

Reproduction

What is sexual reproduction, and what are the gametes in animals and flowering plants?

Reproduction

What is asexual reproduction?

Reproduction

Which type of cell division makes identical cells, and which makes non-identical cells?

Reproduction

Describe what happens when a cell divides by meiosis.

Reproduction

How do meiosis and fertilisation keep the chromosome number the same from one generation to the next?

Reproduction

Describe the structure of DNA.

Reproduction

What is a gene?

Reproduction

What is the genome?

Reproduction with only one parent, no fusion of gametes and no mixing of genetic information. Offspring are genetically identical clones. Only mitosis is involved.

The joining (fusion) of male and female gametes: sperm and egg in animals, pollen and egg in flowering plants. Genetic information is mixed, giving variety in the offspring.

Copies of the genetic information are made, then the cell divides twice to form four gametes, each with a single set of chromosomes and all genetically different.

Mitosis makes identical cells. Meiosis makes non-identical cells.

A polymer made of two strands forming a double helix, contained in chromosomes in the nucleus.

Meiosis halves the number of chromosomes in gametes. Fertilisation restores the full number. The new cell divides by mitosis and, as the embryo develops, cells differentiate.

The entire genetic material of an organism.

A small section of DNA on a chromosome that codes for a particular sequence of amino acids, to make a specific protein.

Reproduction

Give three reasons why understanding the human genome is important.

Reproduction

Define allele.

Reproduction

What is the difference between a dominant and a recessive allele?

Reproduction

What do homozygous and heterozygous mean?

Reproduction

What is the difference between genotype and phenotype?

Reproduction

Give two examples of characteristics controlled by a single gene. Are most characteristics like this?

Reproduction

What ratio of phenotypes do you expect from a cross between two heterozygous parents?

Reproduction **Higher tier**

Construct a Punnett square for $Bb \times bb$. What is the probability of a bb offspring?

A different form of the same gene.

Searching for genes linked to disease; understanding and treating inherited disorders; tracing human migration patterns from the past.

Homozygous: two alleles the same for a trait. Heterozygous: two different alleles.

A dominant allele is always expressed, even if only one copy is present. A recessive allele is only expressed if two copies are present.

Fur colour in mice and red-green colour blindness in humans. No, most are the result of multiple genes interacting.

Genotype is the alleles present. Phenotype is how the characteristic is expressed.

Gametes B, b and b, b. Offspring Bb, Bb, bb, bb. Probability of bb = 2 in 4 = $\frac{1}{2}$ (50%).

3 dominant : 1 recessive, so a probability of 1 in 4 (25%) for the recessive phenotype.

Reproduction

In a family tree, two parents without a trait have a child with the trait. What does this show?

Reproduction

Which disorder is caused by a dominant allele: polydactyly or cystic fibrosis?

Reproduction

Give issues to consider about embryo screening.

Reproduction

What are the human sex chromosomes?

Reproduction

What is the chance that a baby is a girl or a boy, and why?

Variation and evolution

What causes variation within a population?

Variation and evolution

Where do all variants come from, and how many affect the phenotype?

Variation and evolution

Define evolution.

Polydactyly (extra fingers or toes) is caused by a dominant allele. Cystic fibrosis, a disorder of cell membranes, is caused by a recessive allele.

The trait is recessive and both parents are heterozygous carriers.

Females XX, males XY. Humans have 23 pairs of chromosomes; 22 pairs control characteristics only.

It may alleviate suffering, but embryos are destroyed and there are economic, social and ethical concerns. Gene therapy research also raises ethical issues.

Genes inherited (genetic), the conditions in which individuals developed (environmental), or both. The phenotype develops from the genome and its interaction with the environment.

50% each (1 : 1). All eggs carry X; half the sperm carry X and half carry Y.

A change in the inherited characteristics of a population over time through natural selection, which may result in a new species.

Mutations. Most have no effect on the phenotype, some influence it, very few determine it. Rarely a new phenotype suited to an environmental change causes a relatively rapid change in the species.

Variation and evolution

Explain how natural selection leads to evolution.

Variation and evolution

When have two populations formed two new species?

Variation and evolution

When did the first simple life forms develop?

Variation and evolution

What is selective breeding?

Variation and evolution

Describe the steps of selective breeding.

Variation and evolution

Give four examples of characteristics chosen by selective breeding.

Variation and evolution

What is inbreeding and what problem does it cause?

Variation and evolution

Define genetic engineering.

When they become so different in phenotype that they can no longer interbreed to produce fertile offspring.

Variants with phenotypes best suited to their environment survive and breed, passing on their alleles. Over generations these characteristics become more common.

The process by which humans breed plants and animals for particular genetic characteristics. It is also called artificial selection.

More than three billion years ago. All species have evolved from them.

Disease resistance in crops; more meat or milk from animals; gentle nature in dogs; large or unusual flowers.

Choose parents with the desired characteristic and breed them together. Breed the best offspring together. Repeat over many generations.

Modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.

Breeding closely related individuals. Some breeds become prone to disease or inherited defects.

Variation and evolution

Give examples of genetic engineering in plants and in bacteria.

Variation and evolution

What are GM crops and what are the concerns about them?

Variation and evolution **Higher tier**

Describe the main steps in genetic engineering.

The development of understanding of genetics and evolution

What evidence supports the theory of evolution?

The development of understanding of genetics and evolution

What are fossils and how may they form?

The development of understanding of genetics and evolution

Why is the fossil record incomplete?

The development of understanding of genetics and evolution

What is extinction?

The development of understanding of genetics and evolution

How do antibiotic-resistant bacteria arise and spread?

Crops with modified genes, for example resistant to insects or herbicides, with increased yields. Concerns: wild flowers and insects, and human health effects not fully explored.

Plants: resistance to disease or bigger, better fruit. Bacteria: human insulin to treat diabetes.

Characteristics are passed on in genes, the fossil record, and how antibiotic resistance evolves in bacteria.

Enzymes isolate the gene. It is inserted into a vector (plasmid or virus). The vector inserts the gene into the required cells, at an early stage of development.

Early life forms were soft-bodied and left few traces, and many traces were destroyed by geological activity.

Remains of organisms from millions of years ago, found in rocks. They form when decay conditions are absent, by mineral replacement, or as preserved traces.

Mutation produces a resistant strain; antibiotics kill other bacteria, so the resistant ones survive, reproduce and spread because people are not immune.

When there are no remaining individuals of a species still alive. Factors include new predators, diseases or competitors, environmental change, or a single catastrophic event.

The development of understanding of genetics and evolution

How can the development of antibiotic resistance be reduced?

The development of understanding of genetics and evolution

What is MRSA, and why do new antibiotics not solve the problem?

Classification of living organisms

List the Linnaean groups in order.

Classification of living organisms

What is the binomial system?

Classification of living organisms

Name the three domains in Woese's system.

Classification of living organisms

Why was the three-domain system developed?

Classification of living organisms

What is an evolutionary tree?

MRSA is resistant to antibiotics. New antibiotics are costly and slow to develop, so unlikely to keep up with new resistant strains.

Do not prescribe antibiotics inappropriately (such as for viral infections), complete the course, and restrict agricultural use.

Naming organisms using their genus and species, for example *Homo sapiens*. The genus has a capital letter; the species does not.

Kingdom, phylum, class, order, family, genus, species.

Better microscopes showed internal structures, biochemical understanding progressed, and chemical analysis provided new evidence.

Archaea (primitive bacteria in extreme environments), bacteria (true bacteria) and eukaryota (protists, fungi, plants and animals).

A method showing how scientists believe organisms are related, using classification data for living organisms and fossil data for extinct ones.