

CAIE Biology A-level

Topic 17: Selection and Evolution

Flashcards

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Describe the difference between continuous and discontinuous variation.



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- **Continuous variation** - shown by a characteristic that can have any value over a range e.g. human height
- **Discontinuous variation** - shown by a characteristic that can only take certain values e.g eye colour or blood group



Explain the genetic basis of continuous variation.



Explain the genetic basis of continuous variation.

Characteristics that show continuous variation are often controlled by many genes. The alleles at each gene locus have a small effect, all of which are added together to control a characteristic.



Explain the genetic basis of discontinuous variation.



Explain the genetic basis of discontinuous variation.

Typically characteristics that show discontinuous variation are controlled by one or a few genes. The alleles present at these gene loci have a large effect on the characteristic.



State how the phenotype arises.



State how the phenotype arises.

The phenotype results from the interactions between the genotype and the environment.



Why is the t-test used?



Why is the t-test used?

The t-test is used to determine whether there is a statistically significant difference between the means of two data sets that show normal distribution.



Why is genetic variation important for selection?



Why is genetic variation important for selection?

Variation in a population increases the likelihood that some individuals will have a phenotype which is better suited to the environment, particularly as environmental changes occur. These individuals will have more reproductive success.



Explain why natural selection occurs.



Explain why natural selection occurs.

Natural selection occurs because populations have the capacity to produce many offspring and increase their numbers exponentially. The individuals of the population must compete for resources; those who are better adapted (due to genetic variation) will survive, reproduce and pass on their alleles to the next generation.



Describe stabilising selection.



Describe stabilising selection.

In stabilising selection, the extremes of a characteristic are selected against. This does eliminate some genetic variation, and so tends to occur when environmental conditions are constant for a long time.



Give an example of stabilising selection.



Give an example of stabilising selection.

Human birth weights - babies born too far below or above the optimum weight may not survive infancy. They therefore cannot reproduce and pass on their alleles. The extremes are selected against.



Describe and give an example of directional selection.



Describe and give an example of directional selection.

When environmental conditions change, individuals with a characteristic away from the mean will be better suited to the new environment, and this extreme is selected for. An example of this is antibiotic resistance in bacteria.



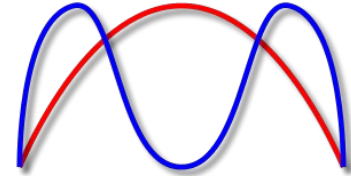
What is disruptive selection?



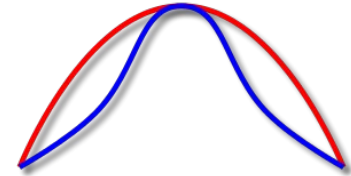
What is disruptive selection?

The extremes of a characteristic are favoured and the mean is selected against. This can result in two subpopulations with different phenotypes, and is important for evolutionary change.

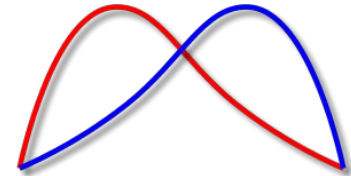
Disruptive selection



Stabilizing selection



Directional selection



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How does selection affect allele frequency in a population?



How does selection affect allele frequency in a population?

Environmental factors exerting the forces of selection change the allele frequency of a population by increasing advantageous alleles. Selection does not affect the probability of new mutant alleles arising, it affects the frequency of the alleles already in the population.



What is genetic drift?



What is genetic drift?

A change in allele frequency in a small population due to chance.



Describe the founder effect.



Describe the founder effect.

The founder effect is a type of genetic drift. It occurs when a small subpopulation is isolated from the larger parent population. This small population has less genetic variation and may not have the same proportion of alleles as there was in the original population.



What is the bottleneck effect?



What is the bottleneck effect?

Population numbers are significantly reduced in one generation, which reduces genetic variation in the next generations. This means the next generations are less likely to survive environmental changes.



State the Hardy-Weinberg equation.



State the Hardy-Weinberg equation.

$$p^2 + 2pq + q^2 = 1$$

p = the frequency of the dominant allele

q = the frequency of the recessive allele



State the conditions that have to be satisfied in the Hardy-Weinberg principle.



State the conditions that have to be satisfied in the Hardy-Weinberg principle.

- The proportion of dominant and recessive alleles remain the same over generations
- No mutations arise
- There is no selection
- The population must be large
- There must be no flow of alleles into or out of the population
- Random mating



What is selective breeding?



What is selective breeding?

The process by which humans artificially select organisms with desirable characteristics and breed them to produce offspring with desirable phenotypes.



Give examples of selective breeding.



Give examples of selective breeding.

- Introducing disease resistance into wheat and rice varieties to limit loss of crops by disease
- Improving the milk yield of cattle
- In maize, inbreeding and hybridisation to produce uniform, vigorous maize crops



Outline the theory of evolution.



Outline the theory of evolution.

Evolution is the process by which new species arise from pre-existing species over time. This is due to changes to the gene pools between generations.



Name one way of investigating evolutionary relationships between species.



Name one way of investigating evolutionary relationships between species.

Reading the DNA sequences of species can allow us to compare them. The more similar the sequences, the more closely related the species.



Describe how subpopulations of a species can be separated.



Describe how subpopulations of a species can be separated.

- Geographically
- Ecologically
- Behaviourally

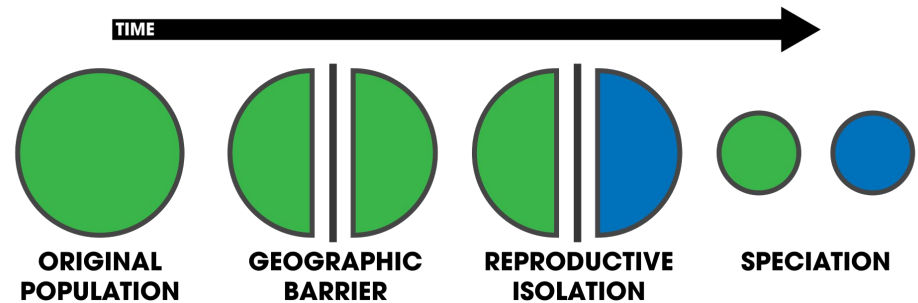


What is allopatric speciation?



What is allopatric speciation?

Speciation that occurs due to geographical separation. The two isolated populations may be exposed to different environments, in which there are different selection pressures. This results in changes in allele frequencies and eventually two new species emerge.



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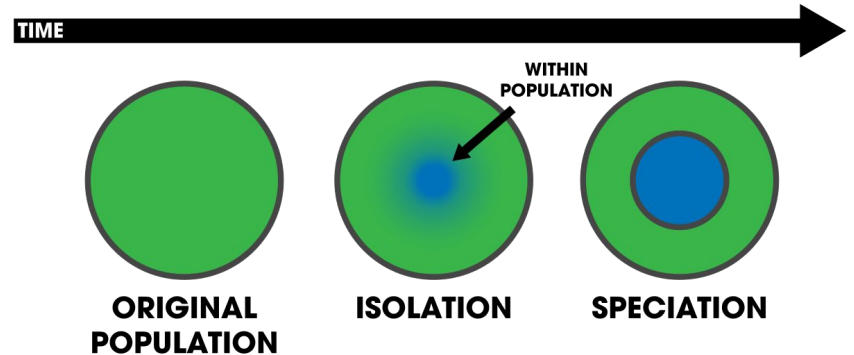


Explain how sympatric speciation may occur.



Explain how sympatric speciation may occur.

Within the same geographical region, subpopulations of a species can become reproductively separated, e.g. they live in different habitats, they may not mate at the same time. The different environmental conditions in each situation exert selective forces, therefore over time the populations become separate species.



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