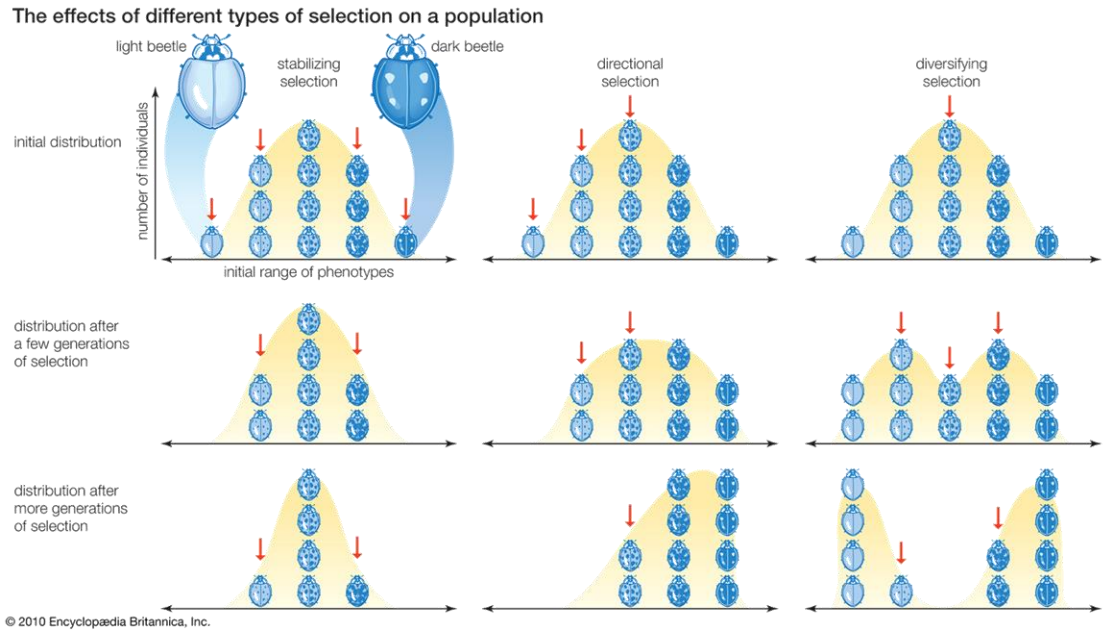
Change Over Time & Classification

Section 2: Evolution of Populations

Genetically speaking, **evolution** is a change in the frequency of alleles in a population over time. A population is a group of species that lives in an area together. Evolution can be measured by examining the development of certain traits that have occurred throughout generations. For example, if an area is sprayed with pesticides, natural selection favors insects with alleles that can resist pesticides. All of the genes found in a population make up its **gene pool**, including all the alleles present.

Three sources of genetic variations found in populations make evolution possible. First, a **mutation** is a change in the genetic material of cells, which is often harmful to organisms. **Genetic recombination** occurs during sexual reproduction, where each chromosome in a pair moves independently during meiosis. In humans, this can produce over 8,000,000,000 gene combinations. Finally, **lateral gene transfer** is passing genes from one organism to another (not including the offspring).

The **Hardy–Weinberg principle** states that allele frequencies will remain constant or have **genetic equilibrium** unless factors cause those frequencies to change. This principle holds true under five conditions. First, species must mate with other species at random. Secondly, genetic changes can affect smaller population sizes. Thirdly, when there is movement in or out of a population, it can be disrupted. Fourthly, mutations can cause a change in allele frequencies and can cause evolution to occur. Finally, when there is no natural selection, genetic equilibrium is disrupted.



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Section 2: Evolution of Populations Continued

When species reproduce and split into two or more species, resulting in the formation of a new species, it is called speciation. The process of speciation fascinated Darwin. Each time this occurs, the diversity of life increases. Some differences are easy to see, and others are not. By looking at finches, we can see how speciation occurs. First, a new population of finches was blown to or flew to the Galapagos Islands from South America. Later, those populations were separated. Some birds left this group and flew to another island. Next, there were changes in the gene pool. Over time, populations on each island became adapted to the local environment. By eating seeds that they found, their beaks started adapting to new food. Next, they experienced reproductive isolation. When birds from populations meet again, the differences in mating behavior or features prevent reproduction. Finally, because of competition, species evolve in a way that increases their differences. The changes above have occurred repeatedly across Galapagos, producing 13 finch species.

Another way the evolution of two separate species can occur is through **reproductive isolation** or when two populations no longer interbreed. These barriers stop the production of offspring; over thousands of years, these populations can produce new, distinct species. This can develop through **behavioral isolation**, **geographical isolation**, or **temporal isolation**. Behavioral isolation occurs when a species fails to send or receive signals from another species. For example, a bird may not recognize the mating ritual of another bird, so it cannot mate. Geographical isolation occurs when there is a lack of opportunities to encounter one another. For example, a river or a mountain may be a geographical obstacle. Finally, temporal isolation is breeding at different times or seasons.

Review:

1. In genetic terms, how is evolution defined?
2. What is the Hardy–Weinberg principle?
3. Identify and describe the ways in which reproductive isolation can occur.