

Ingenious Genes Curriculum Links for AQA GCSE Combined Science: Synergy (8465)

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4.1.3.5 Meiosis

Explain the role of meiotic cell division in halving the chromosome number to form gametes.

Cells in reproductive organs divide by meiosis to form gametes (egg and sperm cells).

When a cell divides to form gametes: • copies of the genetic information are made • the cell divides twice to form four gametes, each with a single set of chromosomes • all gametes are genetically different from each other.

Gametes join at fertilisation to make a new cell with the normal number of chromosomes.

4.4.3.1 Chromosomes and genes

Explain the following terms: gamete, chromosome and gene.

Describe DNA as a polymer made up of two strands forming a double helix.

Describe the genome as the entire genetic material of an organism.

Sexual reproduction involves the joining (fusion) of male and female gametes (sperm and egg cells in animals). In sexual reproduction there is mixing of genetic information, which leads to variety in the offspring. The formation of gametes involves meiosis.

The genetic material in the nucleus of a cell is composed of a chemical called DNA contained in the chromosomes. Human body cells contain 23 pairs of chromosomes. DNA is made of very large molecules in long strands, twisted to form a double helix.

A gene is a small section of DNA on a chromosome. Each gene contains the code for a particular combination of amino acids to make a specific protein. The genome of an organism is made up of all the genes in the DNA of its body cells.

4.4.3.2 Sex determination in humans

Describe sex determination in humans.

In human cells, one of the 23 pairs of chromosomes carries the genes that determine sex. In females the sex chromosomes are the same (XX); in males the chromosomes are different (XY). All eggs contain an X chromosome. Sperm cells contain either an X or a Y chromosome.

4.4.3.3 Single gene inheritance

Explain single gene inheritance.

Predict the results of single gene crosses.

Explain the terms allele/variant, dominant, recessive, homozygous, heterozygous

Some characteristics are controlled by a single gene. Examples are fur colour in mice and red– green colour blindness in humans.

Each gene may have different forms called 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 (therefore no dominant allele present).

If the two alleles present are the same the organism is homozygous for that trait, but if the alleles are different they are heterozygous.

4.4.3.4 Genotype and phenotype

Describe simply how the genome, and its interaction with the environment, influences the development of the phenotype of an organism.

Explain the terms genotype and phenotype.

Recall that most phenotypic features are the result of multiple genes rather than single gene inheritance.

All the genes present in an individual organism interact with the environment in which the organism grows and develops its observable appearance and character. These characteristics are its phenotype.

The variation in the characteristics of individuals of the same kind may be due to differences in:

- the genes they have inherited (genetic causes)
- the conditions in which they have developed (environmental causes)
- a combination of genes and the environment.

Human height is an example of a characteristic determined by many genes, each with different alleles. The set of alleles that determine the height of a person is the genotype for that characteristic. Height is also affected by diet and exercise which are part of the environment in which an individual grows up.

4.4.4.1 Mutations

State that there is usually extensive genetic variation within a population of a species.

Recall that all variants arise from mutations, and that most have no effect on the phenotype, some influence the phenotype and a very few determine the phenotype.

Mutations are changes in DNA molecules that may affect genes. Mutation of a gene can alter the proteins that it contains the code for, or even prevent the protein being produced in cells.

Mutations can happen when DNA is copied during cell division or when cells are affected by environmental factors such as ionising radiation.

4.4.4.2 Evolution through natural selection

Explain how evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment