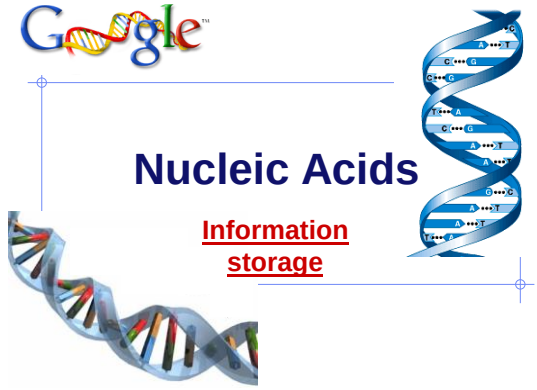
Nucleic acids



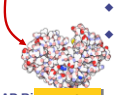
Nucleic Acids

Information storage

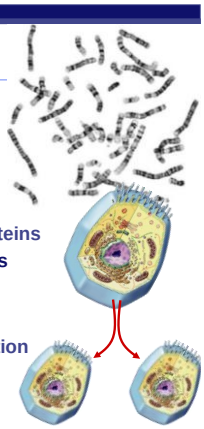
Nucleic Acids

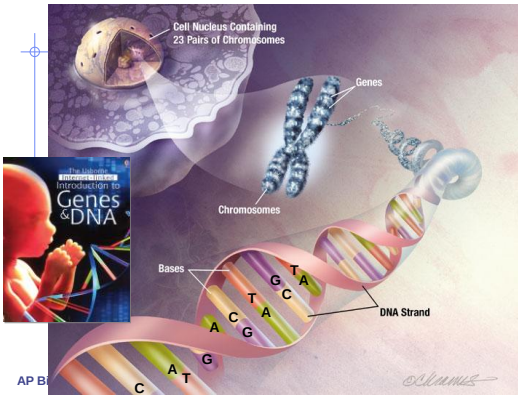
- **Function:**
  - genetic material
    - stores information
      - genes
      - blueprint for building proteins
        - DNA → RNA → proteins
    - transfers information
      - blueprint for new cells
      - blueprint for next generation

DNA



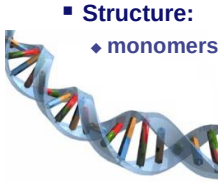
proteins





Nucleic Acids

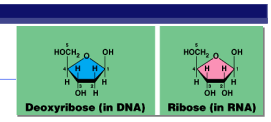
- **Examples:**
  - RNA (ribonucleic acid)
    - single helix
  - DNA (deoxyribonucleic acid)
    - double helix
- **Structure:**
  - monomers = nucleotides



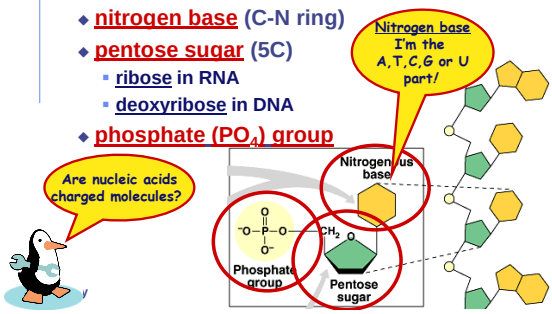
DNA

RNA

Nucleotides

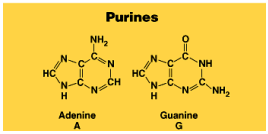


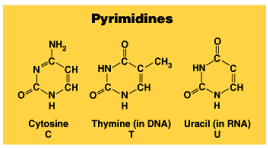
- **3 parts**
  - nitrogen base (C-N ring)
  - pentose sugar (5C)
    - ribose in RNA
    - deoxyribose in DNA
  - phosphate (PO_4) group



Types of nucleotides

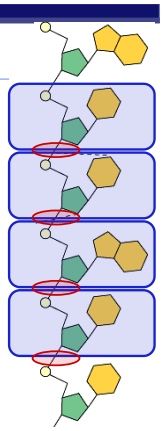
- 2 types of nucleotides
  - different nitrogen bases
  - purines
    - double ring N base
    - adenine (A)
    - guanine (G)
  - pyrimidines
    - single ring N base
    - cytosine (C)
    - thymine (T)
    - uracil (U)





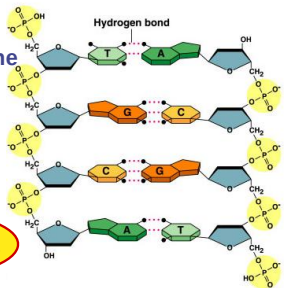
Nucleic polymer

- Backbone
  - sugar to PO_4 bond
  - phosphodiester bond
    - new base added to sugar of previous base
    - polymer grows in one direction
  - N bases hang off the sugar-phosphate backbone



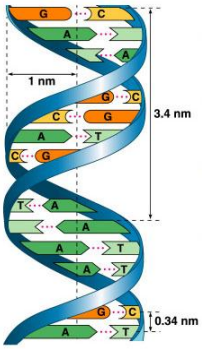
Pairing of nucleotides

- Nucleotides bond between DNA strands
  - H bonds
  - purine :: pyrimidine
  - A :: T
    - 2 H bonds
  - G :: C
    - 3 H bonds



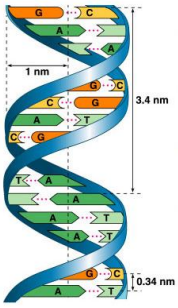
DNA molecule

- Double helix
  - H bonds between bases join the 2 strands
    - A :: T
    - C :: G



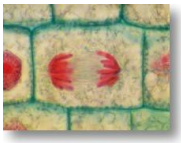
Copying DNA

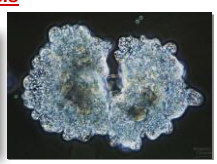
- Replication
  - 2 strands of DNA helix are complementary
    - have one, can build other
    - have one, can rebuild the whole

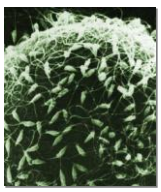


When does a cell copy DNA?

- When in the life of a cell does DNA have to be copied?
  - cell reproduction
    - mitosis
  - gamete production
    - meiosis



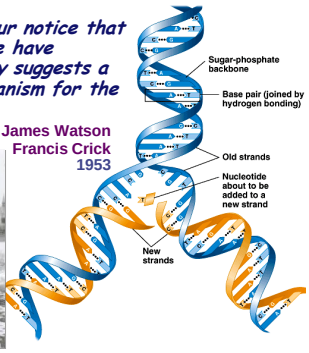




DNA replication

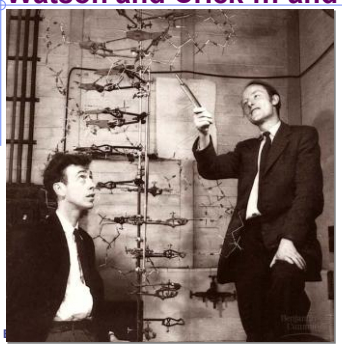
"It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material."

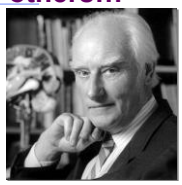
James Watson
Francis Crick
1953



1953 | 1962

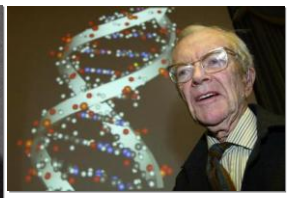
Watson and Crick … and others…



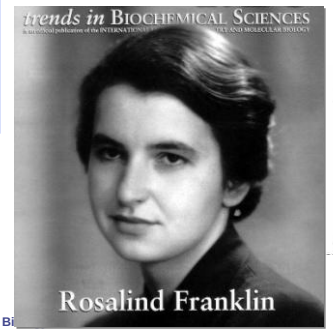


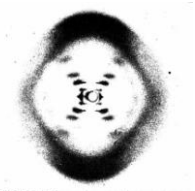
1953 | 1962

Maurice Wilkins… and…



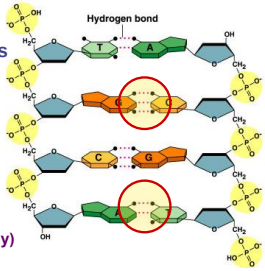
Rosalind Franklin (1920-1958)





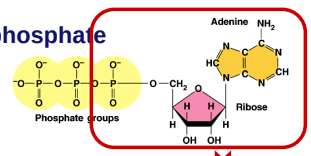
Interesting note…

- Ratio of A-T::G-C affects stability of DNA molecule
  - 2 H bonds vs. 3 H bonds
  - biotech procedures
    - more G-C = need higher T° to separate strands
  - high T° organisms
    - many G-C
  - parasites
    - many A-T (don't know why)

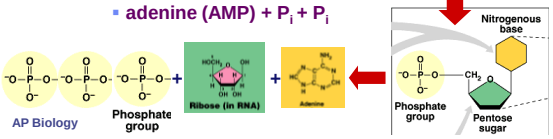


Another interesting note…

- ATP
  Adenosine triphosphate



- modified nucleotide
  - adenine (AMP) + P_i + P_i

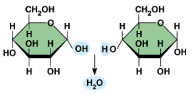


HELIXHELIX

Macromolecule Review

Carbohydrates

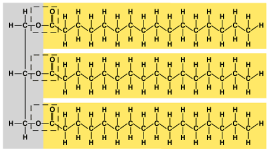
- Structure / monomer
  - monosaccharide
- Function
  - energy
  - raw materials
  - energy storage
  - structural compounds
- Examples
  - glucose, starch, cellulose, glycogen



glycosidic bond

Lipids

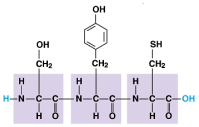
- Structure / building block
  - glycerol, fatty acid, cholesterol, H-C chains
- Function
  - energy storage
  - membranes
  - hormones
- Examples
  - fat, phospholipids, steroids



ester bond (in a fat)

Proteins

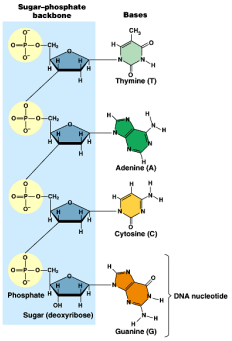
- Structure / monomer
  - amino acids
  - levels of structure
- Function
  - enzymes
  - transport
  - signals
  - defense
  - structure
  - receptors
- Examples
  - digestive enzymes, membrane channels, insulin hormone, actin



peptide bond

Nucleic acids

- Structure / monomer
  - nucleotide
- Function
  - information storage & transfer
- Examples
  - DNA, RNA



phosphodiester bond

Let's build some DNA, baby!