MECHANISMS OF EVOLUTION

EXTENDED ANSWER

1. Harmful alleles which have arisen from a mutation affect the survival and reproduction of the individual and as a result, prevent them from passing on the allele. An example of this is Haemophilia. The Sickle Cell allele is also harmful, but has a very different outcome due to heterozygous advantage.

Compare and contrast natural selection with heterozygous advantage using these two examples.

Similarities:

* Both have selection pressures
* Both are recessive genes
* Both have a favourable genotype/ with a survival advantage
* Both cause a fatal medical condition in the homozygote/ blood condition
* Heterozygote is unaffected by the disease
* Occurs over generations

Differences:

|  |  |
| --- | --- |
| Natural selection | Heterozygous advantage |
| * One selection pressure * Haemophilia can be fatal * Selection against the homozygous recessive * Selection for the homozygous dominant * Harmful allele will disappear from the population * Occurs in any environment | * Two selection pressures * SCA and Malaria can both be fatal * Selection against both homozygous * Selection for the heterozygote * Harmful allele remains in the population * Only occurs in malaria environments |

1. Australian aboriginals migrated to Australia from Africa around 60,000 years ago. Studies have been done into blood group frequencies which show a great variation between the frequencies in Aboriginal groups and African negroes.

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| --- | --- | --- |
| Blood Group | African Negros | Aboriginals |
| O | 48 | 66 |
| A | 27 | 34 |
| B | 21 | 0 |
| AB | 4 | 0 |

Discuss the likelihood of these differences arising due to natural selection, founder effect or genetic drift.

* Not natural selection as blood groups have no selection pressure
* There is no blood group more likely to survive or reproduce than any other
* Change in alleles is due to random factors
* Founder effect could be a possibility as a population of Aboriginals migrated from Africa
* This small population could have had a different allele frequency to the original parent population.
* The B allele could have been eliminated as the group left Africa
* Chance of eliminating an allele is greater in small founder pops
* Aboriginals would have been a small population
* Unlikely as to eliminate the B allele, both B and AB blood groups would need to have remained behind.
* Genetic Drift is possible as this population has been isolated for a long term
* By oceanic geographical barrier
* Random chances of alleles being passed to the next generation
* Could have eliminated the B allele altogether.
* Chance of eliminating an allele is greater in small pops
* And the population would have been very small