Biology Level 3

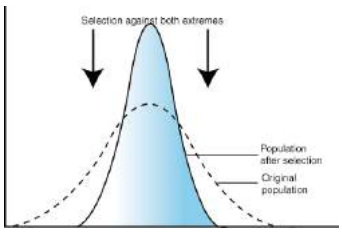
Speciation

Natural Selection

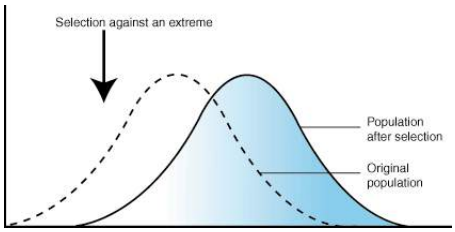
What you need to know:

Natural selection is the process by which the phenotype best adapted to their particular biological niche will be more likely to survive and pass their genes onto the next generation.

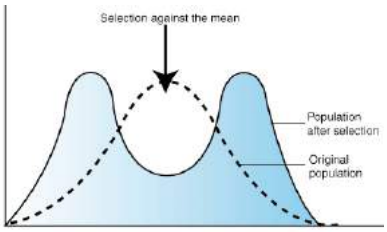
Natural selection is divided into three different types:



Stabilising



Directional



Disruptive

Video Summaries

Speciation

What you need to know

Within a species different groups can develop:
Deme - local population / subgroup where phenotypic variations reflect local environmental factors.
Cline – geographical gradient in the phenotype of individuals of the same species. Often occurs in relation to changing altitude or latitude.

Speciation: The process that leads to the development of a new species.

1. **Allopatric speciation** (different origin)
Speciation occurs because a group becomes geographically isolated from a parent group (e.g. island, glacier, river).

2. **Sympatric speciation** (same origin)
Speciation occurs within the same geographic area. Gene flow Is prevented by a mechanism that is not geographic e.g. behavioural, reproductive.

Reproductive Isolating Mechanisms

Reproductive isolating mechanisms – any factor that prevents two organisms from different species from mating and producing fertile offspring.

Geographic: the physical environment can isolate gene pools.
Temporal: the *timing* of activity or reproduction does not overlap.
Ecological: (habitat) closely related species occupy different niches within the same area.
Ethological: (behavioural) courting rituals that are species specific.
Structural: (anatomical) structural variations between species prevent reproduction.

E.g. Flower shape for pollination

E.g. lock and key sex organs

Video Summaries

Patterns of Evolution

What you need to know

Convergent evolution - species with similar niches develop similar adaptations over time despite having different ancestors. This is due to exposure to similar selection pressures.

- **Analogous organs –** organs have same basic structure and function but evolved independently from different ancestral organs in unrelated species.
- **Ecological equivalents –** species with different origins develop similar adaptations because they occupy similar niches in different geographic areas.

Divergent evolution - two or more related groups develop different adaptions because they occupy different niches.

- **Adaptive radiation** - where a number of different species develop from common ancestor.
- **Homologous organs** are found in related species, evolved from a common ancestral organ which have adapted and diverged to have a different function, but they still have a similar structure.

Parallel evolution - similar features evolve in species with a common ancestor, due to similar selection pressures.
Sequential evolution - this occurs when species change over time. Also called linear, serial or vertical evolution.
Co-evolution - reciprocal evolutionary effect that two species can have on each other when they interact. Each species provides a natural selective influence on the other and they evolve together.

Chance Changes in Genes

What you need to know

Patterns of Evolution
Gradualism – evolutionary change that occurs at a relatively slow, steady rate.

Punctuated equilibrium - evolutionary change in a pattern of short periods of rapid change followed by longer periods of relatively slow change (stasis).

Change changes in gene frequencies
Genetic drift – chance changes in gene frequencies (that occur in small populations). Some genes become more or less common because individuals that carry them produce more offspring as a result of chance rather than adaptive advantage.

Founder effect - occurs when small number of individuals establishes new population. Gene pool will reflect genotypes of founder individuals. Genetic variation is reduced, but otherwise rare genes may be common simply because they were carried by 'founders'.

Bottleneck effect – when a population becomes small and then expands, new gene pool will reflect genotypes of individuals at the bottleneck. This is an important consideration for endangered species.