**Notes Part I: The Nucleus and Role of DNA**

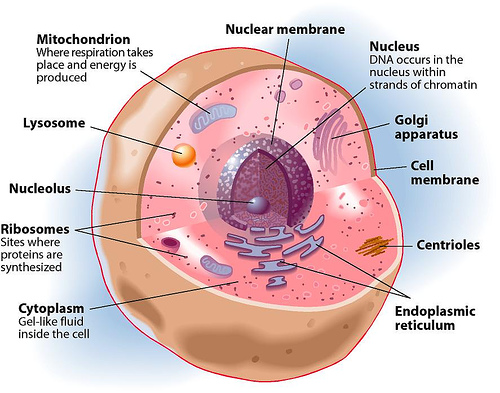
*(Refer to pgs. 125 – 132 in textbook)*

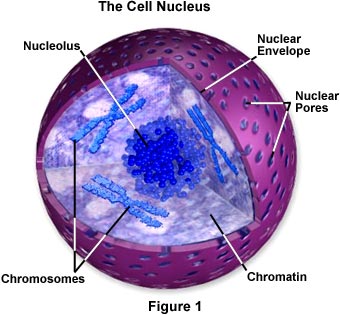
*To understand the process of cell reproduction it is necessary to learning about the parts of the nucleus that play a key roll in*

*controlling cell activities such as cell division, cell function and protein production.*

**Nucleus Role**

Each cell in your body has one nucleus. The nucleus contains genetic material in the form of DNA molecules that together code for proteins, which in turn determine the structure and function of each cell.   
This is why we say that the nucleus is the **control centre of the cell.**

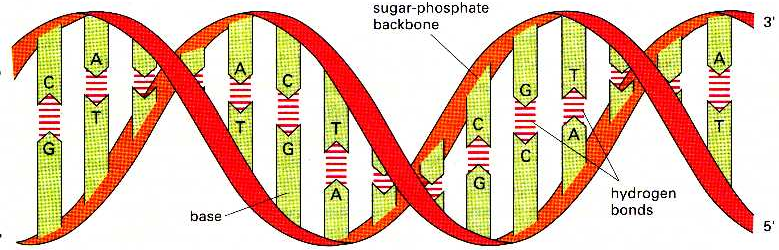




**DNA carries the master set of instructions for cell function**

**What is DNA?**

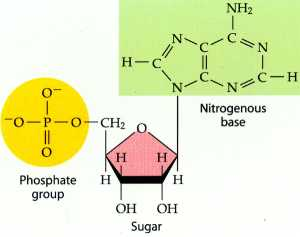
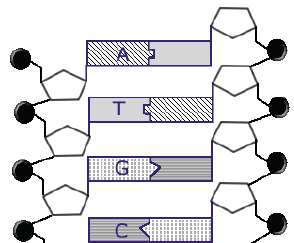
DNA stands for deoxyribose nucleic Acid The DNA molecule looks like a twisted ladder that can be described as a double helix. The 3 basic parts that make up this ladder are sugar and phosphate on the sides and four nitrogen bases combine in pairs to make the steps.



**Nitrogen Bases**

There are 4 different types of bases: A (adenine), G (guanine), C (cytosine),  
 and T (thymine). The order of the bases forms the “genetic code” and determines the types of proteins created. The bases are always paired along the steps of the ladder in a specific way.   
Adenine always joins with thymine and Guanine always joins with Cytosine.

The diagram that follows shows an example of a segment of a DNA molecule (***please fill in the missing bases***):

An example of a sequence of bases which form part of the genetic code is   
(write the matching base below each letter):



The arrangement of these bases provides a set of instructions coded for by the DNA.   
  
It is this set of instructions that determines which proteins are produced by each cell.

The proteins in turn determines the role and function of every part of every living creature. The code differs depending on the species.

Role of DNA in Inheritance:

1. Video -What are Traits? <https://learn.genetics.utah.edu/content/basics/traits/>

**What are inherited traits? Give two examples**

Characteristics that come from parents eye colour/ resistance to a disease  
Traits or characteristics can be affected by both genes and the environment.

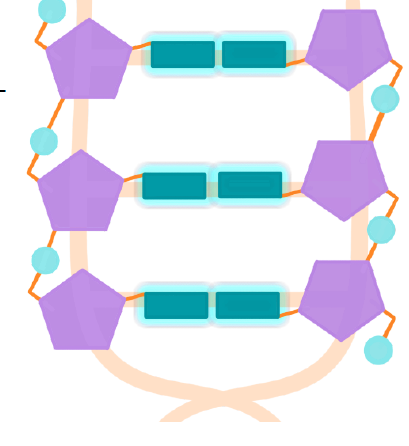
**What is an example of a trait influenced by the environment?**

Love of music/language we speak

1. Video - What are DNA and Genes? <https://learn.genetics.utah.edu/content/basics/dna/>

**What is an organism’s genome? A complete set of genes that are the instructions for building an entire organism**

1. Refer to Expii Link: <https://www.expii.com/t/dna-role-in-inheritance-overview-importance-10171> -   
   Amoeba Sisters Video - DNA, Chromosomes, Genes and Traits: An introduction to Heredity (2:05 min)

In the diagram below label the parts of a nucleotide (A, B and C)

(A) –deoxyribose (sugar) (B) – phosphate (C) – Nitrogen containing base

**How many nucleotides are shown here?   
   
six**

**Where is DNA found in living things?**

**In the cells nucleus in body cells**

The DNA in all living organisms is made up of only four bases. The sequence and number of these bases determine all the different traits or characteristics of living things.

**What is the pneumonic that can help you remember the base pairings?  
 Apples in the trees and cars in the garage.**

**What is a gene? What is a Chromosome?**

A segment of DNA that codes for a specific protein Tightly coiled DNA that contains a number of genes

Complete DNA Model Activity and questions

DNA Structure – Follow up Questions

1. What chemicals make up the backbone or sides of the DNA molecule?

Phosphate and sugar (deoxyribose)

1. What chemical makes up the rungs (or steps) in the DNA molecule?

Nitrogen containing bases

1. Which nitrogen base always pairs with guanine? cytosine with adenine Thymine
2. One side of a DNA molecule contains the following sequence of bases **ACCTGCTAT**

Write the sequence of the bases on the other side of the molecule. TGGACGATA

1. If 20 % of a DNA molecule is adenine, what percent will be guanine? 30%

Explain your thinking. A and T are equal so 20% A and 20% T 100 – 40% = 60% G AND C

60% /2 = 30% as amounts of G AND C are also equal.

1. When constructing the DNA molecule, what did you notice about the orientation of the two strands?

Reversed

1. What do you need to do to your segment of DNA to make it look more like a real DNA molecule?

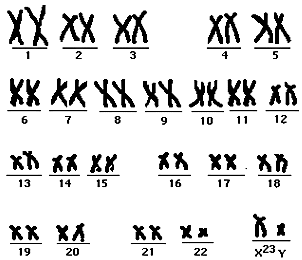
Include thousands of nucleotides and twist the strand

1. When a long DNA is compacted and wrapped around proteins it is called a chromosome.

Why is DNA packaged into this structure? So cells can easily divide up DNA when making new cells

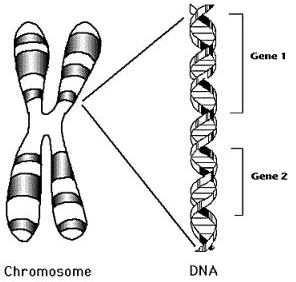
Notes part II: What are Chromosomes, Genes and Proteins?

Understanding Chromosomes

Most of the time, DNA exists in the nucleus in the form of chromatin. When a cell is ready to divide, DNA is coiled up into very compact, X- shaped structures called chromosomes. Human beings have 23 *pairs* of chromosomes (or 46 chromosomes altogether).

The 23rd pair determines the sex of the individual. In males, the 23rd pair is XY while in females, it is XX. Different organisms have different numbers of chromosomes. For Example, corn has \_\_\_\_\_ chromosomes, while a bat has \_\_\_\_\_.

Genes

Genes are small segments of DNA located at specific places on a chromosome. They store the information needed to produce up to 100 000 different proteins used in the cells of your body. The order of the nitrogen bases within a gene determines the protein it produces.

PROTEINS

Two types of proteins produced are enzymes (which speed up chemical reactions in the cell) and hormones (which act as chemical messengers).

*Every cell in your body contains the same DNA, but only certain genes are used to produce specific*

*proteins. For example, in your eye, only the genes relevant to eyesight and structure of your eye are*

*“Turned on” to produce the appropriate proteins for that area.*

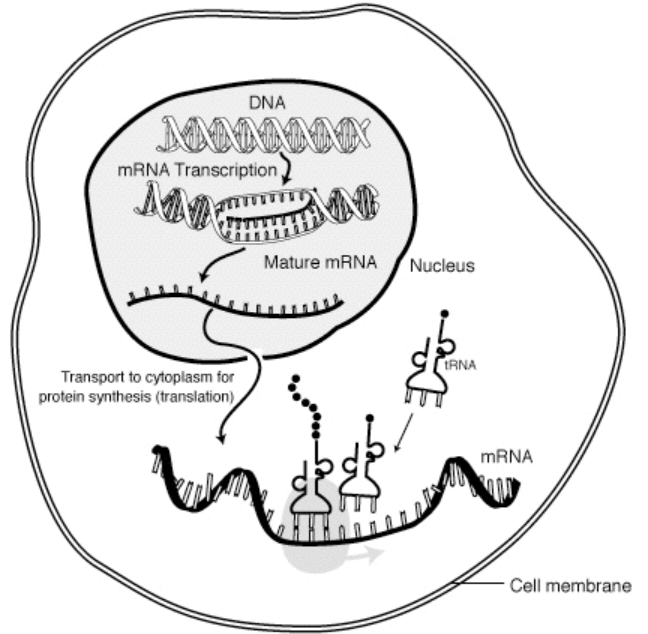
*Refer to the following interactive link to learn more about* ***proteins:*** [*https://learn.genetics.utah.edu/content/basics/proteintypes/*](https://learn.genetics.utah.edu/content/basics/proteintypes/)

1. *Describe four different types of proteins not discussed in notes.*

|  |  |
| --- | --- |
| Regulatory proteins bind DNA to turn genes on and off. Active genes are used to build proteins. | Signaling proteins allow cells to communicate with each other. Signals, receptors, and relay proteins work together to get information from the outside of a cell to the inside. Ie.  EGF (epidermal growth factor) is released at a wound site. It activates the EGF receptor, which signalsskin cells to grow and divide during wound healing. |
| Defense proteins help organisms fight infection, heal damaged tissue, and evade predators. i.e. antibodies | Sensory proteins help us learn about our environment. They help us detect light, sound, touch, smell, taste, pain, and heat. Some organisms can even detect electricity or magnetism. |

***How does DNA code for proteins?***  <http://www.yourgenome.org/video/from-dna-to-protein>

1. *While viewing the video on protein synthesis – briefly list the steps to form a protein following step 1*

*Step 1: Chemical signal from cell* *nucleus to make a certain protein*

*Step 2: DNA is transcribed to create a smaller molecule called RNA   
 that is single stranded. This copy of a segment of DNA that is   
 small enough to exit the nucleus*

*Step 3: The mRNA is able to leave via a nuclear pore*

*Step 4: Once in the cytoplasm. A ribosome can attach to the mRNA and begin translating the RNA into the amino acids that make up the required protein. Nitrogen bases are red in codons, groups or three bases.*

*Last step: Completed protein transported to cells/  
 within cell to perform intended function.*

*What structure translates messenger RNA into a protein? Ribosome*

*Where in the cell are proteins made? In the cytoplasm or on the endoplasmic reticulum*

*What type of molecules are the building blocks for every protein? Amino acids*