

SUBJECT: B6 Inheritance and Variation

UNIT: While you were away



Lesson 1: DNA

1. What is the structure of DNA and what are its components called?
2. Where in the cell is DNA found and how many chromosomes do humans have?

Lesson 2: Sexual and Asexual Reproduction

1. What are the advantages of sexual reproduction compared to asexual reproduction?
2. How do fungi and malarial parasites reproduce both sexually and asexually?

Lesson 3: Meiosis

1. How many daughter cells are produced in meiosis and how do they differ genetically?
2. What is the role of meiosis in sexual reproduction?

Lesson 4 & 5: Genetic Inheritance

1. What is the difference between dominant and recessive alleles?
2. How do you use a Punnett square to predict genetic outcomes?

Lesson 6: Inherited Disorders

1. What is a genotype and how does it relate to inherited traits?
2. What does it mean if someone is homozygous or heterozygous for a trait?

Lesson 7: Variation

1. What are the three main causes of variation in organisms?
2. How can both genetic and environmental factors influence variation?

Lesson 8: Evolution

1. How does natural selection lead to evolution?
2. Why was Darwin's theory of evolution not immediately accepted?

Lesson 9: Selective Breeding

1. How is selective breeding used to enhance desired traits in organisms?
2. What is the process of selective breeding over generations?

Lesson 12: Genetic Engineering

1. How is a gene inserted into a bacterial plasmid during genetic engineering?
2. What are two uses of genetic engineering mentioned in the organiser?

Lesson 13: Evidence of Evolution

1. What is speciation and how does it occur?
2. How does natural selection support the theory of evolution?

Lesson 14: Fossils

1. What are three types of fossil evidence that can be found?
2. How can fossils provide evidence for evolution?

Lesson 15: Extinction

1. How can natural selection lead to the disappearance of less adapted species?
2. What role does environmental change play in species survival?

Lesson 16: Resistant Bacteria

1. How does antibiotic resistance develop in bacteria?
2. What are three ways to reduce the rate of antibiotic resistance?

Lesson 17: Classification of Living Organisms

1. What are the seven levels of classification in the Linnaean system?
2. What are the three domains in Carl Woese's classification system?

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UNIT: Science

DNA

DNA is a polymer that makes you, you. Small sections of this DNA are known as genes and they code for characteristics in an organism. Longer, coiled chains of DNA are known as chromosomes, these are found in the nuclei of cells. Humans have 23 pairs (46) chromosomes.

Ambitious Vocabulary

Variation Chromosome
Selective Evolution

Keywords

Allele – alternative forms of a gene (e.g blue eyes, brown eyes)

Asexual reproduction – cloned offspring produced by a single parent.

Dominant – an allele that is always expressed, even if only one copy is present.

Gamete – sex cells

Gene – small section of DNA that codes for a specific trait.

Genome – the entire genetic material of an organism

Genotype – the combination of alleles in an organism

Heterozygous – a genotype that has two different alleles

Homozygous – a genotype that has two of the same alleles

Recessive – an allele that is only expressed if two copies are present.

Variation

Genetic – variation in DNA.

Environmental – conditions in which they have developed
Combination of both.

Mitosis and Meiosis

Mitosis: Produces 2 daughter cells which are genetically identical, the cell divides only once, there are the same number of chromosomes (46) in each daughter cell, used for growth and repair and in asexual reproduction.

Meiosis: Produces four daughter cells which are not genetically identical, the cell divides twice, chromosome number is halved (23) produces gametes for sexual reproduction.

Evolution

All species of living things have evolved from simple life forms by natural selection. If a characteristic is advantageous in an environment then the individual will be better able to compete for resources, this means they are more likely to survive and reproduce, their offspring then inherit the advantageous allele.

Selective Breeding

Scientists choose parents who have the desired characteristics and breed them. Then select the offspring with the best characteristics and breed them again. This continues over many generations until the desired results are achieved.

Genetic engineering

Using in crops and to make insulin. DNA is removed from human cell and plasmid is isolated from a bacterial cell. Gene required is removed from the human DNA by enzymes, plasmid is cut using enzymes. Gene is inserted into the plasmid. Plasmid (vector) is used to insert the gene into the required cell. Bacteria multiply many times.

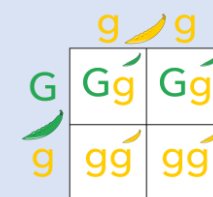
Resistant Bacteria

1. There is a variation in the bacterial population. One bacterium develops a mutation by change that means it is resistant to an antibiotic.
2. The antibiotic kills some of the bacterial, the resistant bacterium survives and reproduces.
3. The antibiotic kills the rest of the non-resistant bacteria so the person may start to feel better but the resistant bacterium survives and continues to multiply.

To reduce the rate of this: antibiotics should only be used when necessary, patients should complete their full course, agricultural use should be restricted.

Punnet Squares

To complete a punnet square you must put the two alleles from the parents on the top and on the left. Then you must copy these alleles down and across to fill in the squares.



The probability is calculated out of 4 potential offspring.

Fossils

Could be:

1. The actual remains of an organism that has not decayed
2. Mineralised forms of the harder parts of an organism such as bones
3. Traces of organisms such as footprints or burrows

Classification

Linnaeus classified living things into:

Kingdom
Phylum
Class
Order
Family
Genus
Species

Due to evidence from chemical analysis, there is now a three-domain system developed by Carl Woese.

The three domains are:

Bacteria
Archaea
Eukaryota

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Natural selection

An organism with a favourable characteristic that suits its environment will more likely survive and therefore reproduce passing on its DNA to its offspring. Darwin's theory was only gradually accepted as: The theory challenged the idea that God made all the animals and plants that live on the Earth. There was insufficient evidence at the time the theory was published to convince many scientists. The mechanism of inheritance and variation was now known until 50 years after the theory was published.

Sexual and asexual reproduction

Advantages of sexual reproduction: Produces variation in the offspring, if the environment changes then variation can give a survival advantage via natural selection, natural selection can be increased by humans in selective breeding to increase food production.

Advantages of asexual reproduction: Only one parent needed, more time and energy efficient as they do not need to find a mate, faster than sexual reproduction, many identical offspring can be produced when conditions are favourable.

DNA structure

DNA is made of base pairs attached to a sugar phosphate backbone. These sections are called nucleotides. All together this structure is known as the double helix.

Cloning in plants and animals

We take cuttings of plants and can culture this tissue through asexual reproduction (mitosis) to then create more of the same plant. Many plants produce seeds but also reproduce asexually by runners such as strawberry plants, or bulb division such as daffodils.

In animals the desired DNA is taken from a specific organism and implanted into an egg cell. This is then cloned as it becomes an embryo.

Malaria

Malarial parasites reproduce asexually in the human host but sexually in the mosquito

Fungi

Many fungi reproduce asexually by spores but also reproduce sexually to give variation.

Protein synthesis

Inside the nucleus is the DNA – this is a template. The template is copied from the DNA and moves out of the nucleus. It binds to a ribosome. A carrier molecule binds to every three bases. Each one carries an amino acid which is joined to the previous amino acid. The amino acid strand folds into a 3D shape.

Understanding of genetics

1856 – Mendel begins his research.

1866 – Mendel published the results, identifying unit of inheritance, his work goes unnoticed by other scientists.

1882 - The chromosome 'dance' of mitosis was observed by Flemming.

1884 - Mendel dies

1900 – Boveri provides the first evidence that chromosomes are inherited.

1902 – Chromosomes are observed separating into gametes during meiosis.

1953 – the structure of the double helix was discovered

Speciation

Parts of a population become geographically or environmentally isolated from each other, if the conditions in each environment are different then different characteristics will be advantageous. This leads to natural selection. Eventually the two separated populations are so different they can no longer interbreed to produce fertile offspring.