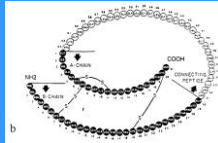
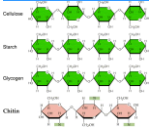
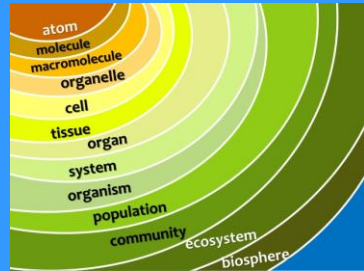


1.5 Structure and Function of Biological Macromolecules



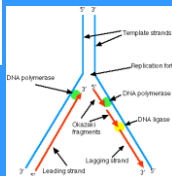
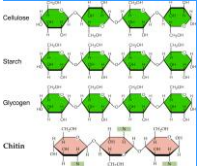
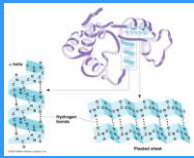
ENDURING UNDERSTANDING

SYI-1 Living systems are organized in a hierarchy of structural levels that interact.



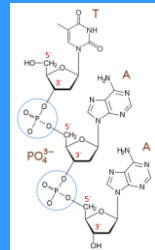
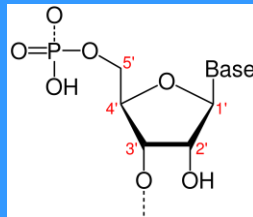
SYI-1.C Explain how a change in the subunits of a polymer may lead to changes in structure or function of the macromolecule

- Directionality of the subcomponents influences structure and function of the polymer



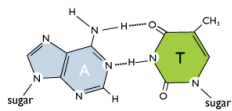
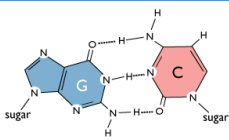
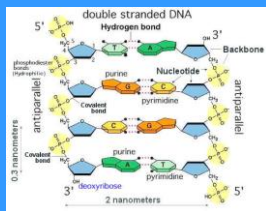
Nucleic Acid Directionality

- Nucleic acids have a linear sequence of nucleotides that have ends, defined by the 3' hydroxyl and 5' phosphates of the sugar.
- During DNA and RNA synthesis, nucleotides are added to the 3' end of the growing strand, resulting in the formation of a covalent bond between nucleotides.



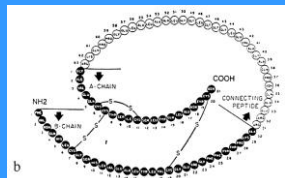
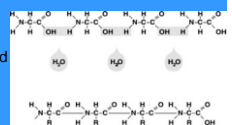
Nucleic Acid Directionality

- DNA is structured as an antiparallel double helix, with each strand running in opposite 5' to 3' orientation.
- Adenine pairs with thymine nucleotides via two hydrogen bonds.
- Cytosine pairs with guanine nucleotides by three hydrogen bonds.



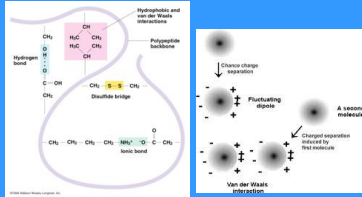
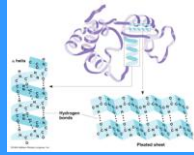
Protein Directionality

- Amino acids connect by the formation of covalent bonds at the carboxyl terminus
- Proteins have primary structure determined by the sequence order of their constituent amino acids
- Primary structure is coded by genes
 - Discovered by Frederick Sanger
 - Pioneered work on AA sequence of insulin
 - late 1940s-early 1950s



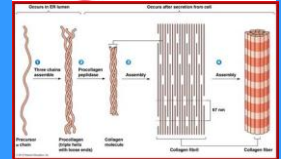
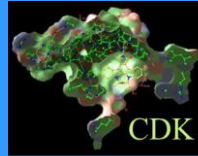
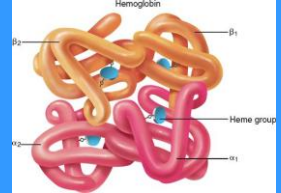
Protein Directionality

- Secondary structure arises through local folding of the amino acid chain into elements such as alpha-helices and beta-sheets
- Tertiary structure is the overall three-dimensional shape of the protein (polypeptide) and often minimizes free energy
- H-bonds
- Disulfide bridges
- Ionic bonds
- van der Waals



Protein Directionality

- Quaternary structure arises from interactions between multiple polypeptide units. (2or more)
- The four elements of protein structure determine the function of a protein.



Carbohydrate Directionality

- The nature of the bonding between carbohydrate subunits determines their relative orientation in the carbohydrate
- Which then determines the secondary structure of the carbohydrate.

