The Structure of DNA (Watson-Crick Model 1953)

- A Giant chemical molecule made of carbon, oxygen, hydrogen phosphorus and nitrogen atoms.
- Double helix (2 strands of spirals) – like a spiral ladder
- Each spiral is made of phosphates and sugars called deoxyribose in an alternate fashion.
- At each rung along the DNA ladder is a base pair.
- These bases contain nitrogen = nitrogenous bases: A= Adenine, T= Thymine, C= Cystosine and G= Guanine
- Each pair is either A with T or G with C
- Each base pair is held together by hydrogen bonds.

What is a Nucleotide?
- A single strand of DNA is actually a long chain of nucleotides, each with one of these 4 different bases.
- This strand is represented by a sequence of these individual letters e.g. AGTCTTCAGGT.
- Usually two strands of nucleotides wrap around each other, giving DNA the appearance of a twisted ladder, called a double helix.
- The backbone chain of pentose sugar-phosphate links forms the struts of the ladder and is always on the outside. The rungs of the ladder are made up of base pairs.
- Extensions: Chemical Formula of DNA
More Information about chromosome, gene and genome

1. **A chromosome** is an organised structure of **DNA** and **protein** that is found in **cells**.

2. Chromosomes also contain DNA-bound proteins, which serve to package the DNA and control its functions.

3. There are 22 pairs of homologous chromosomes called autosomes (non-sex) and 1 pair of sex chromosomes. In human males, XY and females XX sex chromosomes.

4. A chromosome is a single piece of coiled DNA.

5. DNA = Deoxyribose Nucleic Acid and has a double helix structure.

6. Each spiral strand, composed of a sugar phosphate backbone (the rail) and attached bases, is connected to a complementary strand by hydrogen bonding between paired bases (the rungs), adenine (A) with thymine (T) and guanine (G) with cytosine (C).

7. The Total length of DNA in a single cell is about 3 metres long.

8. The **genome** is an organism’s complete set of DNA.

9. Genomes vary widely in size: the smallest known genome for a free-living organism (a bacterium) contains about 600,000 DNA base pairs, while human genome has some 3 billion base pairs.

10. Each chromosome contains many **genes**, the basic physical and functional units of heredity.

11. Genes are specific sequences of bases that encode instructions on how to make proteins.

12. Genes comprise only about 2% of the human genome; the remainder consists of noncoding regions, whose functions may include providing chromosomal structural integrity and regulating where, when, and in what quantity proteins are made.

13. The human genome is estimated to contain 20,000-25,000 genes.
DNA Questions

Directions: Label the diagram below with the following choices:

- Nucleotide
- Deoxyribose
- Base pair
- Hydrogen bond
- Phosphate group
- Nitrogenous base

7. DNA is a polymer, which means that is made up of many repeating single units (monomers). What are the polymer and monomers called?

   ___________________________  ___________________________

8. Draw the basic structure of a nucleotide with its three parts.

   ______________________   __________________  ______________________
9. The “backbone” of the DNA molecule is made up of two components, what are these?
   _________________   _________________

10. Guanine (G), __________(C), thymine (    ) , and _________________(A) are the four _________________ in DNA.

11. In DNA, guanine always forms hydrogen bonds with _________________.

12. Complementary base pairs are :  A - _____   G - _____   C - _____   T - _____

13. The process of  R_________________ produces a new copy of an organism’s genetic information, which is passed on to a new cell.

14. The double coiled, “staircase” shape of DNA is called a _________________.

15. What form the rungs of the ladder? ________________

16. What do the letters DNA stand for?
   _______________________________________________________________________

17. Where in the cell is DNA located? _______________________________________________________________________

18. What are the differences between DNA, chromosomes and genes?
   _______________________________________________________________________
   _______________________________________________________________________
   _______________________________________________________________________

19. What is a genome?
   _______________________________________________________________________

20. How many base pairs and genes does a person have?
   _________________ base pairs         _________________ genes

21. Write the complementary sequence to following DNA strand:

```
T A C T T C A A A A A A A C C G A A C C G A T C
```