

MOLECULAR GENETICS

Molecular Genetics - the branch of genetics concerned with the structure and activity of genetic material at the molecular level

Genetic Material - chromatin (chromosomes) within the nucleus of the cell

- contains the entirety of an organism's hereditary information
= its *Genome*
- this information is encoded in DNA

1. DNA Structure

= Deoxyribonucleic acid

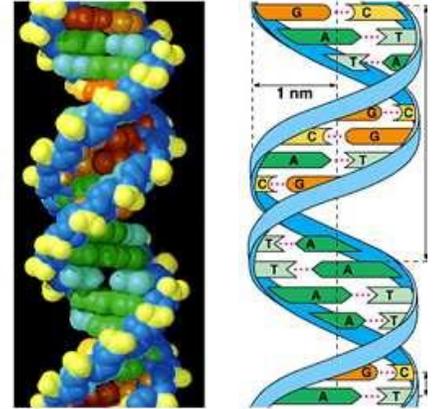
-discovery credited to Watson and Crick in 1953

: based on the work of Rosalind Franklin

-proposed DNA was a long, double stranded twisted structure

:called this a double helix

= looks like a twisted rope ladder

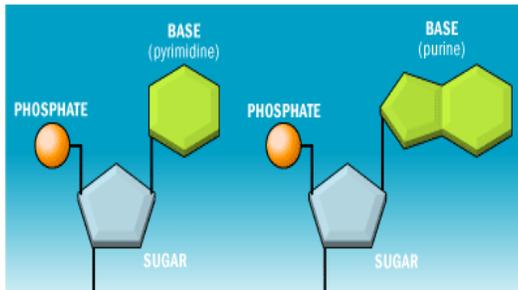


- is composed of subunits called nucleotides

: 1 nucleotide = phosphate + deoxyribose sugar + nitrogen base

: there are 4 different nitrogen bases

ADENINE, THYMINE, CYTOSINE, GUANINE



- C and T = pyrimidines

= have a single ring structure

- A and G = purines

= have a double ring structure

- nucleotides join together to form a double stranded molecule

: the sides of the "ladder" are made up of the alternating sugar-phosphate groups while the nitrogen bases form the "rungs of the ladder"

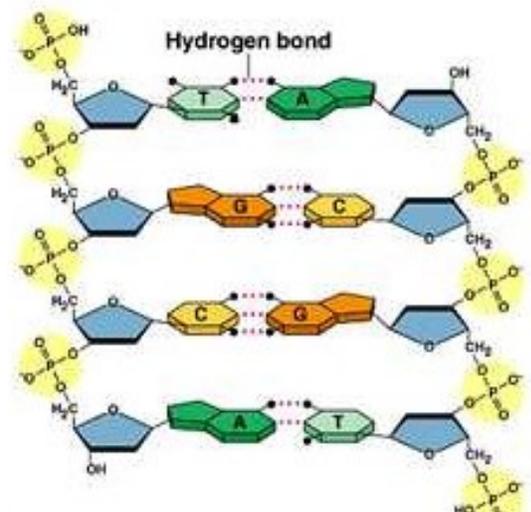
- the bases are held together using weak hydrogen bonds & are paired based on shape & size

: G and C **always** join together (triple bond)

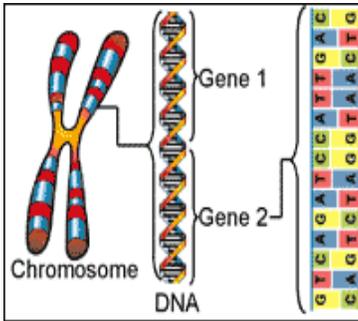
: A and T **always** join together (double bond)

- other pairings do not occur in normal situations

The section of DNA to the right is made up of **EIGHT** nucleotides



2. DNA and How Genes Work



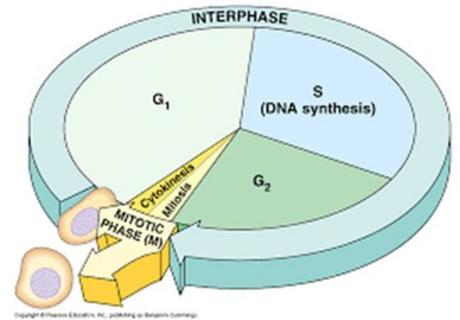
: Genes

- **sections** of chromosomes associated with specific traits
- provide the instructions for the manufacture of all of the traits within an organism
 - = proteins (**structures, enzymes and hormones**)
- as chromosomes are composed of DNA, it is the **sequence** (order) of the **base pairs** of the nucleotides that provides the **genetic code** or instructions for a trait

= traits are preserved and transmitted through the process of DNA Replication

3. DNA Replication

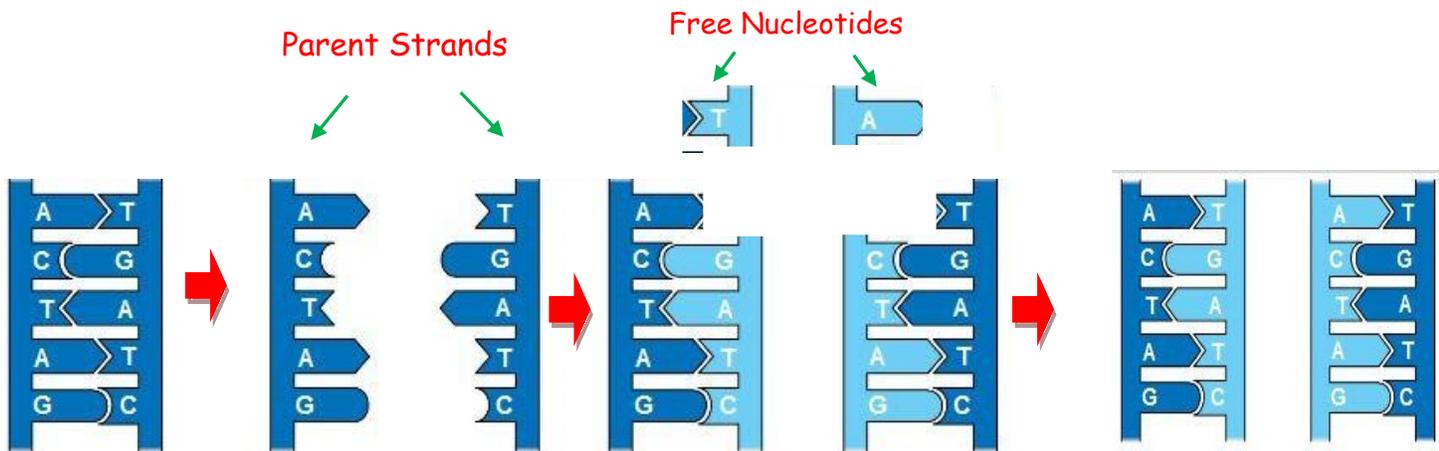
- is the process through which DNA **duplicates itself**
- is the doubling of chromosomes during interphase of the cell cycle
- assures that every cell has identical genetic information after cell division takes place
 - = **mitosis and meiosis**



DNA Replication: <https://www.youtube.com/watch?v=nQjJvhpBIe0>

- Steps in Replication

- 1) DNA molecule **uncoils**
- 2) The DNA molecule **unzips** creating 2 parent strands = hydrogen bonds between base pairs are broken by helicase enzyme
- 3) DNA molecule **rebuilds** = DNA polymerase enzyme attaches free nucleotides to corresponding bases on each parent strand making 2 complete DNA molecules
- 4) both molecules **recoil** allowing for meiosis or mitosis to begin



****SEMICONSERVATIVE REPLICATION:** parent strand is used as a template
= less chance of **errors** in the sequence