CAIE Biology A-level

Topic 17 - Selection and Evolution

Definitions and Concepts

Allopatric speciation - A form of speciation that occurs when two populations become geographically isolated due to a physical barrier.

Antibiotic-resistant bacteria - Bacteria that mutate to become resistant to an antibiotic, survive and reproduce very rapidly, passing on their antibiotic resistance.

Artificial selection - See 'selective breeding'.

Climate change - The gradual change in regional and global climate patterns attributed to increasing atmospheric levels of greenhouse gases (e.g. carbon dioxide, methane gas).

Competition - When different organisms compete for the same resources (e.g. light, water, mates, territory) in an ecosystem. This limits population sizes.

Continuous variation - A type of variation that cannot be categorised e.g. skin colour, height. It produces a continuous range in which a characteristic can take any value. Multiple genes influence continuous variation.

Directional selection - A type of selection that favours one extreme phenotype and selects against all other phenotypes.

Discontinuous variation - A type of variation that can be categorised e.g. blood group. A characteristic can only appear in discrete values. One or two genes influence discontinuous variation.

Disruptive selection - A type of selection that favours individuals with extreme phenotypes and selects against those with phenotypes close to the mean.

Evolution - The gradual change in the allele frequencies within a population over time. Occurs due to natural selection.

Founder effect - A type of genetic drift in which a few individuals of a species break off from the population and form a new colony. This results in smaller gene pools and an increased frequency of rare alleles.

Gene pool - All of the different versions of genes (alleles) in the individuals that make up a population.

Genetic bottleneck - A drastic reduction in population size leading to reduced genetic diversity within a population.

Genetic drift - Random variations in allele frequencies in small populations, due to mutations.

Hardy–Weinberg principle - A model that predicts that the ratio of dominant and recessive alleles in a population will remain constant between generations if the following five conditions are met: no new mutations; no natural selection; no migration; large population; and random mating. It provides a formula for calculating the frequencies of alleles:

$$p^2 + 2pq + q^2 = 1.0$$

where p is the frequency of the dominant allele, and q is the frequency of the recessive allele.

Inbreeding - The formation of offspring from the breeding of closely related individuals.

Natural selection - The process by which the frequency of beneficial alleles gradually increases in a population's gene pool over time. This theory was developed by Charles Darwin.

Selection pressures - Factors that affect an organism's ability to survive in an environment e.g. disease, prey, competitors, water availability.

Selective breeding - The process by which humans artificially select organisms with desirable characteristics and breed them to produce offspring with desirable phenotypes. Selective breeding may also be referred to as 'artificial selection'.

Speciation - The formation of new species due to the evolution of two reproductively separated populations. Two forms: allopatric and sympatric speciation.

Stabilising selection - A type of selection that favours individuals with phenotypes close to the mean (average) and selects against extreme phenotypes.

Sympatric speciation - A form of speciation that occurs when two populations within the same area become reproductively isolated.

T-test - A statistical test used to determine whether there is a statistically significant difference between the means of two data sets that show normal distribution. A paired t-test compares means from two different samples. An unpaired t-test compares means from the same sample.

Variation - The differences between individuals due to genes, the environment or a combination of both.