**Chapter 11 Genetics**

**Character Traits**

* are physical, psychological or physiological attributes that may vary from one individual to another within the same species

**Chromosomes**

* **eukaryotic** cells contain a nucleus that contains chromosomes (coloured bodies because they stain)



* hold the basic genetic info
* chromatin = 1 molecule = 1 chromosome of DNA wrapped around protein balls (histones)
* chromatin is a mass of DNA and proteins within the nucleus of most cells not undergoing division (mitosis)

**1 strand of DNA = 1 chromosome**



* when the cell is set to divide to reproduce or form sex cells (gametes) the chromatin contracts and becomes chromosomes
* humans have 46 chromosomes = 23 pairs = 22 autosomes and 1 sex pair
* chromosomes can be classified according to size and distinctive features (bands, placement of centre)
* homologous chromosomes = matching chromosomes e.g. a pair of chromosome 21
* an ordered representation of a person's chromosomes = a karyotype
* sex chromosomes are not the same size in boys = x and y homologous chromosomes

**Karyotype**



What's the problem with the above karyotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Homework tonight = go to this website and do the activity**

 **http://www.biology.arizona.edu/human\_bio/activities/karyotyping/karyotyping.html**

**Amniocentesis**

* a procedure performed on a pregnant woman approx. 4 months gestation
* a needle is inserted through the abdominal wall into the uterus
* fetal cells floating in the amniotic fluid are removed
* the cells are grown up (tissue culture in vitro)
* the DNA = chromosomes are obtained from the cells
* a karyotype = a picture of the chromosomes is made
* some genetic defects can be determined this way e.g. trisomy 21 = Down's Syndrome



**DNA and Genes**

* each chromosome is made up of DNA
* DNA is shaped like a twisted ladder = a double helix
* DNA is a polymer = a long molecule made up of repeating units (nucleotides = PSB)
* 1 nucleotide = 1 PSB = a phosphate--deoxyribose sugar--nitrogenous base (A or T or G or C)
* phosphate--sugar backbone = the sides of the ladder
* base pairs = the rungs of the ladder
* **Guanine--Cytosine** and **Adenine--Thymine** = complementary base pairs in DNA
* **a particular sequence of base pairs = 1 gene**
* **1 gene codes for 1 protein**
* all of our genes from mummy and daddy = our **genome**
* we have thousands of genes
* genes = the blueprint instructions for making proteins = brown skin, blue eyes, pointy nose!
* 1 gene = a DNA segment that contains info for making 1 protein
* **1 different base pair may mean 1 different amino acid which means a different shape to the protein = could be a major difference or not**

**DNA segment in the nucleus (too short to be a gene)**

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 A G C T T A G C T C A

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|  |  |  |  |  |  |  |  |  |  |  |  |

**Complementary Strand of mRNA made in the nucleus and sent into the cytoplasm**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |

**tRNA**



**Proteins**

* your proteins determine who and what you are!!!!!
* a protein is a molecule that plays a specific role in the functioning of an organism and in the expression of its character traits

|  |  |
| --- | --- |
| **Task** | **Example** |
| Support | Elastin makes the skin firm yet elastic |
| Transport of substances | Hemoglobin Hb carries oxygen O2 in the blood |
| Control and message relay | Hormones control cell functions and relay messages e.g. insulin helps control the amount of sugar in the blood e.g.growth hormone or testosterone |
| Immunity | Antibodies protect us from disease |
| Catalysis | Enzymes speed up biochemical reactions e.g. amylase breaks down starch to make digestion faster |

**Protein Structure**

* there are over **100 000** proteins making up your body
* the **shape** of the protein determines what is does
* proteins are molecules made up of one or more chains of amino acids
* proteins are polymers = long molecules of amino acids
* there are 20 essential amino acids = animal food sources e.g. cow muscle = red meat has all 20
* the types of the amino acids and the sequence of the amino acids determines the shape of the protein e.g. my hair versus someone with straight hair
* an amino acid is a molecule that can combine with other amino acids to form proteins
* **change the shape = change the function, colour etc**

**1 protein**

**Protein Synthesis**



* DNA to protein = protein synthesis
* **transcription of DNA** and **translation into protein**

**Transcription (in the nucleus)**

* DNA has a long chain of base pairs
* 3 base pairs = 1 codon = the code for 1 amino acid
* DNA unzips to expose a gene
* 1 side of the DNA is copied by an enzyme
* this makes a copy of the DNA called messenger RNA (ribonucleic acid) mRNA
* mRNA has copied the long chain of bases
* 3 bases = 1 triplet = 1 amino acid
* mRNA contains G, C and A but T is replaced by U = uracil
* the mRNA leaves the nucleus through a pore in the membrane and enters the cytoplasm



**Translation (in the cytoplasm)**

* the mRNA attaches itself to a ribosome in the cytoplasm
* the ribosome slides over the mRNA and reads triplets of bases on the mRNA
* each triplet codes for an amino acid = the genetic code!!!!!
* the amino acids are brought to the ribosome by transfer RNA (tRNA)
* the tRNA carry 1 triplet complementary to the triplet on the mRNA **plus** 1 amino acid
* the amino acids are linked together as they are brought in one by one
* there are start codons and stop codons that tell the ribosome to start and stop making a protein



**mRNA code for amino acids**



**Mutations**

* 1 base pair too many
* 1 base pair lost
* 1 base pair different = point mutation
* additional sections of base pairs
* deletions of sections of base pairs
* **messes up the sequence** and the **shape** of the protein
* maybe it functions; maybe it doesn't
* thank the chemistry gods or whomever for your good fortune!!!!!!!!! be grateful for what you've got!!