

Module 3-Topic 3- Evolution

Variation- the presence of variety of difference between individuals
Variation within a species is known as intraspecific variation

Causes of variation

Genetic variation

- Rare random mutations producing new alleles
- different alleles in each of the parents (In sexually reproducing organisms)
- mixing of alleles during meiosis, to produce varied gametes
- random fertilisation of the varied gametes

This type is due to the difference in the DNA and can be inherited by offspring

Environmental- environmental factors not genetic

- exposure to light- tanning
- Diet- amount of food eaten variation in height and weight
- light intensity- rate of photosynthesis and height in plants
- mineral availability- nitrates for growth in plants

These factors cause variation between genetically identical individuals and so do not affect the DNA so can not be inherited so are not important in evolution

Continuous and Discontinuous variation

Discontinuous variation characteristics are discrete, clear cut with no intermediates

- Blood types/groups in humans
- gender
- normal coloured or albino animals/plants
- beak shape and size in birds
- drug resistance in microorganisms

Usually caused by one or two genes controlling the characteristics

Continuous variation have a full range of phenotypes between extremes
are controlled by many genes or the environment or both

- height (genes and environment)
- skin colour (genes and environment)
- eye colour (genes)
- length of leaves on one plant (environment)

Adaptations

Behavioral adaptations that help it to survive in the conditions it lives in. E.g. worms contracting into its burrow quickly when you touch them- they have no eyes so they do not know if you are a predator or not. Or sparrows playing dead when you pick them up and then flying away when you have left

Physiological/biochemistry adaptations ensure the correct functioning of the cell processes. Yeast can respire sugars anaerobically or aerobically to get energy depending on the amount of oxygen in the air. Producing the correct enzymes to respire and adapt.

Anatomical adaptations are structural adaptations that allow the organism to fulfill its role, e.g. many bacteria have a flagella to move

Darwin's theory of natural selection

Observations

- all organisms over-reproduce
- population sizes remain fairly constant in the wild
- individuals within a species vary from each other
- some of these variations are inherited

Deductions

- there is competition for survival due to limited food, predators, diseases and environmental conditions- selection pressure
- individuals with characteristics that are best suited to the conditions are more likely to survive and reproduce
- the favorable alleles determining these characteristics are passed on to the offspring

This occurs over a number of generations in a species becoming more adapted to the environmental conditions.

Natural selection can lead to speciation. This is how evolution is thought to occur.

Speciation is the formation of a new species

Allopatric speciation- geographical separation preventing interbreeding leading to speciation

Sympatric speciation- a reproductive barrier preventing interbreeding leading to speciation e.g. physical incompatibility (size or organs no longer compatible), or a mating call not recognised.

Evidence for evolution

Fossils

- mineralised remains of dead organisms
- the fossil record is incomplete as only a few remains become fossilised
- they can be dated and put in order to give evidence on how species have changed over time
- evidence of past climate and vegetation and therefore adaptations can be deduced
- e.g. horses used to have 4 toes but as the habitat became less swampy they adapted to having hoofed toes

DNA

- genes determine the structures of cells and whole bodies
- changes in DNA are caused by mutations which are rare
- similarities in DNA show how close species are
- more similar more closely related more recent common ancestor is
- Human and chimpanzees have a 0.87% DNA difference suggesting a recent common ancestor
- Humans and gorillas have a 1.04% difference in coding DNA more distant common ancestor
- Woolly mammoths have less DNA difference with Asian elephant than African elephants
- Eyes come from a gene Pax-6 which can be added to organisms to cause eyes to form suggesting that all eyes come from a common ancestor

Molecular evidence

- Genes code for making proteins so the structure of proteins can be used to deduce evolutionary relationships, the more similar the protein structure the more closely related the 2 species are. This is used for phylogenetic classification

Evolution of antibiotic resistance in bacteria

- a few individuals in a population may have a chance mutation making them resistant to antibiotics
- these individuals survive when other are killed by antibiotics
- the surviving individuals reproduce rapidly and result in a new antibiotic resistant strain of bacteria
- the greater use of antibiotics by human the more chance of resistant strains forming
- research is needed to develop new drugs
- conservation of biodiversity is important to protect possible new sources of drugs

Evolution of pesticide resistance in insects

- natural selection has resulted in the development in resistance in some insects
- e.g. mosquitos and DDT
- new pesticides are needed and these may be found in plants that produce toxic chemicals so the maintaining of biodiversity is important