

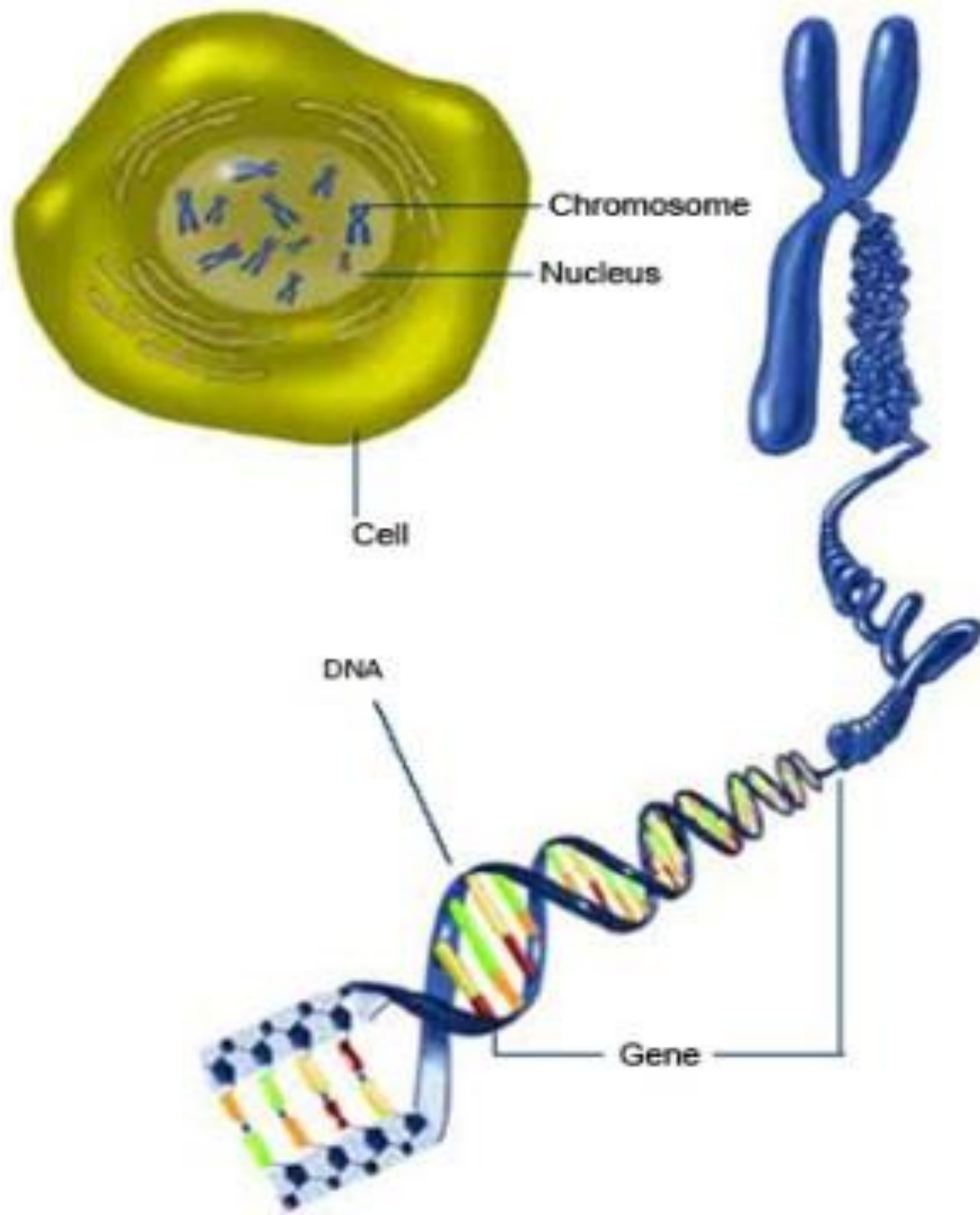
CHROMOSOMES, GENES AND DNA

Don't give out booklet until first
activity is completed!



BACK TO BACK ACTIVITY

- Pupils sit back to back. Pupil 1 describes picture and pupil 2 draws.

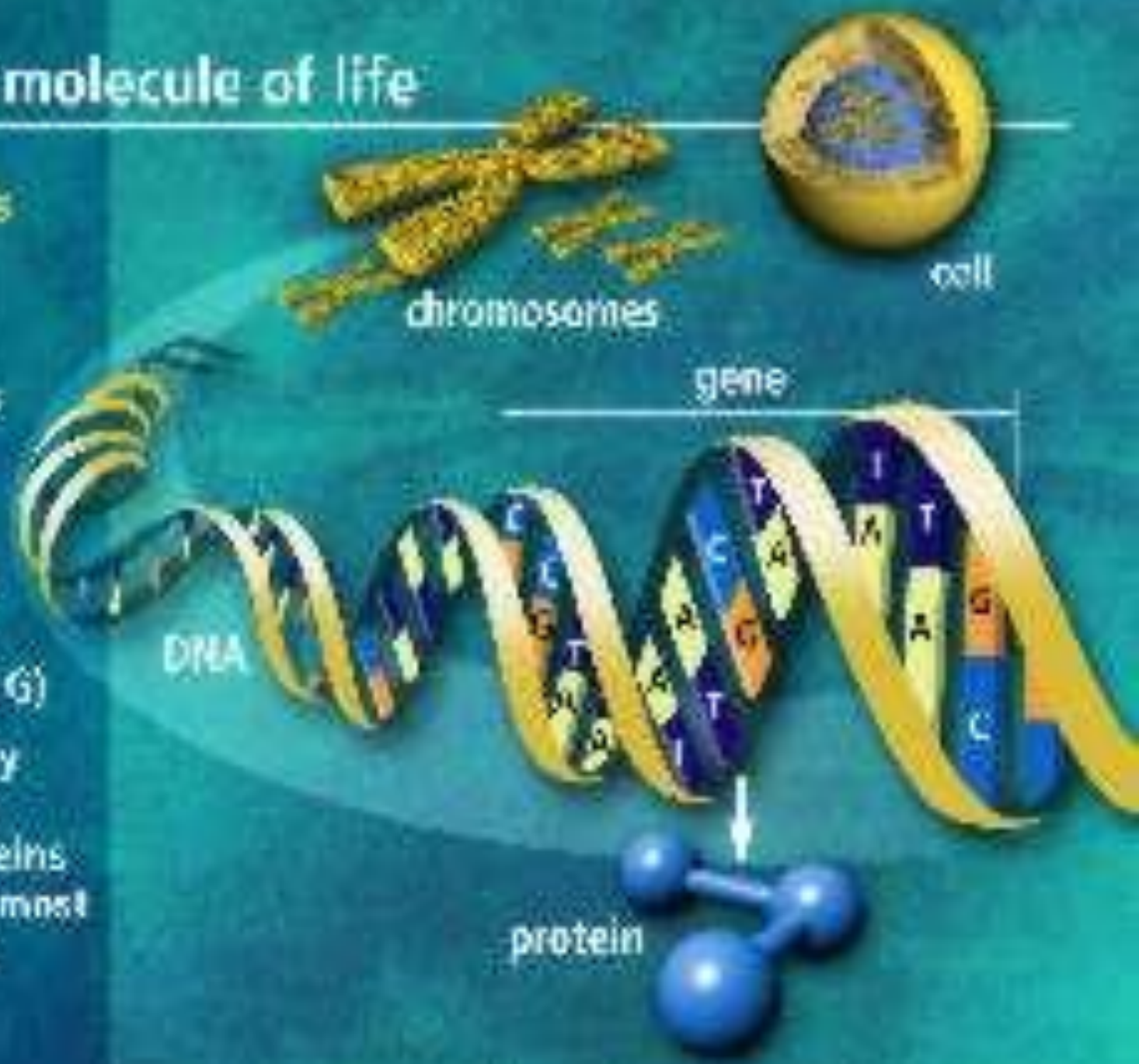


DNA the molecule of life

Trillions of cells

Each cell:

- 46 human chromosomes
- 2 meters of DNA
- 3 billion DNA subunits (the bases: A, T, C, G)
- Approximately 30,000 genes code for proteins that perform most life functions



journey into your genes

- http://www.pbs.org/wgbh/nova/genome/dna_flash.html

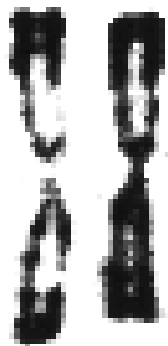
what is DNA?

- <http://learn.genetics.utah.edu/content/begin/tour/>



DEFINITIONS

- **Chromosomes** are genetic structures found in the nucleus of a cell.
- They are made of **DNA** (deoxyribonucleic acid) and **occur as functional pairs except in sex cells (sperm and eggs)**.
- **Genes** are short sections of chromosomes that **operate as functional units to control characteristics**. Genes are **short lengths of DNA**.
- There are hundreds of genes contained in a chromosome.



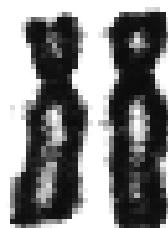
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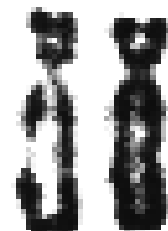
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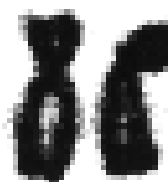
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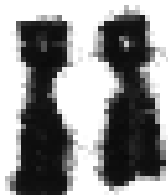
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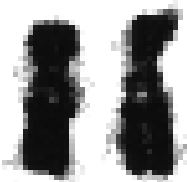
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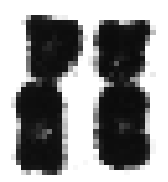
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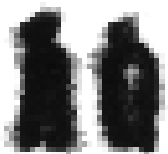


11



12

human karyotype



13



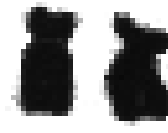
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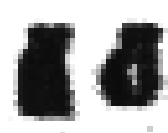
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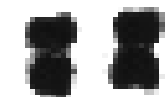
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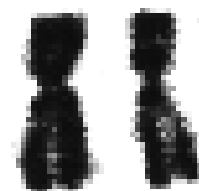
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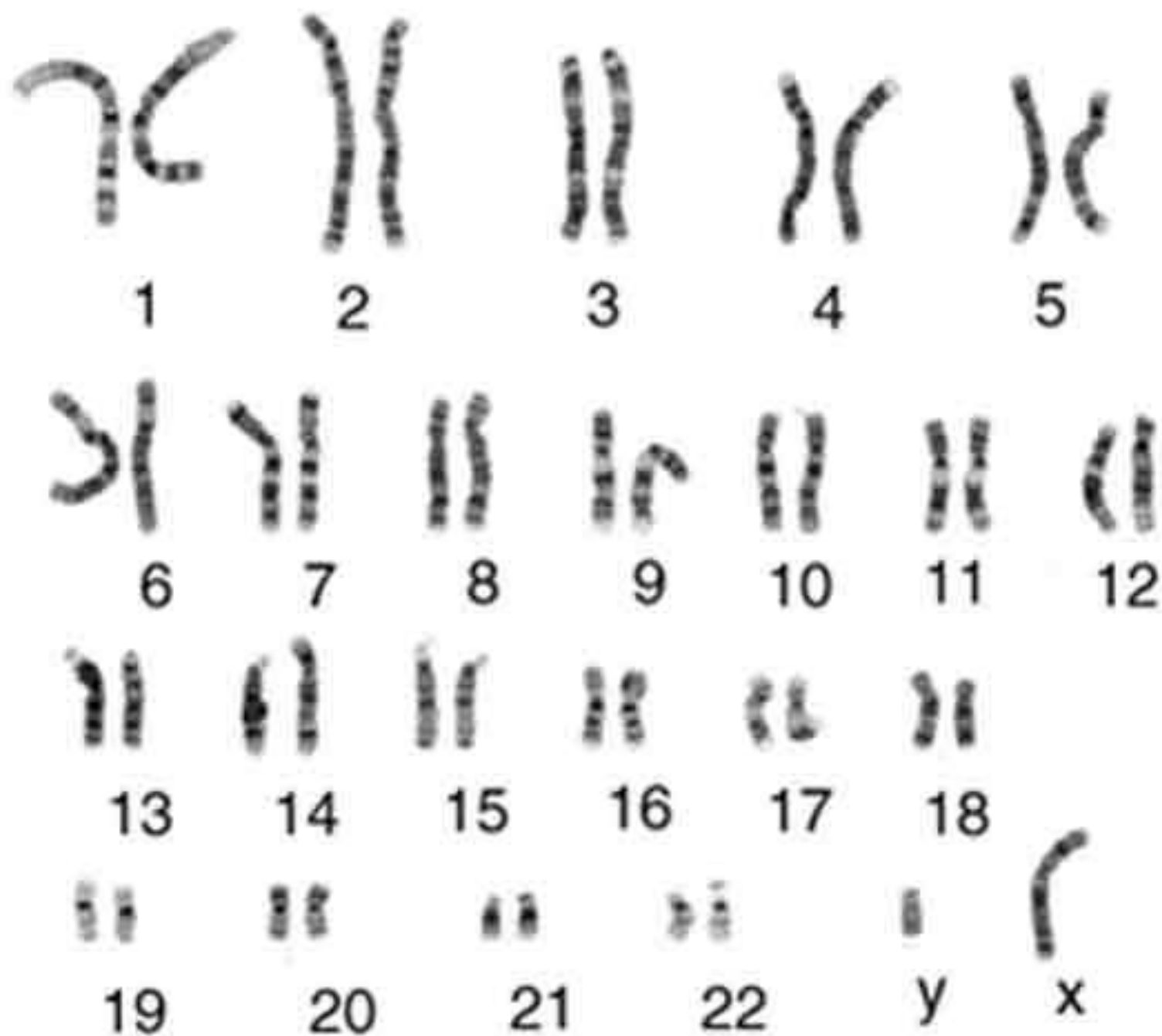
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22



X



DNA STRUCTURE

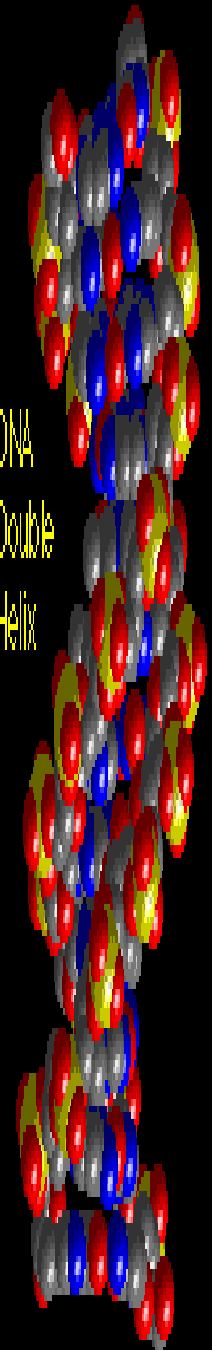
DNA is made up of units called nucleotides which contain:

- **A deoxyribose sugar**
- **A phosphate group**
- **A base**

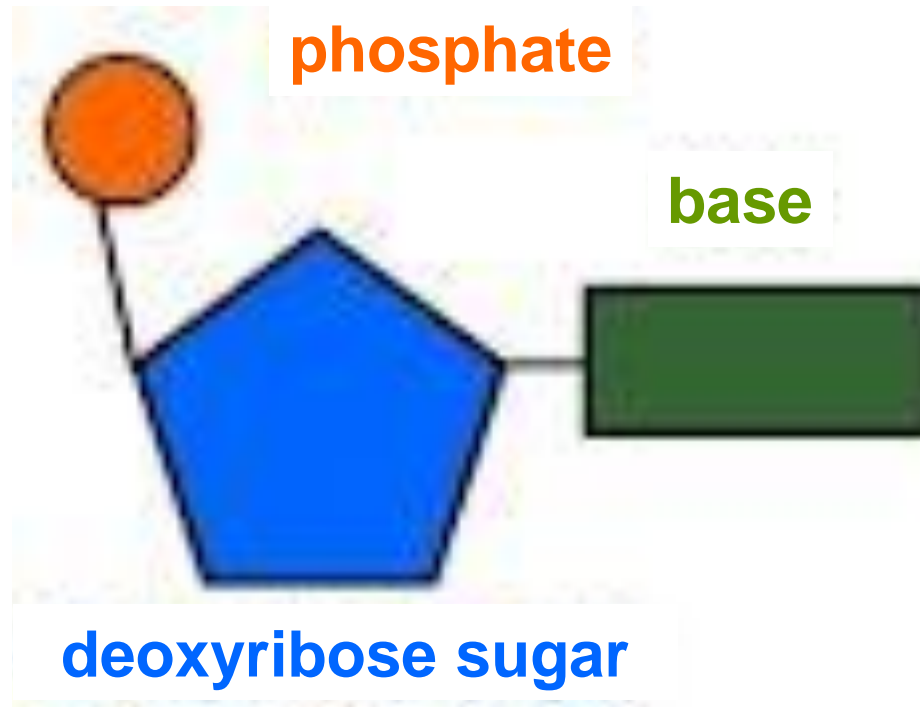
DNA
Double
Helix



DNA
Double
Helix



A NUCLEOTIDE



- Nucleotides join together to form long chains.
- Two chains are joined together by their bases.
- The two chains run in opposite directions (**antiparallel**).



What do you notice about the bases?

DNA Structure

There are four types of bases

- **Adenine**
- **Thymine**
- **Cytosine**
- **Guanine**

DNA
Double
Helix



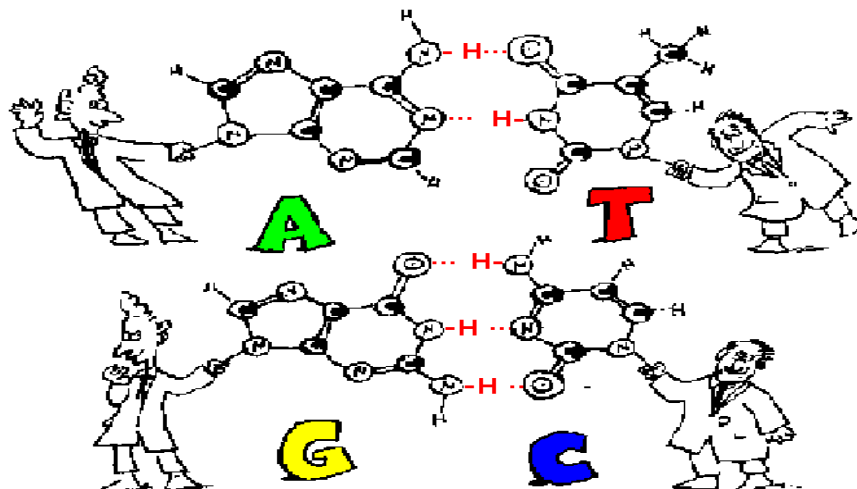
DNA
Double
Helix



DNA Structure

- **A**denine binds with **T**hymine
- **G**uanine binds with **C**ytosine
- I go to school **A****T** **G**lenlola **C**ollegiate

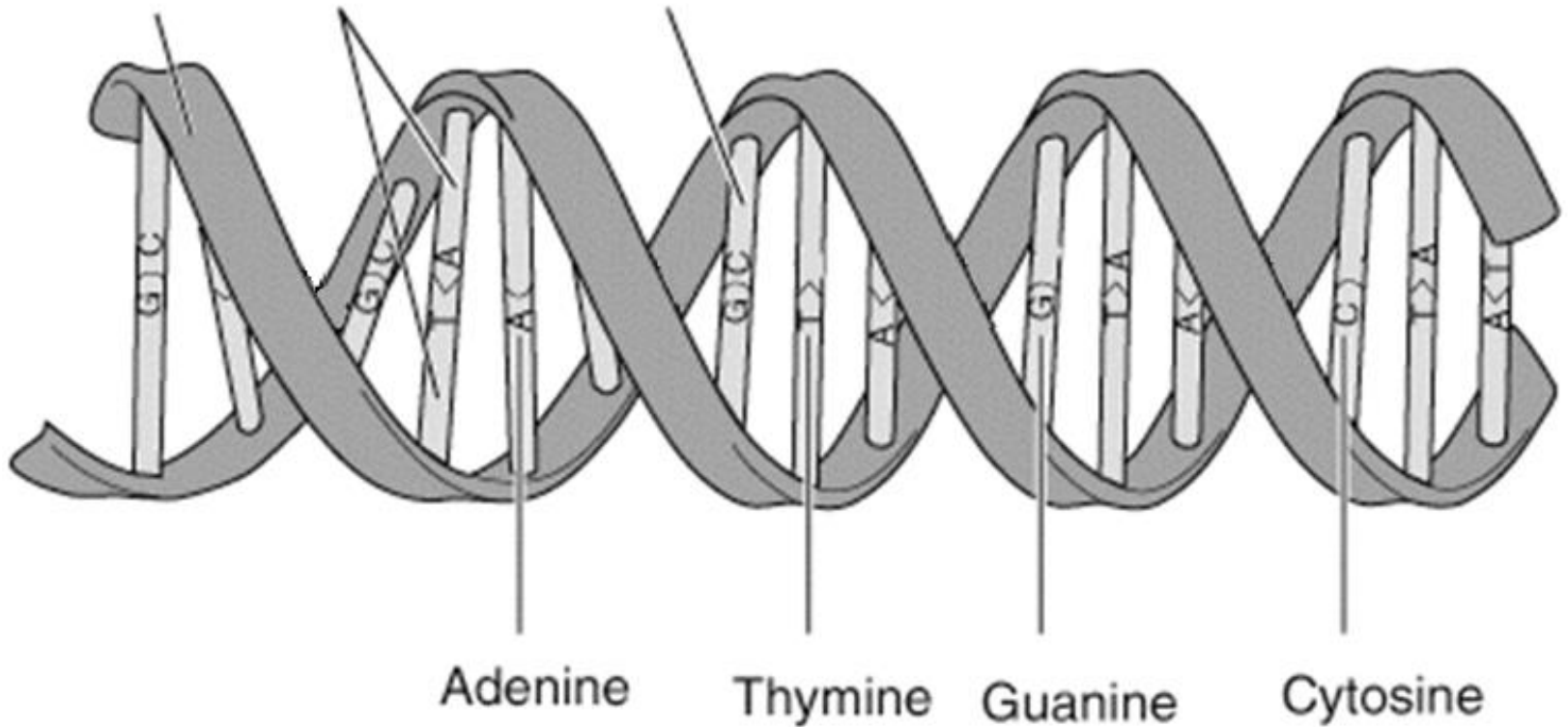
DNA
Double
Helix



sugar
phosphate
backbone

base
pair

base



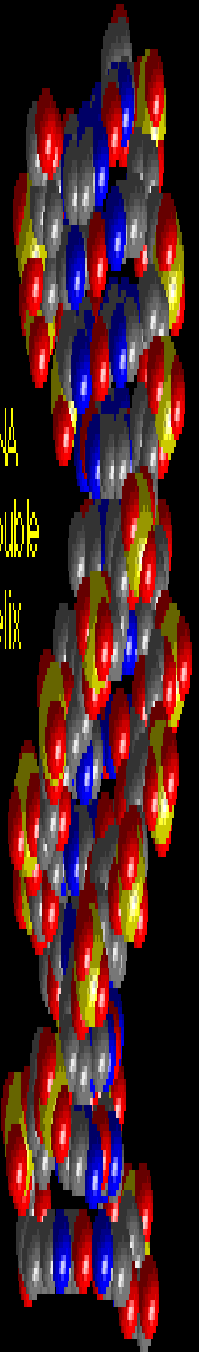
- The two chains run in opposite directions (antiparallel).
- The DNA chains twist to form a **double helix**

- Build a DNA model animation

How does DNA work?

- DNA provides a **code** which allows the cell to make **protein**.
- The most common proteins that the DNA makes are **enzymes**.
- By making enzymes DNA controls **the development of the cell**.

DNA
Double
Helix



How does DNA work?

- The bases along **one side** of the DNA molecule form the **genetic code**.
- Each sequence of **three bases** is called **a base triplet**.
- Each base triplet **codes for an amino acid** - which are the building blocks of **protein**.

DNA
Double
Helix



Base triplets code for amino acids

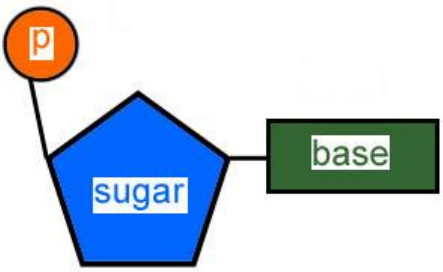


Figure 3 Protein synthesis – making protein from DNA

Questions

- 1 Use Figure 3 to work out the length of DNA required (in number of bases on the coding strand) to code for a protein consisting of 177 amino acids?





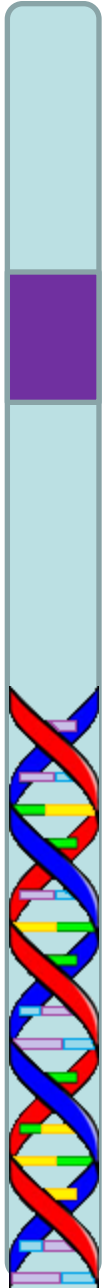
codes for

short length

made of

made of

made of



chromosome



gene



DNA

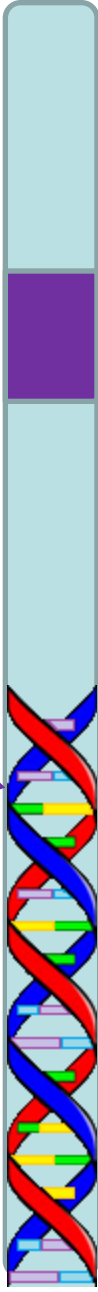
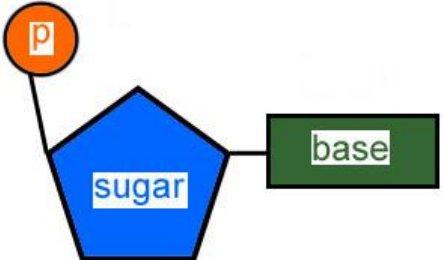
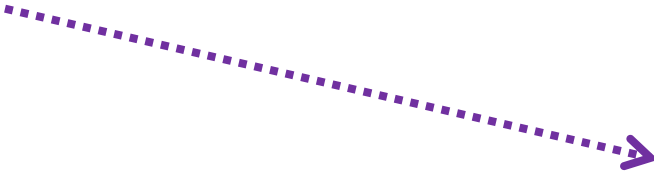


nucleotide

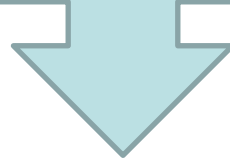


sugar & phosphate & base

protein



DNA
Base triplet
codes for



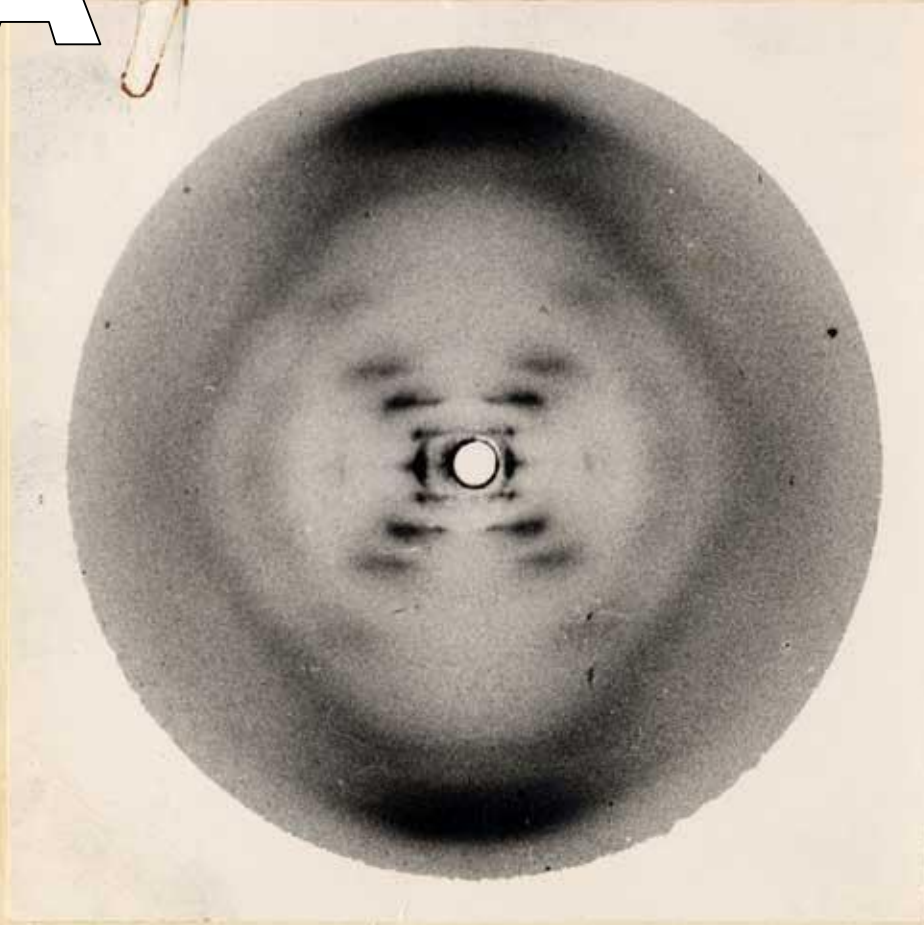
Amino acid
Join to form



PROTEIN

video DNA

https://www.youtube.com/watch?v=VegLVn_1oCE



Franklin &
Gosling
F.D. 51
Type D

Plate 1

HOT QUESTION

ERWIN CHARGAFF discovered that there was a relationship between the number of bases in the DNA which he was studying. His results are in the table below.

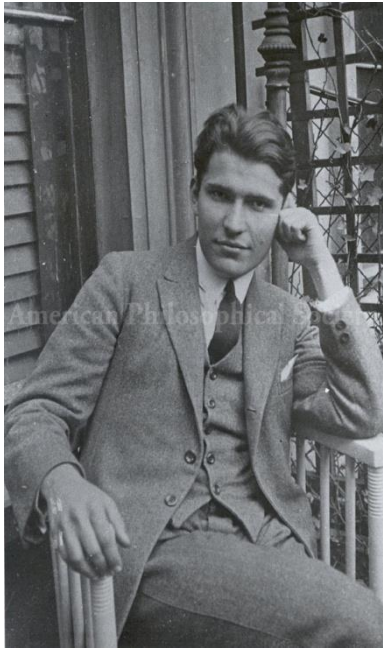
What does this suggest about the bases?

BASE	PERCENTAGE
Adenine	30
Cytosine	20
Gaunine	20
Thymine	30

Who discovered DNA?

- Cut and paste





Erwin Chargaff



**Rosalind
Franklin**



**Maurice
Wilkins**



**James
Watson**



Francis Crick

Who discovered DNA?

Discovered there are **equal numbers of A&T** and of **G&C**

Used **X-ray diffraction** to find the overall structure of DNA

Used molecular modelling to deduce that **A always pairs with T** and **C always pairs with G**

Used molecular modelling to deduce DNA is a double helix



Erwin Chargaff

Discovered there are **equal numbers of A&T** and of **G&C**



Rosalind Franklin



Maurice Wilkins

Used **X-ray diffraction** to find the overall structure of DNA



James Watson



Francis Crick

Used molecular modelling to deduce that **A always pairs with T** and **C always pairs with G**

Used molecular modelling to deduce DNA is a double helix

Development of the scientific theory of the structure of DNA



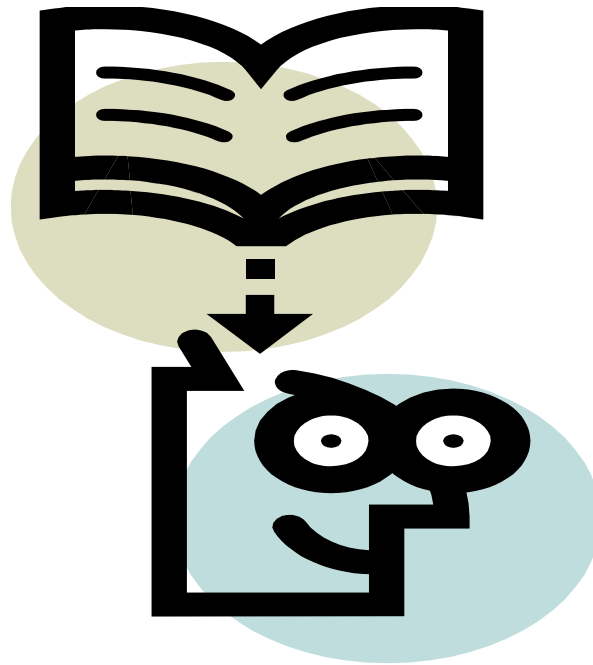
The scientific paper published by Watson and Crick in Nature magazine in 1951 and the model that they built was the result of scientists sharing their scientific knowledge.

The scientific theory of the structure of DNA was developed in stages, with **input from a number of different lines of evidence.**

The theory was **validated by peer review.** Scientists working in this field reviewed the scientific paper and the model.

This is an example of the **collaborative nature of science.**

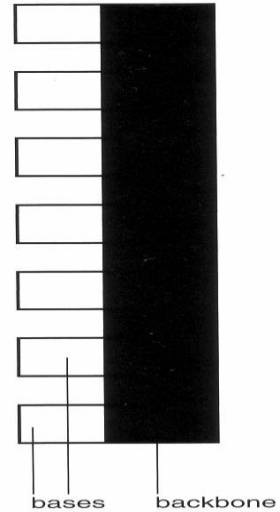
Complete Exam Questions





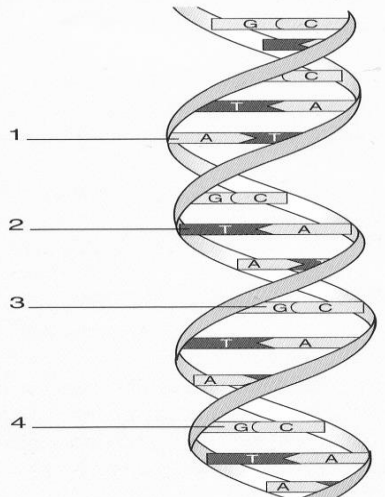
Exam questions

1 The diagram shows one strand of a DNA molecule.



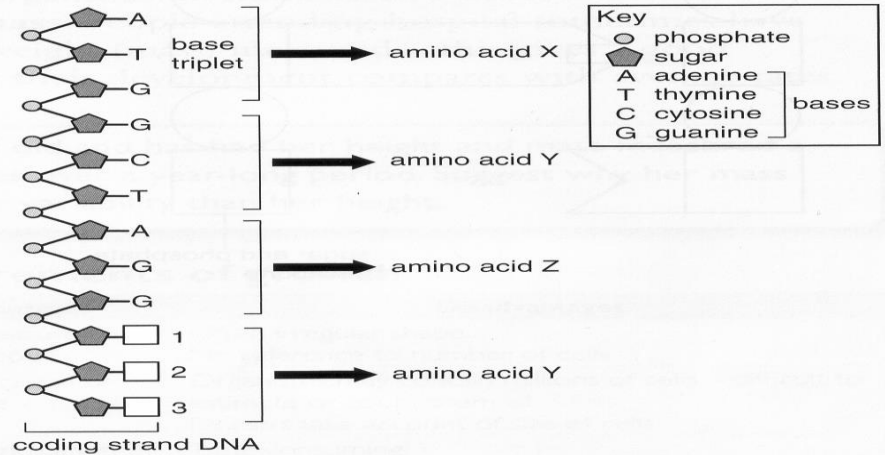
- Copy and complete the diagram by drawing the missing strand. (1 mark)
- Name the **two** chemicals that make up the backbone. (2 marks)
- Describe the three-dimensional shape of DNA. (1 mark)

2 The diagram below shows the 3D structure of DNA, which was discovered by Watson and Crick.



- Name **two** other scientists who made a discovery about the 3D structure of DNA. (2 marks)
- If there were 18 of these structures along a coding strand of DNA how many amino acids would they code for? (1 mark)

3 a) The diagram shows how DNA codes for amino acids.



- Give the names of the missing bases 1, 2 and 3. (1 mark)
 - Use the diagram and your knowledge to calculate how many bases would be required to produce 30 amino acids. (1 mark)
- Franklin and Wilkins showed that the arrangement of DNA resembled a ladder structure although they did not know how the pieces were linked.
 - Describe **two** further advances that Watson and Crick added to our understanding of the structure of DNA and name the process they used. (3 marks)
 - Name **one** other scientist who added to our knowledge of DNA and describe his/her contribution. (2 marks)

DNA

- <http://youtu.be/zwibgNGe4aY>