Evolution

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Tags	

Explain how the relationship between the morphological structures provide evidence to support the theory of evolution

- Organisms with anatomical homology have morphological structure such as bones that they inherited from a Common ancestor
- Refer to examples in the question/ the pentadactyl (1-2-5) limb structure in forelimb of organisms are homologous structures have different functions but highly similar in structure with those of a common ancestor, showing descent with modification as the ancestral structure was altered by natural selection in the different organisms to suit their specialised emvironments, resulting in variations of the ancestral structure showing that divergent evolution has occured

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Advantages of molecular methods in classifying organisms

- Molecular data such as nucleotide and amino acid sequences are quantifiable, in abundance and open to statistical analysis amd easily converted to numerical form. The degree of relatedness between different species can be inferred and quantified by calculating nucleotide differences between species (advantages in constructing phylogeny)
- Molecular data can be easily described in an unambiguous manner as A, C, G and T is easily recognisable and cannot be confused. Protein and nucleic acid sequence data are precise and accurate. This facilitates the objective assessment of evolutionary relationships.
- Molecular data is based strictly on heritable material.

- All organisms can be compared with the use of some molecular data as all living organisms have nucleic acids and proteins, so molecular data can be collected from any organism.
- DNA information provides abundance of data for analysis and it allows easy homology assessment.
- Mitochondrial DNA does not undergo recombination thus any changes to DNA is due solely to the accumulation of mutations over time making it the ideal candidate for a molecular clock as we can estimate the time of speciation
- DNA sequence data can be used to compare species which are morphological indistinguishable due to convergent evolution or are because they are very closely related
- As changes in nucleotide sequences accumulate over time with clockwork regulation, we can estimate the time of speciation of modern to ancient species and place the speciation events on a timescale above

differences between classification and phylogeny

Classification	Phylogeny
Groups organism based on overall morphological similarities and does not take into account the evolutionary history of organisms	Trace evolutionary history of organisms based on ancestor-descendent relationships
Group organisms into a kingdom, phylum, class, order, family genus and species using a hierarchical classification	Arranged based on their evolutionary relationship with each other with each organism assigned a position on a branching tree relative to other organisms
Organism is presented as a binomial nomenclature/name	Organism placed on a branch on a phylogenetic tree
Does not allow inference of speciation events as it just a naming system	Indicates speciation events as the node of the phylogenetic tre
Does not allow inference of common ancestors	Common ancestor represented on same branch

Classification	Phylogeny
Unable to infer of how closely 2 related species are especially when grouped together in the same hierarchy	How recently a branch point occurs indicates how closely 2 related species are

Suggest reason for evolution of species

Allopatric speciation:

- Geographical isolation due to [type of barrier such as sea, land formation etc] resulting in allopatric speciation
- Results in disruption of gene flow between the two populations
- Different environments with different selection pressure such as predation, habitats amd available food sources
- Individuals best adapted to the environment will have a selective advantage will be selected for and favourable alleles will be passed on to the next generation and so frequency of favourable soles will increase
- Increase Allele frequency for favourable alleles due to natural selection and genetic drift
- The sub populations evolve independently and accumulate different mutations and allele frequency changes,subjected to genetic drift and natural selection and over time led to reproductive isolation such that they can no longer interbreed to produce viable, fertile offspring giving rise to formation of new species

Sympatric speciation:

For plants

- two soil types in close proximity to each other (older volcanic soil and younger calcareous soil)
- Plants that normally grow on volcanic soil started to grow on calcerous soil, flowering time difference arose as a physiological response to growing on a different soil type

- Thus physiological isolation prevented interbreeding and hence disrupted gene flow between sub-populations although they were close in proximity
- Resulted in evolutionary changes occurring independently within each sub-population such as genetic changes from accumulation of mutations as well as changes in allele frequency through genetic drift and natural selection occured within each sub-population
- Variation arises with plants with favourable traits that were better adapted and had a selective advantage to specific soil conditions and were selected for, increasing frequency of favourable allele and survived reproduced and passed on their alleles to next generation
- Over thousands of successive generations, each sub population become genetically distinct, reproductively isolated species, unable to interbreed to form fertile viable offspring

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Species concept

Species concept	Definition
Biological species	A group of organisms of same species that are capable of interbreeding and producing fertile, viable offspring and is reproductively isolated from other species, share a common gene pool and have the same chromosome number
Ecological	A species is a group of organisms sharing the same ecological niche ans the differences between species are due to differences in the ecological resources they depend on. This means that if a species can no longer occupy a particular niche, it is considered a new species
Morphological	A species is a group of organisms sharing similar body shape, size

Species concept	Definition
	and other structural features and this definition can be applied to all organisms including sexually and asexually reproducing organisms
Phylogeny	Organisation of species according to particular characteristics and takes into consideration the evolutionary relationships between species

How are species not native to a land appear there

- The invasive species colonists the new island due to having reduced competition for resources in the /better resources or environment in the new land
- This leads to a founder effect which reduces genetic variation compared to original population

Which traits are natural selection and genetic drift

Natural selection:

- The trait confers a selective advantage for a particular habitat such as body size
- Quote examples from the question
- Explain how having such traits confer a selective advantage

genetic drift:

- Trait does not provide selective advantage
- The differences in trait could be due to random changes in allele frequency in small population from generations due to chance event
- Change occur due to chance events

Study of species with molecular homologies

- Evaluarinf molecular homologies based on DNA of housekeeping genes such as cytochrome c gene CSM determine degree of nucleotide similarity
- The more related they are, the greater similarity there is in the sequence of their DNA allowing determination of ancestor descendant relationships
- Helps to understand the link between genotype and phenotype
- Reveals structure of genetic variation between different populations of the individual species

Why do bigger lands have greater species

- Greater number of habitats
- Greater variety of type of habitats + name 2 examples
- More available niches

How are certain alleles favoured by natural selection

- Random mutations occurs in gene leading to the allele
- Individuals with these favourable traits are selected for as (reason in context of question)
- These individuals survive till maturity, reproducing to produce viable fertile offspring, passing their alleles to the next generation
- Over time, frequency of alleles for the favourable adaptations increased

Types of evidence to study evolutionary relationships

- Molecular homology
- Antomical homology
- Fossils

How micro evolution and macro evolution occurs

- Micro evolution occurs over a few generations after the ancestral population with variations in phenotypes arrived

    - Individuals with favourable phenotype to adapt to the selection pressure were selected for causing changes to allele frequency within ancestral species
- Macro evolution
    - Caused by geographical isolation/ reproductive isolation
    - Disrupted gene flow and prevented interbreeding
    - Subpopulations were subjected to genetic drift and accumulation of mutations and natural selection and over many genes evolved independently into new species