

7.012 EVOLUTION SECTION

You are a time-traveling evolutionary biologist studying a particular species of snake on an island off the coast of Massachusetts. You travel 300,000 years into the past and observe that the snakes are a variety of colors (red, blue, yellow, green) and that most of the snakes are blue. This same species of snake and the same mix of colors are found on the mainland.



a) Assuming that all the snakes are descended from an ancestral blue snake, where did the other colors come from?

Mutation. Mutations in the pigment-producing genes of the snake could have resulted in progeny of different colors.

At the present time, the snakes are still the same variety of colors, but most of the snakes are green.

b) Explain this change in color frequency (evolution) as though it were based solely on each of the following processes.....

i) Bottleneck effect.

It happened that most of the snakes on the island were killed by a flood that did not discriminate on the basis of color. Although there was no selective advantage to green, it just so happened (chance events) that most of the surviving snakes happened to be green (the survivors were not a representative sample of the original population); resulting in a mostly green population.

ii) Founder effect.

Although there was no selective advantage to green, it just so happened that a catastrophe killed all the snakes on the island. It then happened that the island was colonized by a group of snakes from the mainland of different colors, most of which were green, resulting in a large population of green snakes on the island.

iii) Migration.

A large number of green snakes migrated to the island from the mainland; the mainland population happens to be mostly green. This increased the frequency of the green allele in the island population, resulting in mostly green snakes.

iv) Non-random mating.

For some reason (a genetic influence on behavior), green snakes become the "mate of choice" among the snakes on the island, leading to an increase in the frequency of the green allele in the population.

v) Natural selection.

Some selective force acts against the non-green snakes, reducing their number or reproductive output, resulting in a relative increase in green snakes. For example, a predator could come to the island which is unable to see the green snakes against the green foliage and therefore eats only the other snakes.