

## DNA & Replication Notes

### I. DNA

- a. DNA is short for deoxyribonucleic acid.
- b. It is found in the nucleus of cells in the structure of a chromosome.
- c. DNA requirements
  - i. Genes carry information from one generation to another
  - ii. Genes determine heritable characteristics of organisms
  - iii. Genes are easily copied

### II. DNA structure

- a. DNA is a nucleic acid made up of units called nucleotides.
  - i. 5-carbon sugar called deoxyribose
  - ii. Phosphate group
  - iii. Nitrogenous base (4 of them)
    - 1. Purines (2 rings)
      - a. Adenine
      - b. Guanine
    - 2. Pyrimidines (1 ring)
      - a. Cytosine
      - b. Thymine
- b. DNA looks like a ladder when untwisted.
  - i. The backbone is made up of a sugar and phosphate
  - ii. The nitrogenous bases make up the ladder rungs

### III. Chargaff's Rules- How are nucleotides related?

- a. Erwin Chargaff- American biochemist discovered the percentages of G, C, A, and T in DNA samples (He discovered the base pairing rules)
  - i.  $A = T$
  - ii.  $C = G$

### IV. X-Ray Evidence

- a. Rosalind Franklin used X-ray diffraction to learn about the structure of DNA (She at the same time as Watson and Crick to discover the shape of DNA)

### V. The Double Helix

- a. Francis Crick and James Watson were trying to determine the 3-D structure of DNA
  - i. They used Franklins work to determine that DNA was a double helix, which is two strands wound around each other.
  - ii. It looks like a twisted ladder.
  - iii. It is held together by hydrogen bonds between the nitrogenous bases
    - A-T has 2 hydrogen bonds
    - C-G has 3 hydrogen bonds

### DNA replication (duplicating DNA)

- a. DNA strands are **complementary**- that is each strand can be used to make the other strand.
- b. Starts by the DNA molecule unzipping and the hydrogen bonds between base pairs breaking. **DNA helicase** binds and stimulates unwinding.
- c. **DNA single-stranded binding proteins** stabilize the single strand structure.
- d. The sites on DNA where separation and replication occur are called **replication forks**.
- e. Replication takes place in both directions until each chromosome is completely copied. In a **5' → 3' direction**.
- f. There are two replicating strands the **leading strand** and the **lagging strand**. The leading strand moves in a forward motion. The lagging strand moves in a backwards motion.
  - i. The lagging strand is made up of **Okazaki fragments** which replicate short pieces of DNA at a time.
- g. **DNA polymerase** the principal enzyme in DNA rep. joins individual nucleotides to produce a DNA molecule, which is a polymer. DNA polymerase also proofreads each new DNA strand.
- h. **Primase** is an enzyme that helps start DNA replication in an Okazaki fragment.
- i. **DNA ligase** removes the gaps that are in place due mainly to the use of primase in the lagging strand.

