Chapter 5-6: Gene Flow

The forces of evolution take place within a population, which is defined as a group of interbreeding members of a species living in a geographical area. The collection of genes within this population is referred to as the gene pool. Gene flow is the addition of an immigrant's genes to the gene pool of a population that leads to altered allele frequencies in the population. In this plate, we examine how gene flow takes place in a population of fish as we explore its history.

The history of the fish population is seen in four views, represented by the four rows of diagrams in the plate. As the history proceeds, we will see how new genes arise in a population, changing the character of it. Plan to use medium colors, and watch for the arrows, which are an integral part of the plate.

The process of gene flow begins with an original **fish population (A)** living in a lake. The fish are all of the same species, so the same medium color should be used for all of them. The gene pool in this population is stable and the phenotypes of all fish appear the same.

At some point in the history of the population, a climatic change occurs, and the lake begins to dry at a high area across its center. When this occurs, a **separation of the population (B)** occurs, indicated by the arrows. The result of this is seen in the second diagram, where the original fish population is split into two populations. You should use the same color that you used in the first diagram because the gene pool remains the same, despite the population division. One group has now been geographically isolated from another group of the same species.

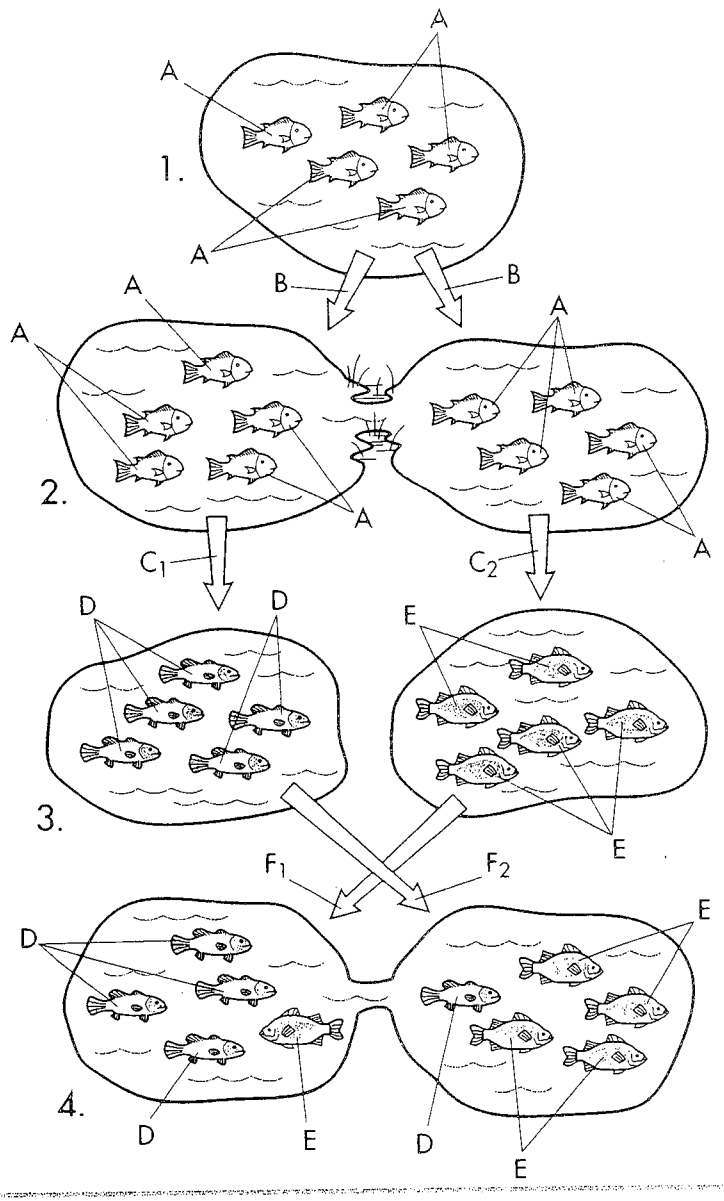
Now we have seen how members of a population can become geographically isolated by an environmental change. Geographic isolation results when two populations are unable to interbreed. Note, however, the gene pool is still the same, despite the separation. We now continue with the history of the population and investigate the introduction of new genes.

The two fish populations continue to live separately. At some time in the future, it is possible that a mutation may occur in the population on the left. This is the **first mutation (C_1)**. While this is happening, a **second mutation (C_2)** may take place in the second fish population and a new gene will be introduced to both groups. In the lake on the left, there is **a new population (D)**, while in the lake on the right the **second new population (E)** arises. Different colors should be used for the fish, because they now have different genetic compositions. The gene pools of the two populations are different. It should be noted, however, that new species of fish have not arisen. Instead, some new genes have entered the population. The species remains the same because the fish in the two lakes can still breed with one another.

Having established two different gene pools in two different populations of fish, we are now ready to examine the process of gene flow. Your attention should be focused on the fourth diagram as you continue your reading below. The same colors used in the third diagram should be used in the fourth because the gene pool has not changed.

Let us suppose that at some time in the future, a climatic change causes a channel to form between the two lakes, so that the fish are no longer isolated geographically. As a consequence of the union, a fish of the second population swims into the first population in a **first exchange (F_1)**. Similarly, a fish of the first population swims to the second population, in a **second exchange (F_2)**. The addition of each immigrant fish brings its genes into the populations. Genes are exchanged between the two groups during interbreeding. If the stranger brings variations into the population, then the effect of gene flow is similar to that of a mutation. In this way, variability is introduced to the population and new combinations of genes are possible in the gene pool.

Contribution of gene flow to evolutionary change depends on the rate of immigration and the amount of genetic difference between the immigrants and the host population. For example, when the immigration rate is low (one fish has entered the population in our example), the effect on the host population's gene pool is small. By contrast, if many immigrants enter the population, the effect will be great and the contribution of gene flow to evolutionary change will be substantial.



Gene Flow

- ○ Original Fish Population ..... A
- ○ Separation of Population ..... B
- ○ First Mutation ..... C_1
- ○ Second Mutation ..... C_2
- ○ First New Population .. D
- ○ Second New Population .. E
- ○ First Exchange ..... F_1
- ○ Second Exchange ..... F_2

5.6 Gene Flow

a. A group of interbreeding members of a species living in a geographical area:
b. The collection of genes within the population is referred to as:
c. The addition (or subtraction) of genes to the gene pool of a population:
d. This alters the gene ____ in the population.
e. When the water dried up in the middle, the fish became ____ isolated.
f. What happened in each of the new fish populations that made their genetic compositions different?
g. When the fish are then allowed to interbreed, ____ is introduced & new combinations of genes are possible.
h. Contribution of gene flow to evolutionary change depends on: