

Understandings:

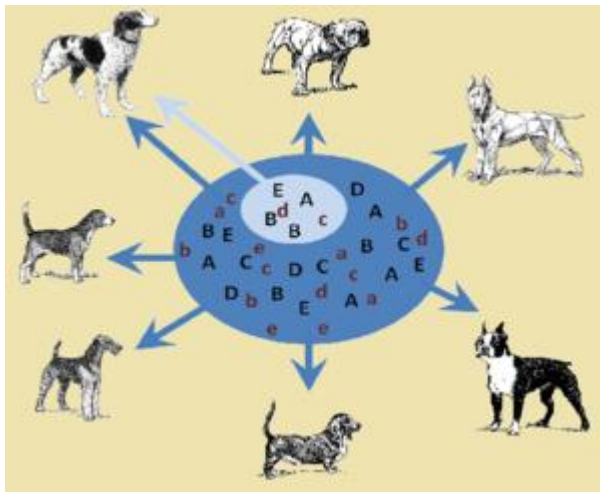
1. Explain what a gene pool is.

- First, let's recall what a population is. Population is a group of same species (interbreed and provide fertile offspring) living at the same place, at the same time.

A gene pool is simply all the genes (more correctly all the alleles) in a population.

The picture below shows the gene pool for dogs. The letters represent all the alleles.

So the word gene pool is literally a pool of all the genes!



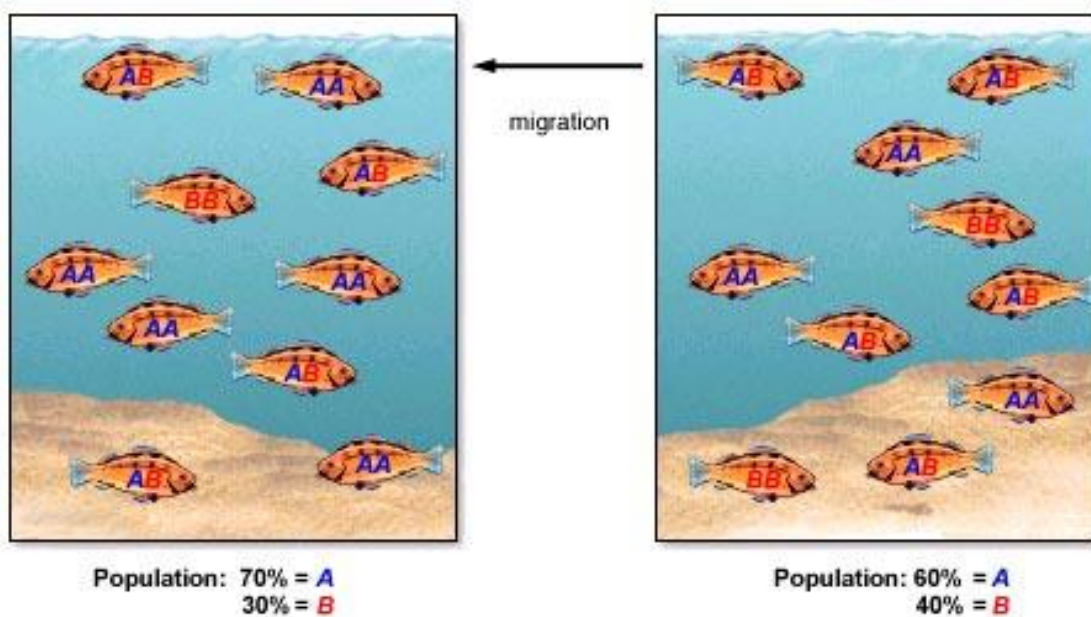
2. Explain the link between allele frequencies and evolution.

- Okay, before digging in, let's recap about the evolution and allele.

Theory of evolution was initially proposed by Darwin, and the theory of heritage with phenotypes and genotypes was introduced by Gregor Mendel.

But you see, when Darwin proposed his theory of evolution, he had no idea about the phenotypes and genotypes (I am exaggerating. He probably had some idea about it). All he knew was that evolution happens when a certain characteristic is fitter for reproduction.

Now ladies and gentlemen, we can use Gregor Mendel's discoveries to explain evolution even better. So, Darwin's natural selection was dependent on the characteristic. But what is characteristic in "Mendel terms"? It is the phenotypes! Thus evolution means a gradual change in phenotypes. But hey, phenotypes depend on the genotypes! So, this means that evolution is the gradual change in appearances of certain alleles. In other words, evolution = change in allele frequencies!



3. Outline the different categories of reproductive isolation.

- We have mentioned that evolution happens when frequencies of alleles change, but what about speciation?

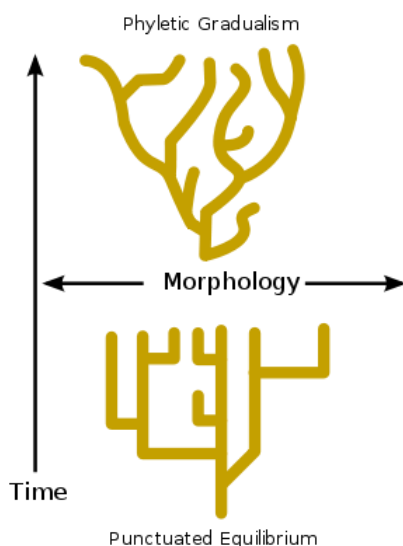
Simply, speciation is when one population diverges into two different populations hence become different species. Thus they evolve into different species and therefore get separated in gene pool. In order for that to happen, they need to be reproductively isolated from each other. So, there are three ways of reproductive isolation IB wants us to know.

The first distinction to make is whether speciation takes place in the same geographic area or due to geographic separation.

Speciation in same geographic area. Sympatric speciation. Sym (same) patric (land).	Speciation due to difference of geographic area. Allopatric speciation. Allo (different) patric (land).
<p><u>Temporal isolation:</u> Temporal means “momentary” so it is associated with time. Essentially, temporal isolation is when the reproductively active period becomes different. This is common in plants, where the <u>flowering period differs</u> due to difference in response of weather & temperature. So when one flower is active, then another flower might be not active.</p> <p><u>Behavioral isolation:</u> This is very vague, but it is basically when the members in a population is only attracted and can attract members from the same population. Hm!</p>	<p><u>Geographical isolation:</u> This is the most common type of speciation I <u>would say</u>, just a speculation. Since many populations migrate, there is a large chance that the population might become isolated. This is also common for fish. The fluctuations in water separate them and therefore make them reproductively isolated.</p>

4 and 5. Explain what gradualism and punctuated equilibrium is. Then, distinguish those two theories.

- We have two theories about the rate of evolution.



The first theory is that evolution happens gradually, which is gradualism. Imagine a giraffe's neck. Gradualism says that their neck's length is naturally selected gradually until the optimal length is reached. Although we miss some fossils evidence of these intermediary steps, gradualists think that they exist. We just have not found it.

On the other hand, punctuated equilibrium is the opposite. It says that evolution happens rapidly in intervals. Giraffe's neck therefore is short for long period, and then natural selection happens during a short span and only tall giraffes survive. So missing fossil evidence might not be gaps after all. The fact that there aren't any might be the evidence.

Applications and skills:

1. Identify examples of directional, stabilizing and disruptive selection.

- We can have selection in three different ways, depending on what the nature favors.

The first one is stabilizing. This is when the average phenotypes are favored rather than extreme phenotypes. An example is number of offspring females get. Having too few reduces the chance of them surviving. Having too many reduces the chance of providing them with enough nutrition. Thus enough is good!

The second one is disruptive selection. This is when favor the extreme phenotypes. It can be both side of the extremes, such as short and tall. Eventually they won't be able to interbreed. An example is the bird Loxia curvirostra. They have an asymmetrical overlap of beaks and asymmetrical characteristics help them to access to seeds easier.

The third one is directional. This is when there is selection of one side of disruptive selection. This is progressive change. Isolated populations are usually favored for this selection. Eventually they won't be able to interbreed. Thus taking the same example, direction is when only the Loxia bird with beak overlap from left to right is favored.

2. Explain how speciation in the genus Allium happened by polyploidy.

- Polyploid is when there are more than three sets of homologous chromosomes and may happen due to error in cell division. Some can have $1n$, most have $2n$ and some have $3n$. Allium is a genus that includes onions, leeks, garlics etc. and it is polyploidy is common in these.

Since polyploids become reproductively isolated, those with polyploids usually reproduce asexually, therefore most common in plants.

3. Be able to compare allele frequencies of geographically isolated populations.

- Yes, done in class.

TOK:

1. Punctuated equilibrium was long considered an alternative theory of evolution and a challenge to the long established paradigm of Darwinian gradualism. How do paradigm shifts proceed in science and what factors are involved in their success?