small population
  - Ex. Fruit Fly populations in Hawaii and the Founder Effect

Genetic drift has been observed in some small human populations that have become isolated due to reasons such as religious practices and belief systems. For example, in Lancaster County, Pennsylvania, there is an Amish population of about 12,000 people who have a unique lifestyle and marry other members of their community. By chance, at least one of the original 30 Amish settlers in this community carried a recessive allele that results in short arms and legs and extra fingers and toes in offspring. Because of small gene pool, many individuals inherited the recessive allele over time. Today, the frequency of this allele among the Amish is high (1 in 14 rather than 1 in 1000 in the larger population of the U.S.)

Genetic Equilibrium is the Opposite of Evolution!

- **Genetic Equilibrium = all allele frequencies remain constant with no change!**
- **5 things needed to maintain genetic equilibrium**

1. Random mating: all members of population have equal chance to produce offspring
2. Large Population Size: less genetic drift occurs in larger populations
3. No immigration or emigration: prevents bringing new alleles into the population, no alleles can leave

Genetic Equilibrium …continued…..

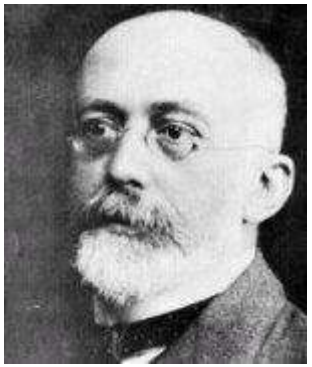
4. No mutations: mutations introduce new alleles into the population

5. No natural selection: no phenotype can have a better advantage in the environment to survive and reproduce than another.

Genetic Equilibrium is the Opposite of Evolution!

1. **Hardy-Weinberg Principle-** states that allele frequencies in population will remain constant unless one or more factors cause those frequencies to change

Godfrey Hardy
(1877-1947)



Wilhelm Weinberg
(1862-1937)

So what? What is important to understand about this?

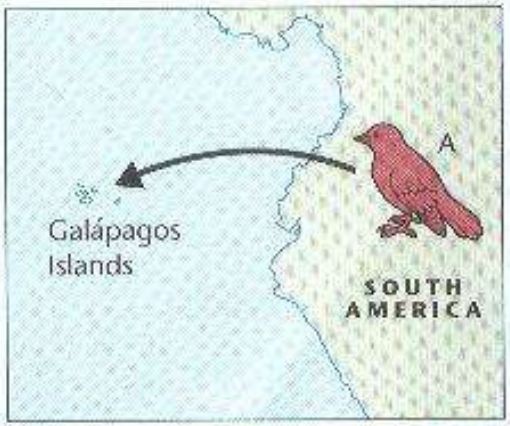
1. Genetic Equilibrium is the Opposite of Evolution!
2. Natural Selection and Genetic Drift cause changes in allele frequency which causes Evolution!
3. Evolution can lead to a new species (Speciation)

So what? What is important to understand about this? Continued…..

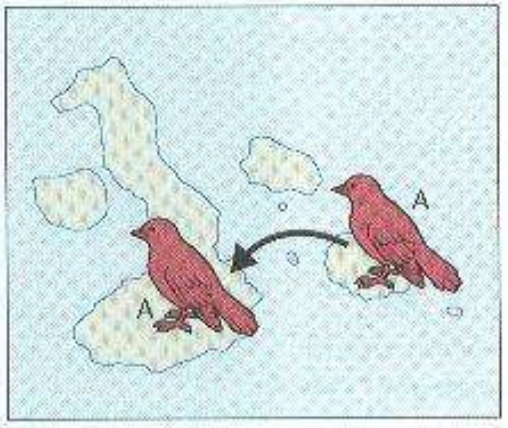
4. A new species is”isolated” from other species reproductively

5. Reproductive isolation can be behavioral (courtship differences); geographic (barrier between habitat) or temporal (breeding season diff.)

The Eastern and Western Meadowlark have overlapping ranges but do not interbreed, because they have different mating songs

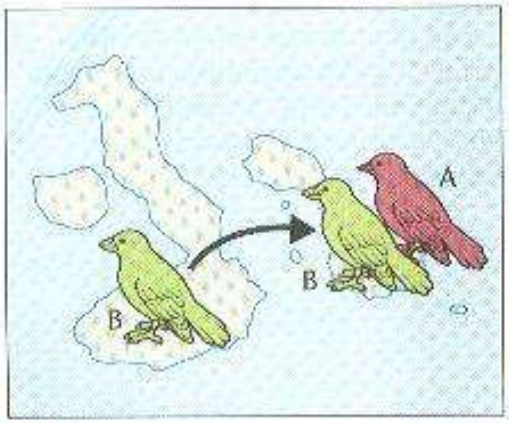


1 Founders Arrive
A few finches travel from South America to one of the islands. There, they survive and reproduce.

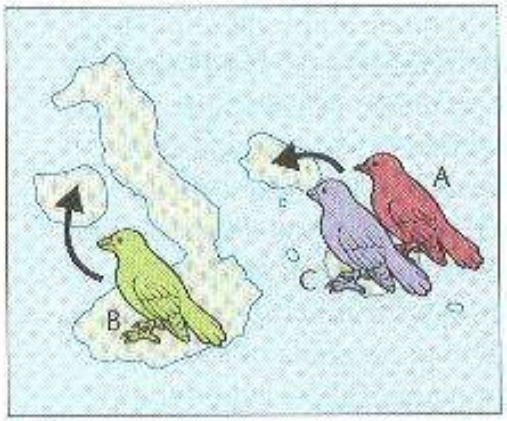


2 Separation of Populations
Some birds from species A cross to a second island. The two populations no longer share a gene pool.

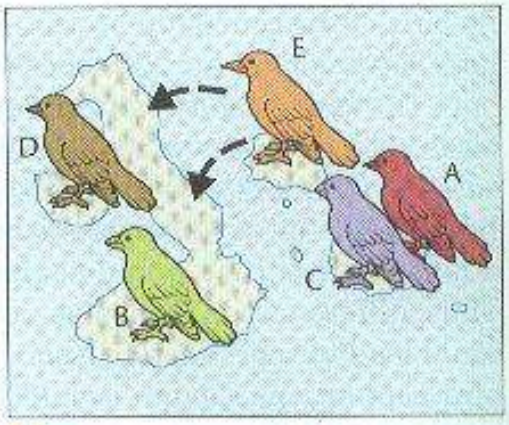
3 Changes in the Gene Pool
Seed sizes on the second island favor birds with larger beaks. The population on the second island evolves into a population, B, with larger beaks.



4 Reproductive Isolation
If a few population-B birds cross back to the first island, they will not mate with the birds of population A. The gene pools are now separate. Populations A and B are separate species.



5 Ecological Competition
As species A and B compete for seeds on the first island, they continue to evolve. A new species, C, may evolve. Some members of the original species B may travel to a new island.



6 Continued Evolution
The process continues, leading to the formation of all 13 finch species on the Galápagos.