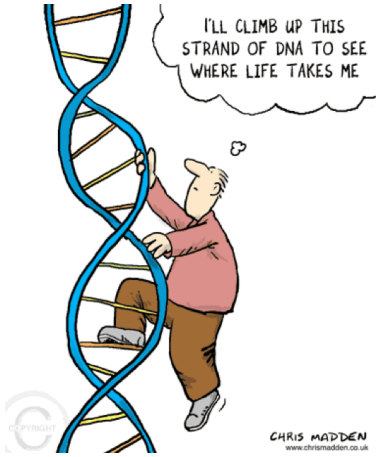
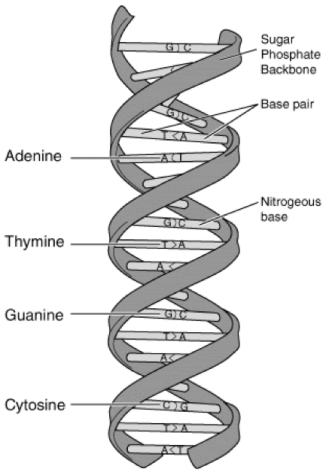
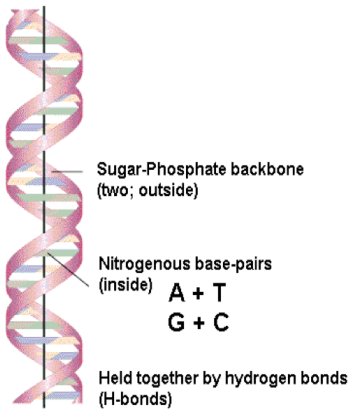
Year 10 Advanced Science – Genetics – Mr. E. Hung Note: G4

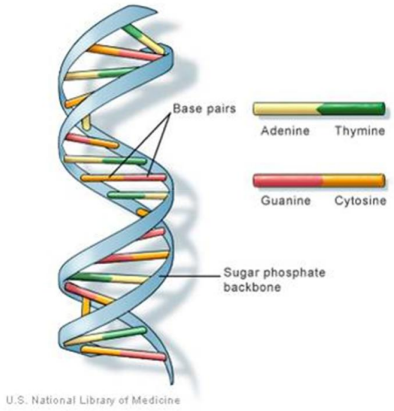
The Structure of DNA (Watson-Crick Model 1953)



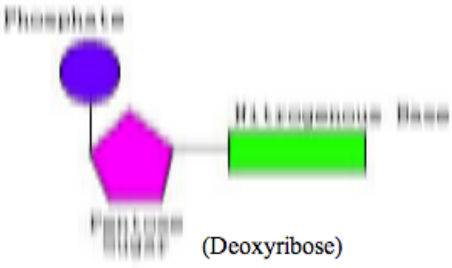
- A Giant chemical molecule made of carbon, oxygen, hydrogen phosphorus and nitrogen atoms.
- Double helix (2 strands of spirals) – like a spiral ladder
- Each spiral is made of phosphates and sugars called deoxyribose in an alternate fashion.
- At each rung along the DNA ladder is a base pair.
- These 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.



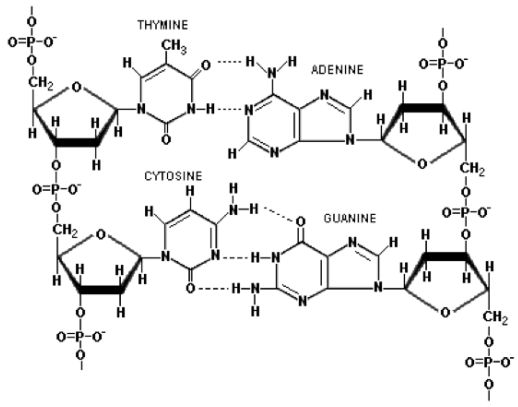


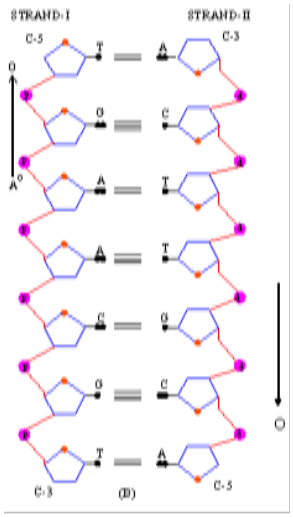


- What is a Nucleotide?
- A single strand of DNA is actually a long chain of nucleotides, each with one of these 4 different bases.
- This strand is represented by a sequence of these individual letters e.g. AGTCTTCAGGT.
- Usually two strands of nucleotides wrap around each other, giving DNA the appearance of a twisted ladder, called a double helix.



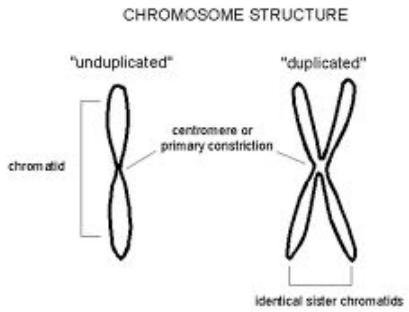
- The backbone chain of pentose sugar-phosphate links forms the struts of the ladder and is always on the outside. The rungs of the ladder are made up of base pairs.
- Extensions: Chemical Formula of DNA



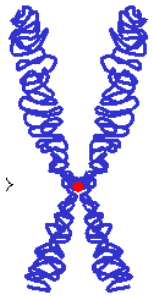


More Information about chromosome, gene and genome

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 = Dexoyribose Nucleic Acid and has a double helix structure.



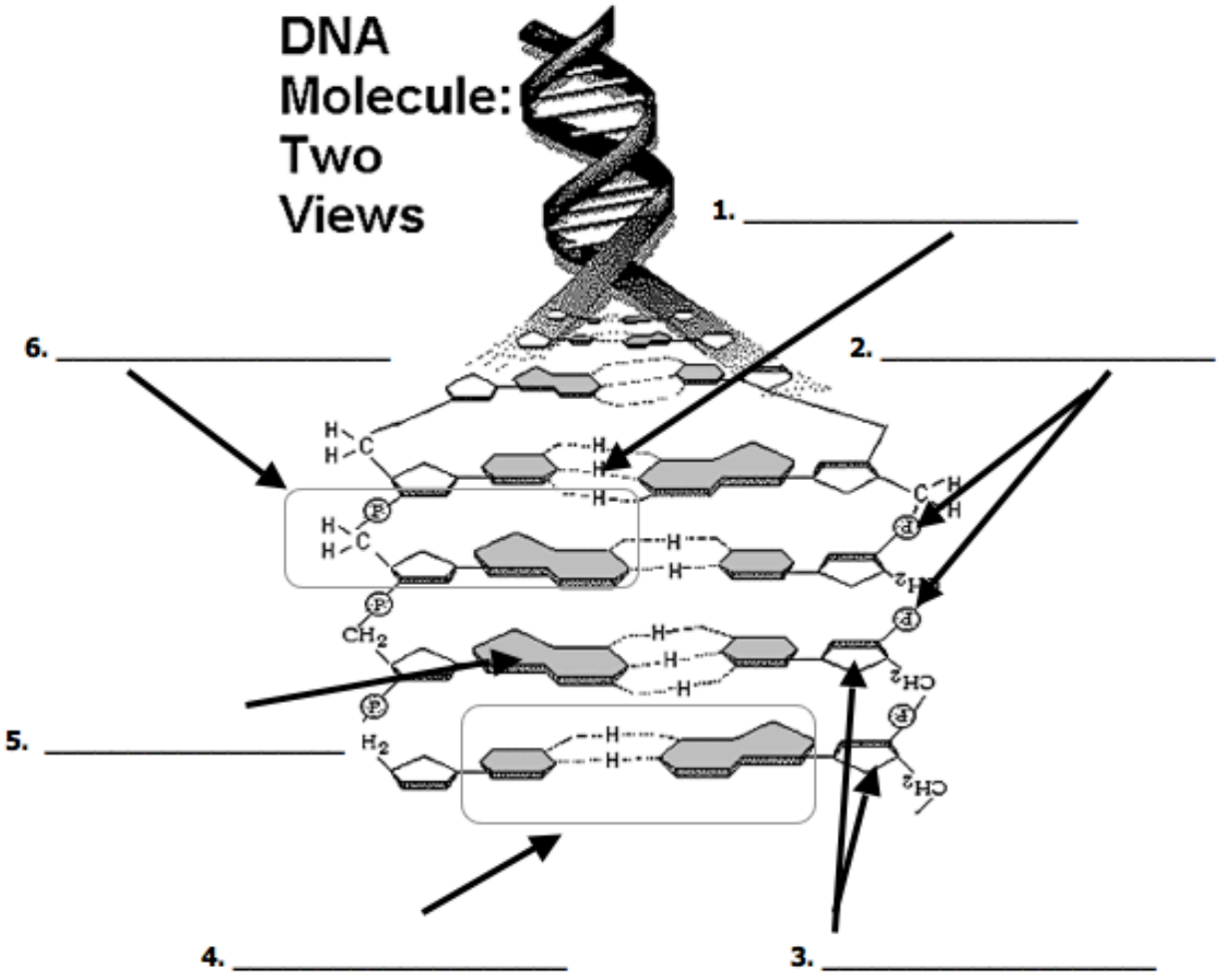
6. Each spiral strand, composed of a sugar phosphate backbone (the rail) and attached bases, is connected to a complementary strand by hydrogen bonding between bases (the rungs), adenine (A) with thymine (T) and guanine (G) with cytosine (C).
7. The Total length of DNA in a single cell is about 3 metres 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

Name: _____

Directions: Label the diagram below with the following choices:

- Nucleotide
- Deoxyribose
- Phosphate group
- Base pair
- Hydrogen bond
- 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?

_____

_____

_____

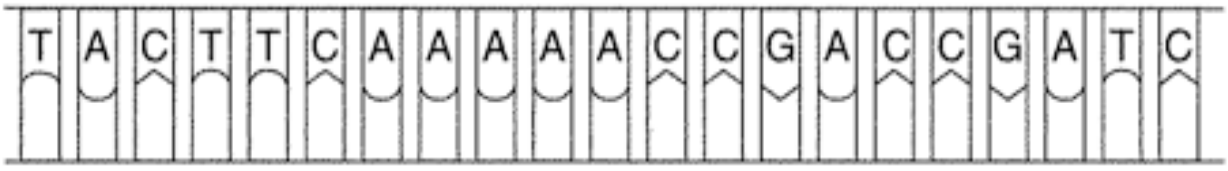
19. What is a genome?

_____

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

_____ base pairs _____genes

21. Write the complementary sequence to following DNA strand:



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