Edexcel GCSE BIOLOGY, GENETICS Part 1

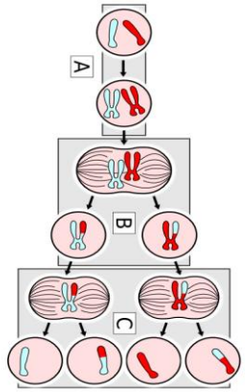
Meiosis

Meiosis halves the number of chromosomes

Gametes are made in reproductive organs (in animals ovaries and testes)

Cells divide by meiosis to form gametes

- Copies of the genetic information are made.
- The cell divides twice to form four daughter cells each with half the number of chromosomes.
- All haploid gametes are genetically different from each other.



Gametes join at fertilisation to restore the number of chromosomes

The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed

Sexual and asexual reproduction

Advantages and disadvantages of sexual and asexual reproduction (Biology only)

Reproduction advantages/disadvantages	
Sexual	***Asexual***
Needs two parents.	Only one parent needed (quicker).
Produces variation in the offspring.	Identical offspring (no variation).
If the environment changes variation gives a survival advantage by natural selection.	Vulnerable to rapidly changing conditions due to lack of variation.
Negative mutations are not always inherited.	Negative mutation can affect all offspring.
Natural selection can by speeded up using selective breeding to increase food production.	Food/medicine production can be extremely quick.

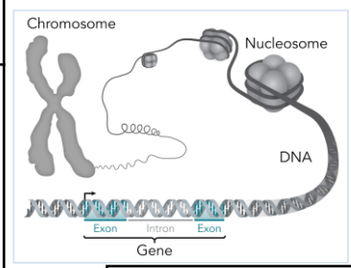
DNA and the genome

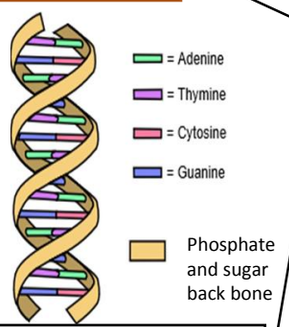
Genetic material in the nucleus is composed of a chemical called DNA.

DNA structure

Polymer made up of two strands forming a double helix.

Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.





(HT only) Not all parts code for proteins. Non-coding parts can switch genes on and off. Mutations may affect how genes are expressed.

Extracting DNA

DNA can be extracted from fruit

- Dissolve salt and washing up liquid together with a mashed up sample of fruit (kiwi fruit is good) and place in a 60°C water bath for 15 minutes.
- Filter and add protease solution to the filtrate in a boiling tube. Tilt the boiling tube and carefully add ice cold ethanol.
- The white layer that forms at the interphase is DNA and can be pulled out on a glass rod

Protein synthesis (Biology HT only)

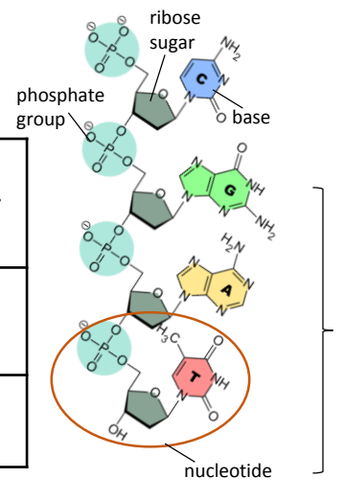
(Biology HT) A sequence of 3 bases is the code for a particular amino acid. The order of bases controls the order in which each amino acids combine and fold to produce a specific shaped protein such as enzymes..

Genetic variants.

In non coding DNA	Affects phenotype by influencing the binding of RNA polymerase and altering the quantity of protein produced.
In coding DNA	Affects phenotype by altering the sequence of amino acids and therefore the activity of the protein produced.

DNA is polymer made from four different nucleotides. Each nucleotide consists of a common sugar, phosphate group and one of 4 different bases A, C, G & T

Repeating nucleotide units.



In DNA the complementary strands C, A, T, G always link in the same way. C always linked to G on the opposite strand and A to T.

Making new proteins (protein synthesis) transcription and translation

Composed of chains of amino acids. A sequence of 3 bases (codon) codes for a particular amino acid.

RNA polymerase binds to non-coding DNA located in front of a gene.

⇩

RNA polymerase produces a complementary mRNA strand from the coding DNA of the gene.

⇩

mRNA moves from the nucleus and attaches to a ribosome in the cytoplasm.

⇩

Ribosomes translate each triplet of bases (codons) into specific amino acids according to mRNA template

⇩

Amino acids are transferred to the ribosome by tRNA.

⇩

Amino acids are linked together to form polypeptides.

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Cell division

Meiosis halves the number of chromosomes

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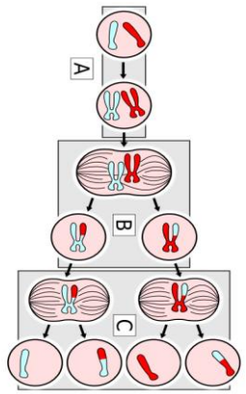

Gametes join at fertilisation to restore the number of chromosomes

The new cell divides by mitosis. The number of cells increase. As the embryo develops cells differentiate.

Meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed

Meiosis

Sexual and asexual reproduction

Advantages and disadvantages of sexual and asexual reproduction (Biology only)

Sexual	*Asexual*
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DNA and the genome

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Contained in structures called chromosomes. A gene is a small section of DNA on a chromosome. Each gene codes for a sequence of amino acids to make a specific protein.

DNA can be extracted from fruit	Dissolve salt and washing up liquid together with a mashed up sample of fruit (kiwi fruit is good) and place in a 60°C water bath for 15 minutes.
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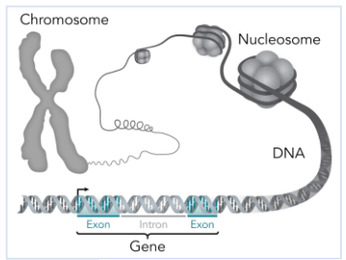
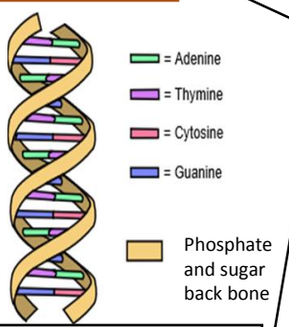
DNA structure





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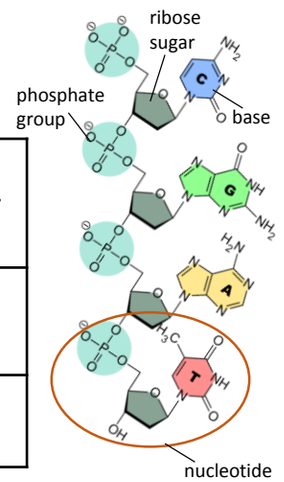

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Protein synthesis (Biology HT only)

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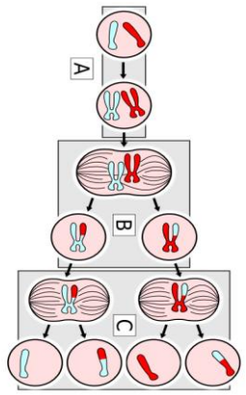

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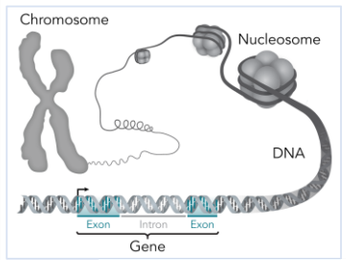

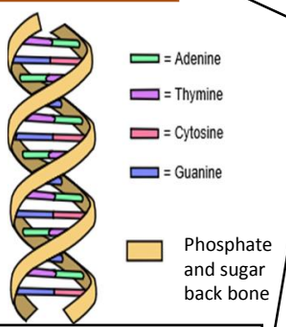

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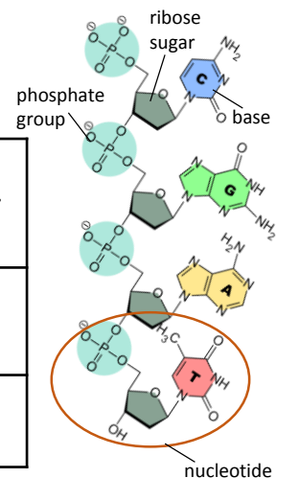

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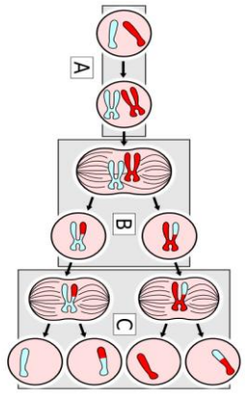

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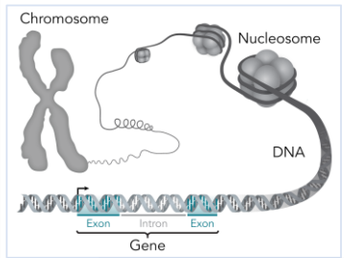

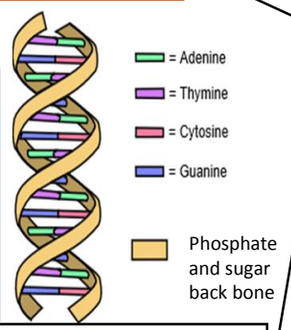

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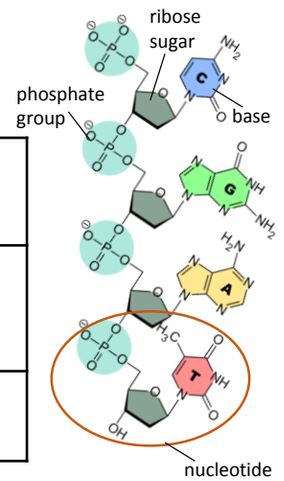

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