




AQA B6a Reproduction
BIOLOGY TRIPLE (page 1 of 3)

sexual reproduction	involves the joining (fusion) of male and female gametes. There is a mixing of genetic information which leads to variety in the offspring
asexual reproduction	Involves only one parent and no fusion of gametes. There is no mixing of genetic information. This leads to genetically identical offspring (clones).
gamete	A gamete is a sex cell: Sperm and egg cell in animals Pollen and egg cells in flowering plants
mitosis	Involved in asexual reproduction. Identical cells are formed
meiosis	Involved in sexual reproduction. Non-identical cells are formed. Cells in the reproductive organs divide by meiosis to produce gametes (sex cells)

Sexual Reproduction Advantages	Asexual Reproduction Advantages
<ul style="list-style-type: none"> Gametes are all different (is variation in offspring) If the environment changes, variation gives a survival advantage by natural selection Natural selection can be speeded up by selective breeding to increase food production. 	<ul style="list-style-type: none"> Only needs one parent (faster) More time and energy efficient as do not need to find a mate Many identical offspring can be produced when conditions are favourable (Food/medicine production can be extremely quick.)

Some organisms use both sexual and asexual reproduction depending on the circumstances

Malarial parasites		Asexually in the human host but sexually in a mosquito.
Fungi		Asexually by spores, sexually to give variation.
Plants		Produce seeds sexually, asexually by runners in strawberry plants, bulbs division in daffodils.

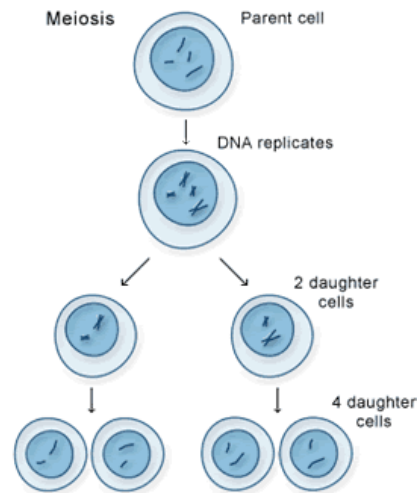
Meiosis

Meiosis halves the number of chromosomes in gametes.

Gametes join during fertilisation to restore the full number of chromosomes

The process:

- Copies of the genetic information are made
- The cell divides twice to form 4 gametes each with a single set of chromosomes
- All gametes are genetically different to each other.



Once fertilisation has taken place the new cell divides by mitosis. The number of cells increases. As the embryo develops cells differentiate.

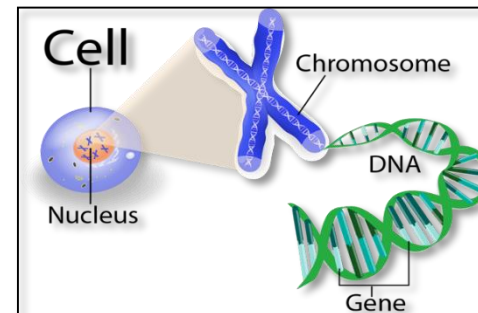
DNA and the genome key words

The genetic material in the nucleus of a cell is made of a chemical called DNA

DNA	A polymer made up of two strands forming a double helix.
chromosome	A thread like structure containing coiled DNA found in the nucleus of eukaryotic cells.
gene	A section of DNA on a chromosome that codes for a specific protein or characteristic.
genome	the entire genetic material of that organism. The whole human genome has now been studied and this will have great importance for medicine in the future.

understanding the human genome will help us:

- search for genes linked to different types of disease
- understanding and treatment of inherited disorders
- use in tracing human migration patterns from the past.

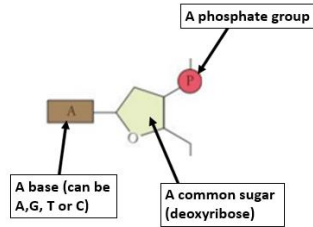
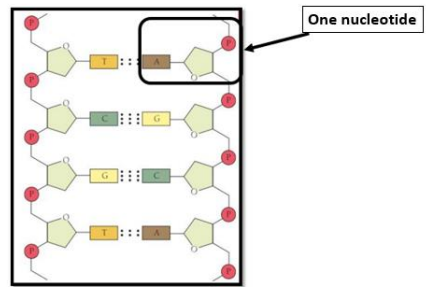


DNA structure

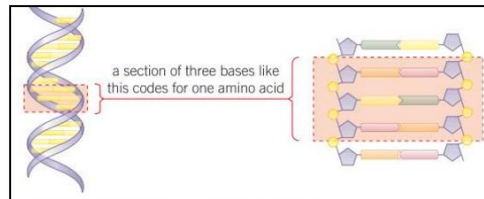
DNA as a polymer made from four different nucleotides. Each nucleotide consists of a common sugar and phosphate group with one of four different bases attached to the sugar.

The long strands of DNA consist of alternating sugar and phosphate sections. Attached to each sugar is one of the four bases.

The DNA polymer is made up of repeating nucleotide units.

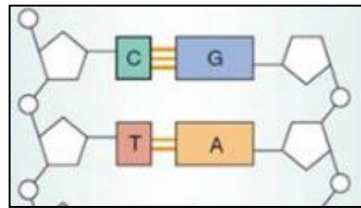


A sequence of three bases is the code for a particular amino acid. The order of bases controls the order in which amino acids are assembled to produce a particular protein.



DNA contains four bases, A, C, G and T.

In the complementary strands a C is always linked to a G on the opposite strand and a T to an A.



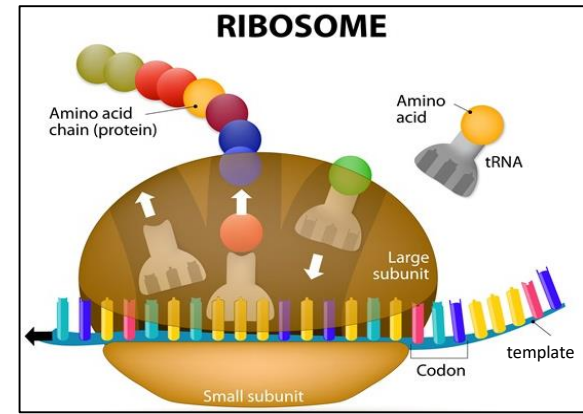
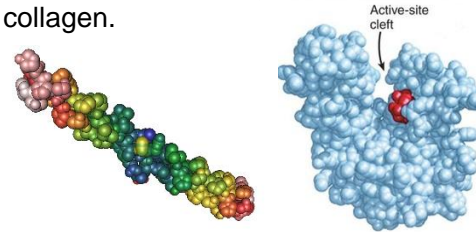
Genetic variants may influence phenotype (the physical expression of a gene):

- a) in coding DNA by altering the activity of a protein
 - b) in non-coding DNA by altering whether genes are expressed or not.
- Not all parts of DNA code for proteins. Non-coding parts of DNA can switch genes on and off, so variations in these areas of DNA may affect how genes are expressed.

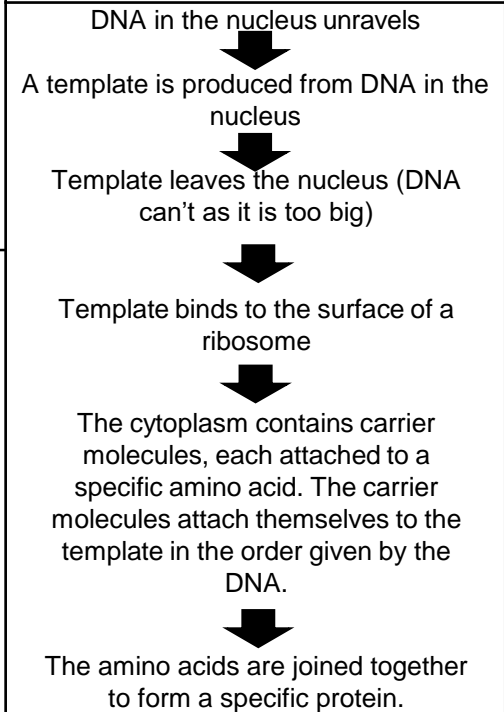
Protein synthesis

Proteins are synthesised on ribosomes, according to a template. Carrier molecules bring specific amino acids to add to the growing protein chain in the correct order.

When the protein chain is complete it folds up to form a unique shape. This unique shape enables the proteins to do their job as enzymes, hormones or forming structures in the body such as collagen.

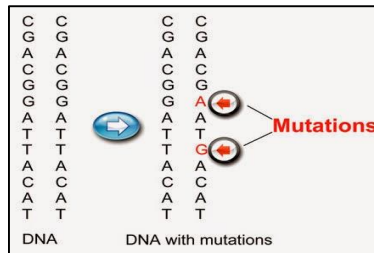


Protein synthesis in more detail



Gene mutations

Mutations occur continuously. Most do not alter the protein, or only alter it slightly so that its appearance or function is not changed. Few mutations code for an altered protein with a different shape. An enzyme may no longer fit the substrate binding site or a structural protein may lose its strength.



Genetics keywords

Allele	Alternate forms of the same gene.
dominant	A type of allele – always expressed if only one copy present and when paired with a recessive allele. It is shown by a capital letter and ‘takes over’.
recessive	A type of allele – only expressed when paired with another recessive allele. It is shown by a lower case letter.
homozygous	Pair of the same alleles, dominant or recessive. Example: BB or bb
heterozygous	Two different alleles are present 1 dominant and 1 recessive. Example: Bb
genotype	Alleles that are present for a particular feature for example BB, Bb or bb
phenotype	Physical expression of an allele combination for example black fur, blonde hair, blue eyes.

Genetic inheritance

Some characteristics are controlled by a single gene, such as: fur colour in mice; and red-green colour blindness in humans. Each gene may have different forms called alleles.

The alleles present, or genotype, operate at a molecular level to develop characteristics that can be expressed as a phenotype.

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. Most characteristics are a result of multiple genes interacting, rather than a single gene.







Sex determination

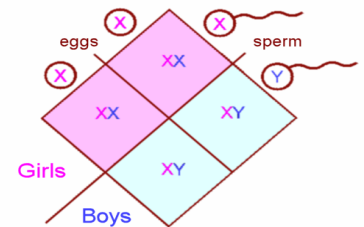
Ordinary human body cells contain 23 pairs of chromosomes.

22 pairs control characteristics only, but one of the pairs carries the genes that determine sex.

In females the sex chromosomes are the same (XX).
In males the chromosomes are different (XY).

Using a punnet square (using mouse fur colour as an example)

Parent phenotype	black fur 	white fur 									
Parent genotype	BB	Bb									
Gametes present	In each egg  	In each sperm  									
Genetic cross (Punnett square – these are diagrams used to predict the inheritance of characteristics)	<table border="1"> <tr> <td>Gametes</td> <td>b</td> <td>b</td> </tr> <tr> <td>B</td> <td>Bb</td> <td>Bb</td> </tr> <tr> <td>B</td> <td>Bb</td> <td>Bb</td> </tr> </table>		Gametes	b	b	B	Bb	Bb	B	Bb	Bb
	Gametes	b	b								
B	Bb	Bb									
B	Bb	Bb									
<p>The probability of black fur offspring phenotype is 100%. All offspring genotypes are heterozygous (Bb).</p>											



Inherited disorders

Some disorders are inherited. These disorders are caused by the inheritance of certain alleles.

Inherited disorder	Cause	Symptoms
polydactyly	Inheritance of one dominant allele	Extra fingers and toes
cystic fibrosis	Inheritance of two recessive alleles (both parents must be carriers or have CF themselves)	A disorder of cell membranes. Makes mucus too thick; causes breathing difficulties, problems in digestive and reproductive systems

Screening for inherited disorders

Pregnancy tests can check for inherited disorders:

Type of screening	What happens and when	Disadvantages
chorionic villus screening	A sample of the placenta tested at 10-12 weeks of pregnancy	Increased risk of miscarriage, parents may choose abortion if baby affected
amniocentesis	A sample of fluid tested at 15-16 weeks of pregnancy	Increased risk of miscarriage, parents may choose abortion if baby affected
IVF	Embryos produced by IVF, tested and only healthy embryos implanted	Expensive and IVF has low success rate