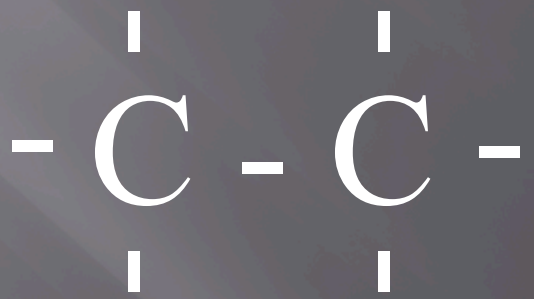
ORGANIC MOLECULES

Organic Compounds

- **Compounds** that contain **CARBON** are called **organic**.
- **Macromolecules** are large **organic molecules**.

Organic Molecules

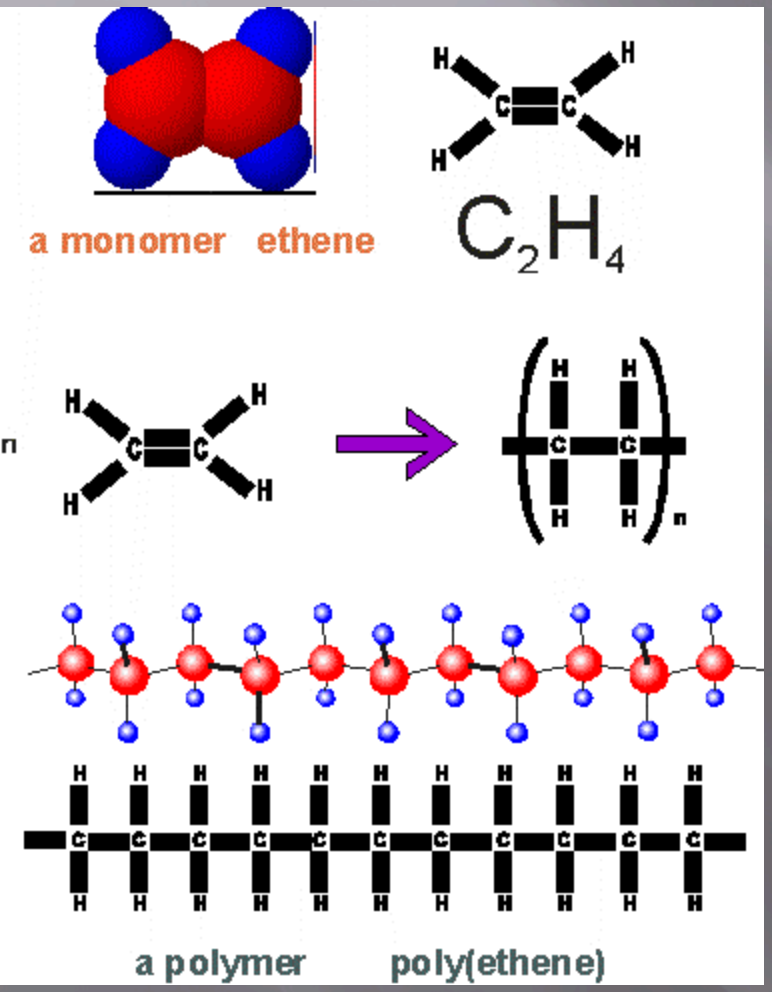
- Carbon has 4 electrons in outer shell.
- Carbon can form covalent bonds with as many as 4 other atoms (elements).
- Usually with C, H, O or N.



Macromolecules: "giant molecules"

- *There are four classes of organic (carbon based) macromolecules*
  1. Carbohydrates
  2. Lipids
  3. Proteins
  4. Nucleic Acids

Macromolecules are polymers



- **Large organic molecules.**
- Also called **POLYMERS**.
- Made up of smaller "building blocks" called **MONOMERS**.

- *What is a polymer?*
- Poly = many; mer = part.

1. Carbohydrates

- Carbo = carbon, hydrate = water; carbohydrates have the molecular formula $(CH_2O)_n$
  - Common types:
    - Sugar
    - Starch

Carbohydrates

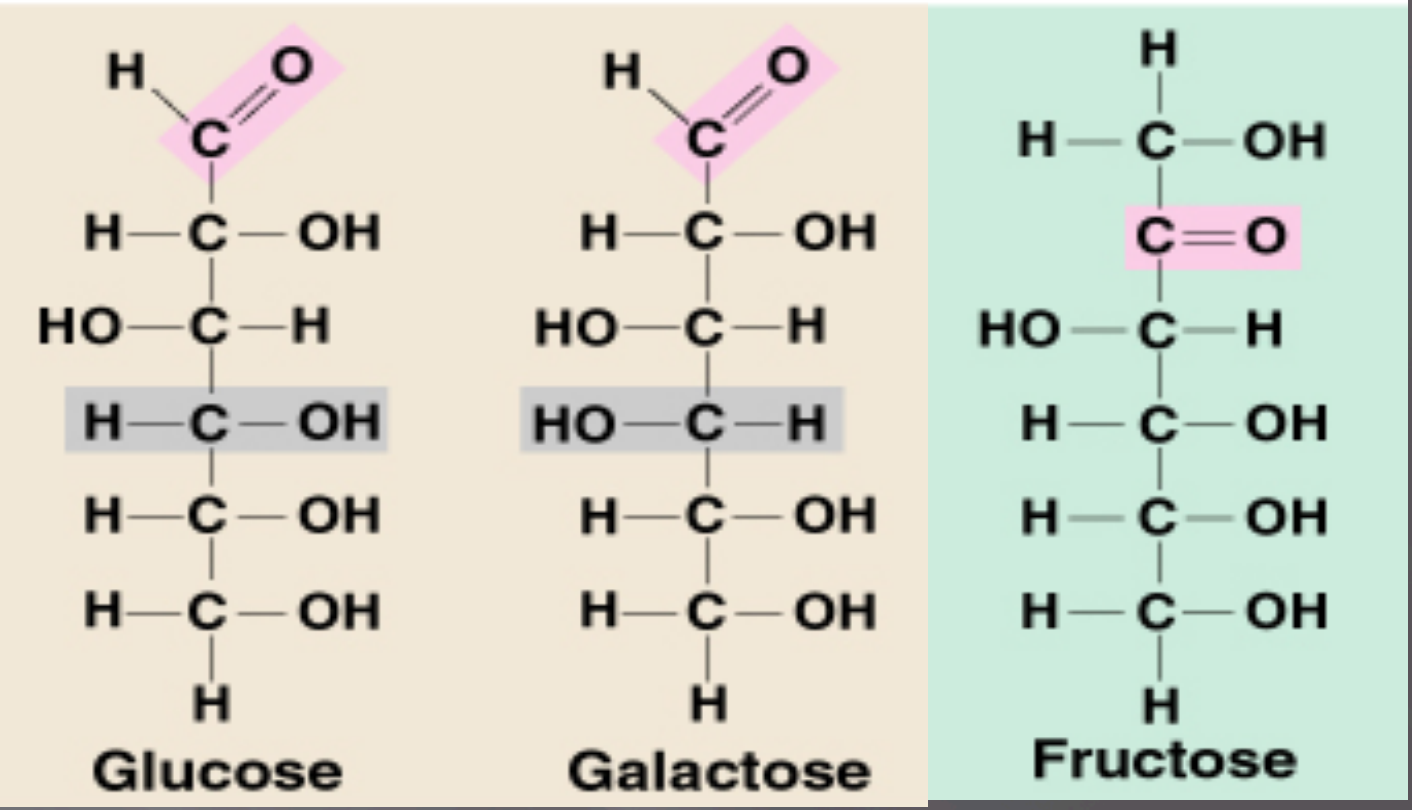
- Functions:
  - Store chemical energy for cellular use
  - Structural support in cells
    - E.g. cellulose cell wall in plants

Monosaccharides

- Simplest kind of carbohydrate
- Single sugar molecule
- Basic building block is a monosaccharide
  $(CH_2O)n$; n = 3,5,6

Monosaccharides

- Monosaccharide
  - E.g. glucose, galactose, fructose



Disaccharides

- Disaccharide - two mono's linked
  - **sucrose – table sugar**
  - **Lactose – milk sugar**
  - **Maltose – malt sugar**

Formation of Disaccharides

- Glucose + glucose = maltose
- Glucose + fructose = sucrose
- Glucose + galactose = lactose

Polysaccharides

- Polysaccharides – Many mono's linked
  - E.g. **starch, glycogen, cellulose**
  - **Insoluble**

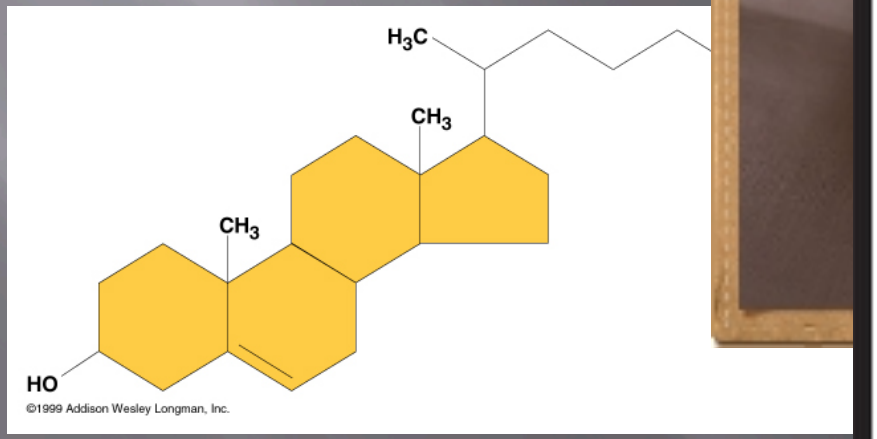
2. Lipids

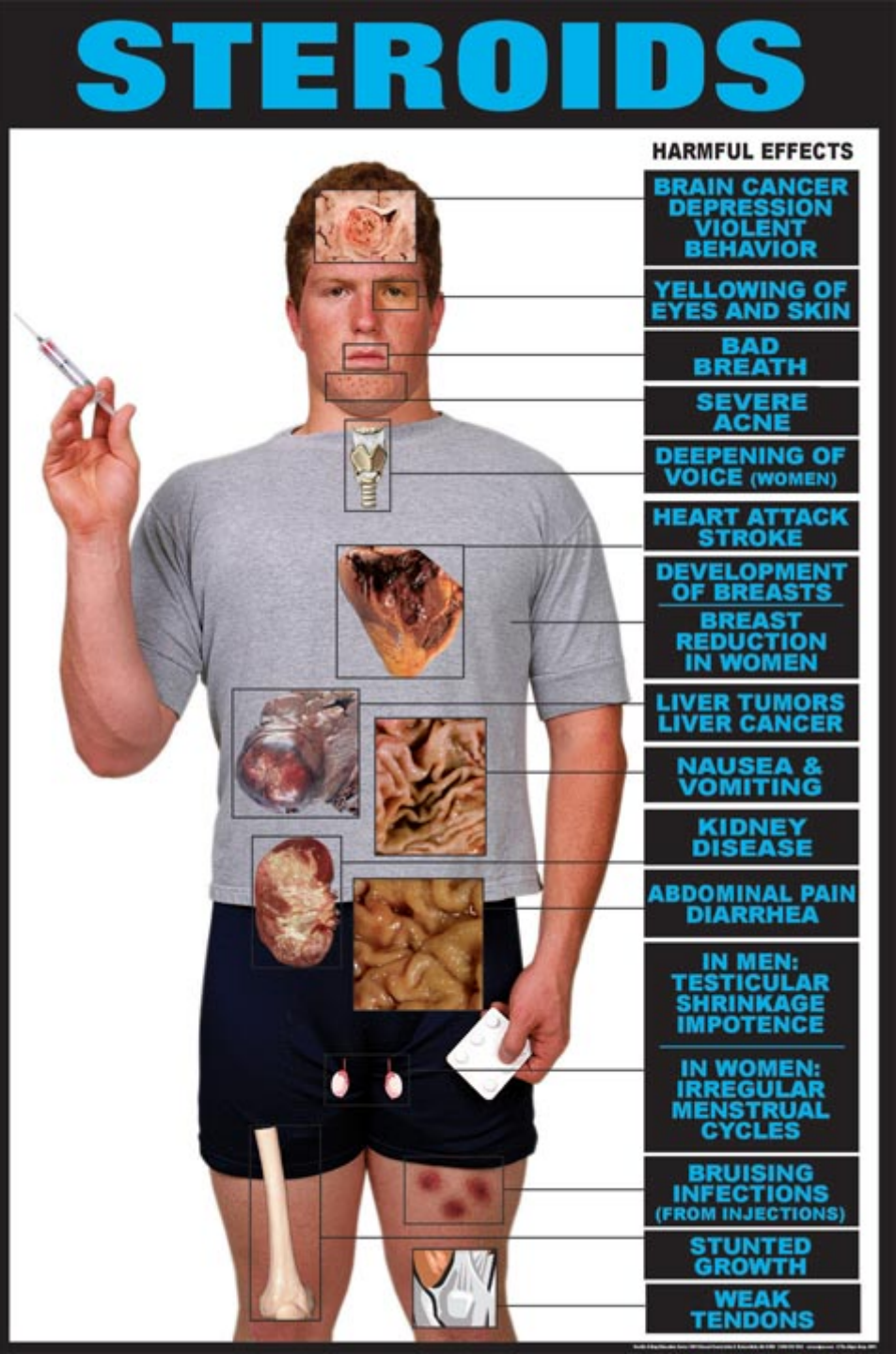
- Contain **fewer oxygen's than carbohydrates**
- **Not** water soluble

Lip

Examples:

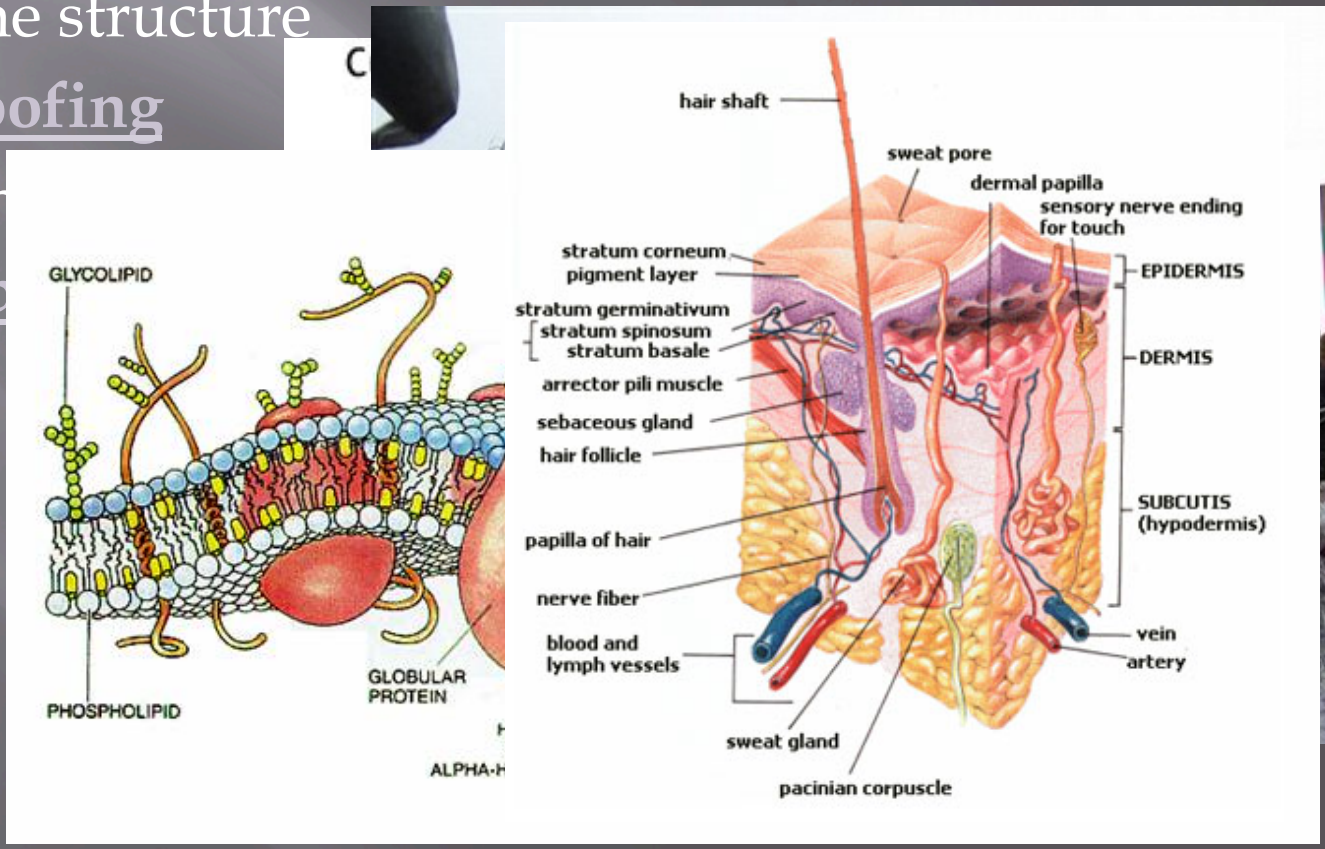
- Fats
- Oils
- Waxes
- Steroids





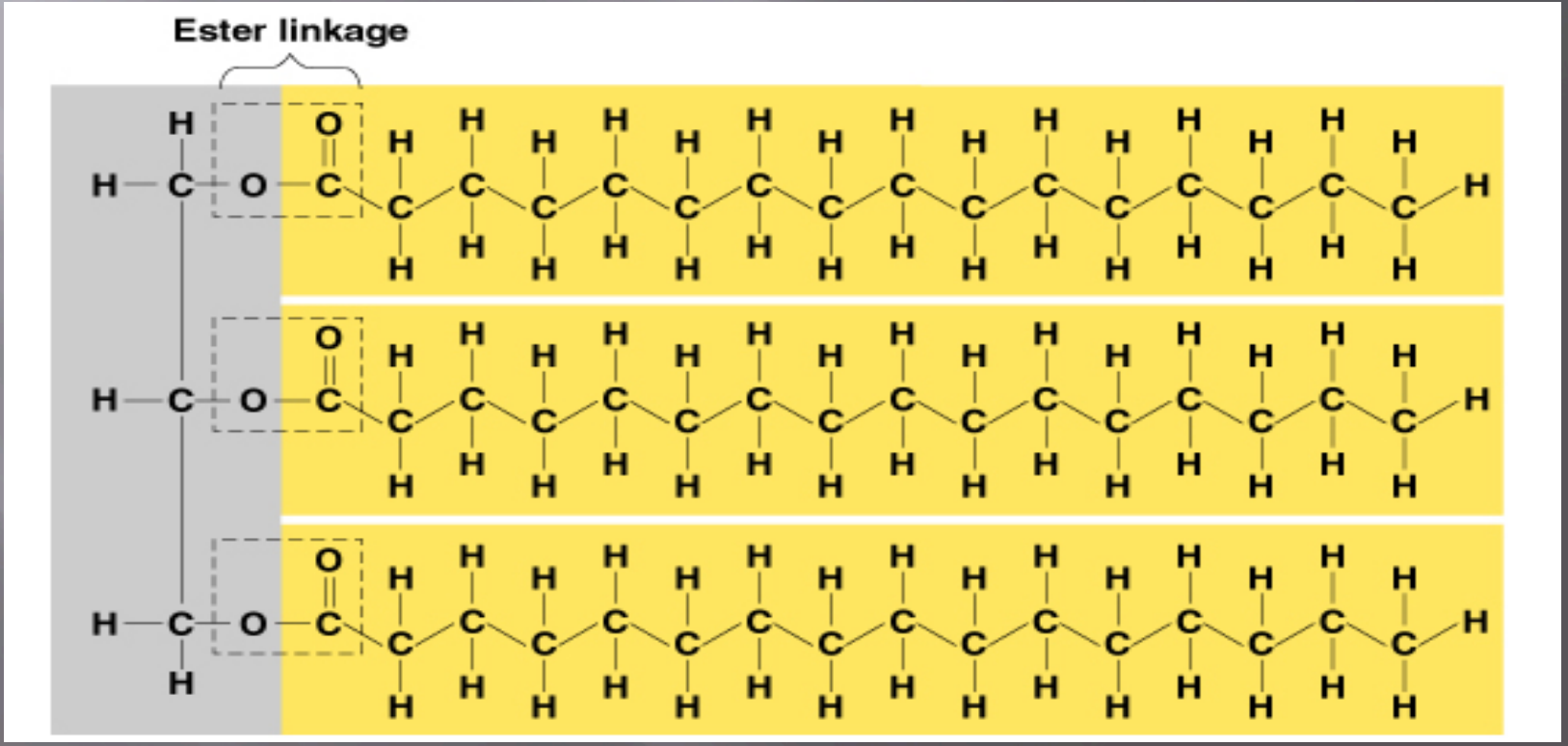
Lipids

- Functions:
  - Energy storage – long term
  - Membrane structure
  - Waterproofing
  - Insulation
  - Shock ab
  - Chemical



Lipids

- Are made of two parts
- 1 Glycerol + 3 fatty acids



Lipids

- Fatty acids are long molecules with a polar, hydrophilic end and a non-polar, hydrophobic "tail".

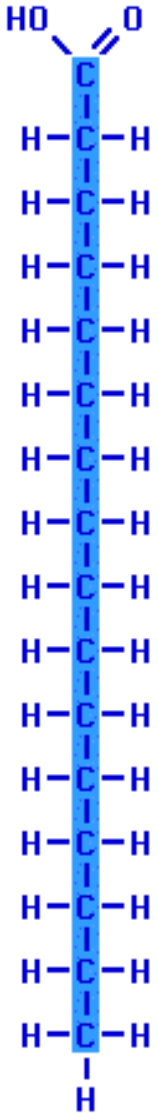
Fatty Acids: Saturated or Unsaturated

1. Saturated fats: "saturated with **hydrogen**"
   - have only **single** C-C bonds
   - **solid** at room temp
   - most **animal** fats

Fatty Acids: Saturated or Unsaturated

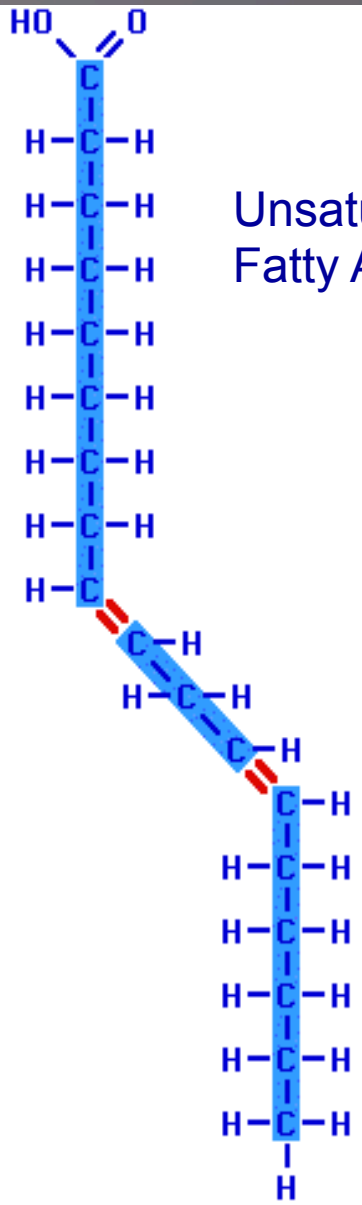
2. Unsaturated fats :
   - liquid at room temp
   - double bonds between carbons C = C
   - most plant fats

Saturated Fatty Acid



Palmitic acid

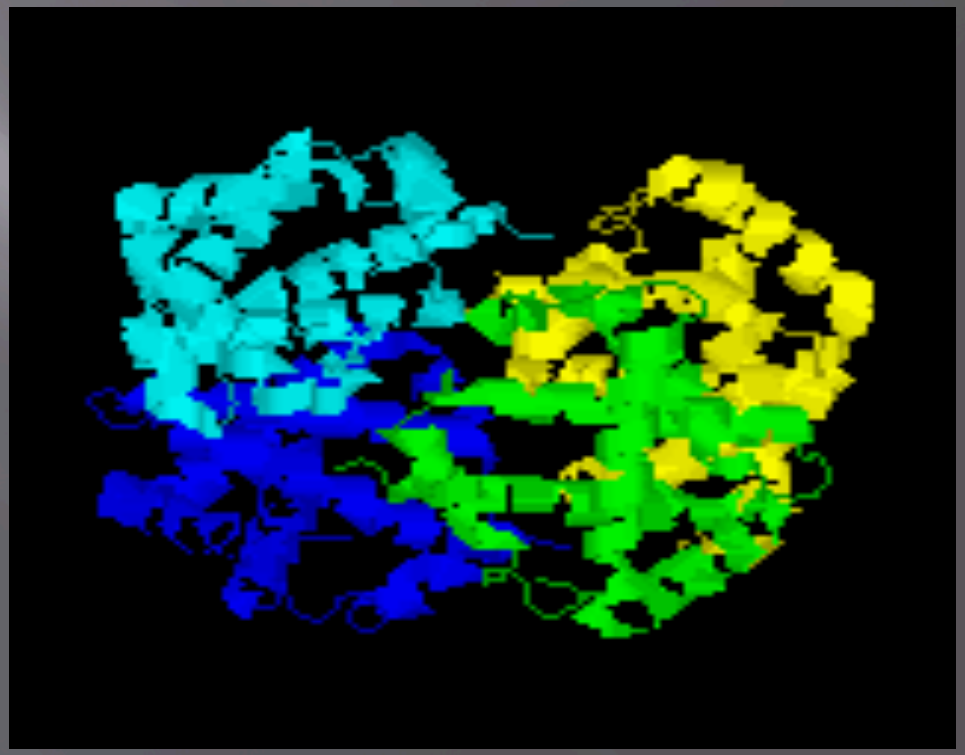
Unsaturated Fatty Acid



Linoleic acid

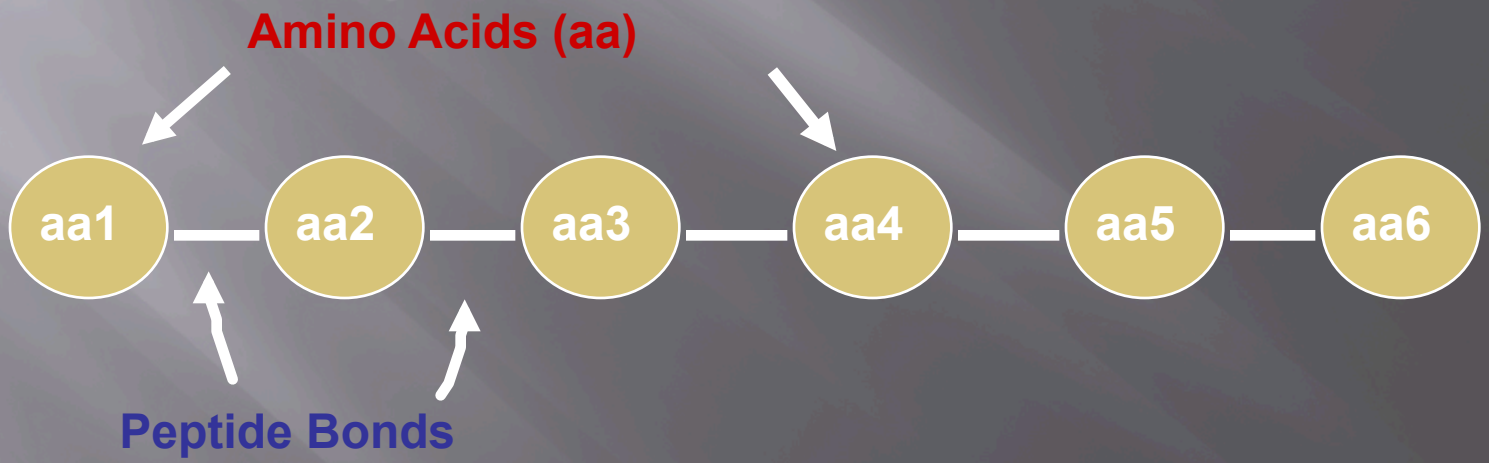
4. Protein

- Polymer of amino acids
- Made of elements carbon, hydrogen, oxygen and nitrogen (CHON)



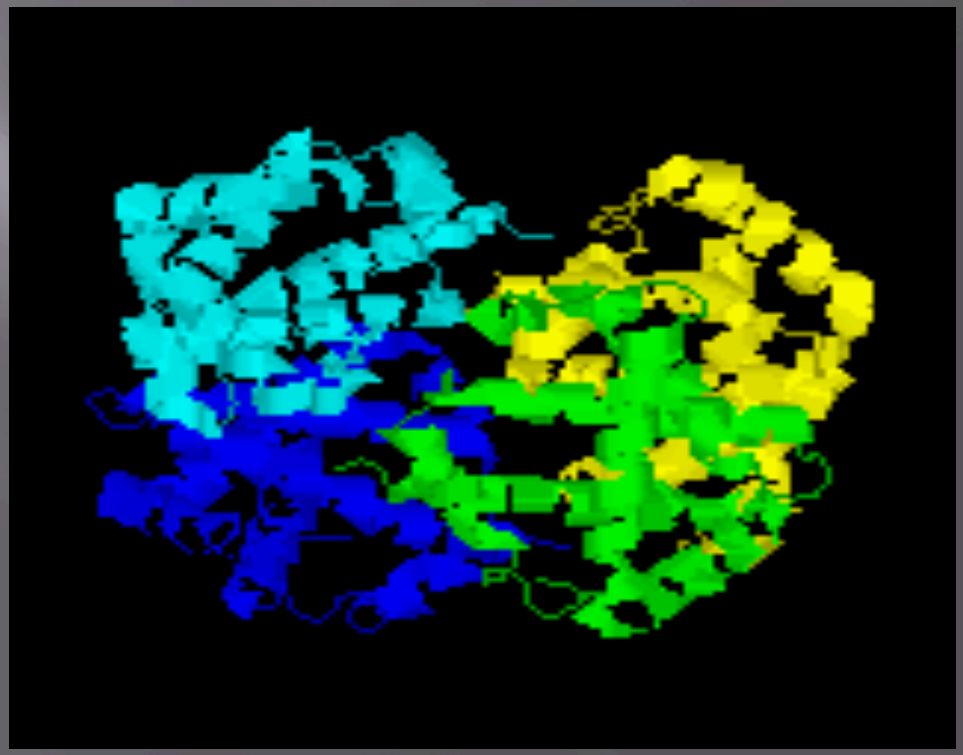
Amino Acids

Amino acids bonded together by peptide bonds (straight chains)



4. Protein

- 20 amino acids needed by humans
- We can only make 10
- Ones we have to take in are called essential amino acids



Proteins

- Basic Function

1. Storage: albumin (egg white)
2. Transport: hemoglobin
3. Regulatory: hormones
4. Movement: muscles
5. Structural: membranes, hair, nails
6. Enzymes: cellular reactions

Shape important to Protein Function

- Changing shape changes function

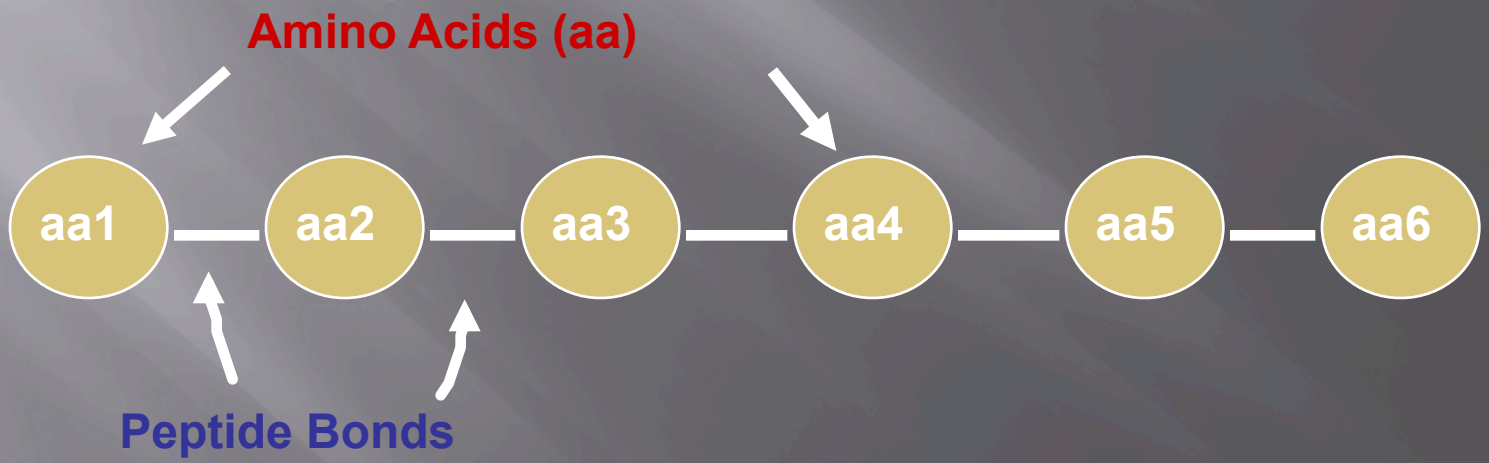
Proteins (Polypeptides)

Four levels of protein structure:

A. Primary Structure
B. Secondary Structure
C. Tertiary Structure
D. Quaternary Structure

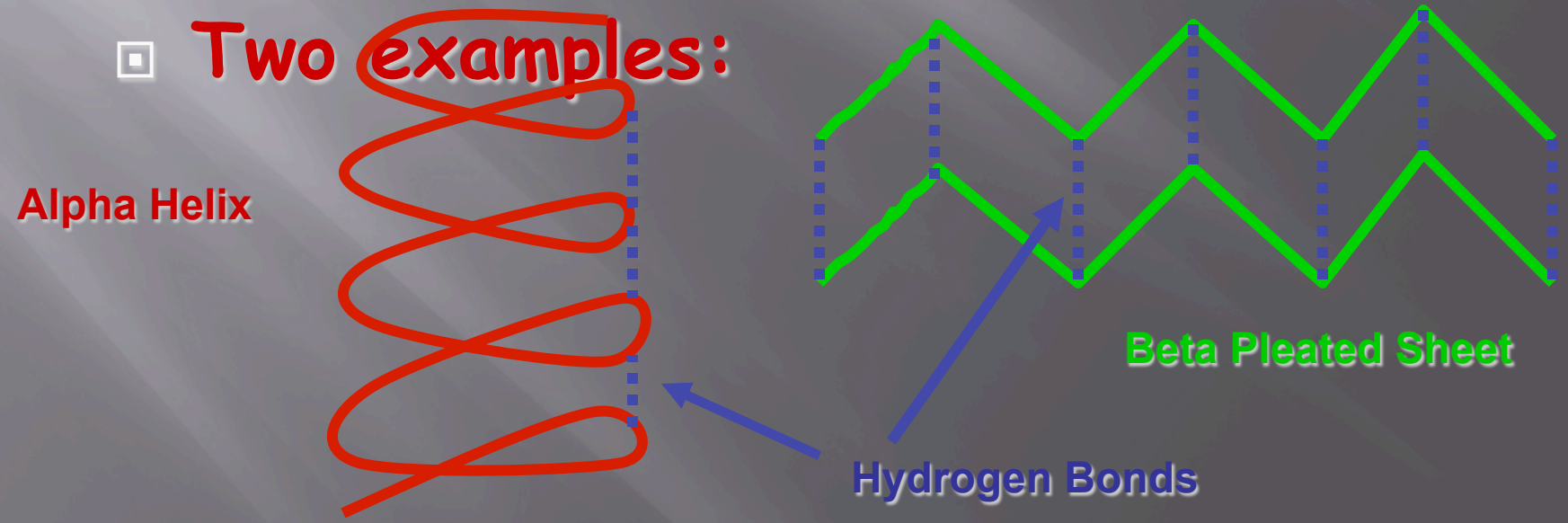
Primary Structure

Amino acids bonded together by peptide bonds (straight chains)



Secondary Structure

- 3-dimensional folding arrangement of a primary structure into coils and pleats held together by hydrogen bonds.
- Two examples:

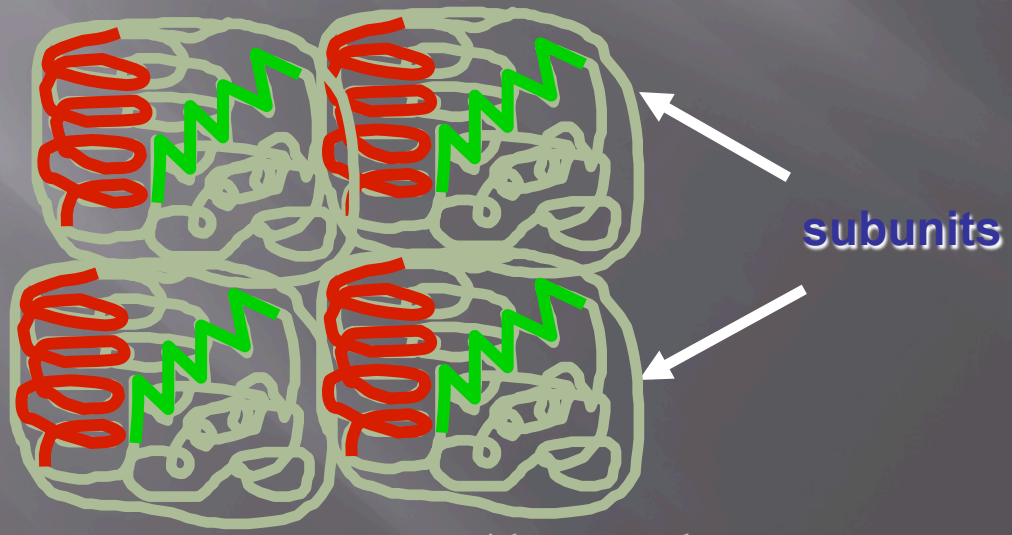


Tertiary Structure

- Secondary structures bent and folded into a more complex 3-D arrangement of linked polypeptides
- Bonds: H-bonds, ionic, disulfide bridges (S-S)
- Call a "subunit"

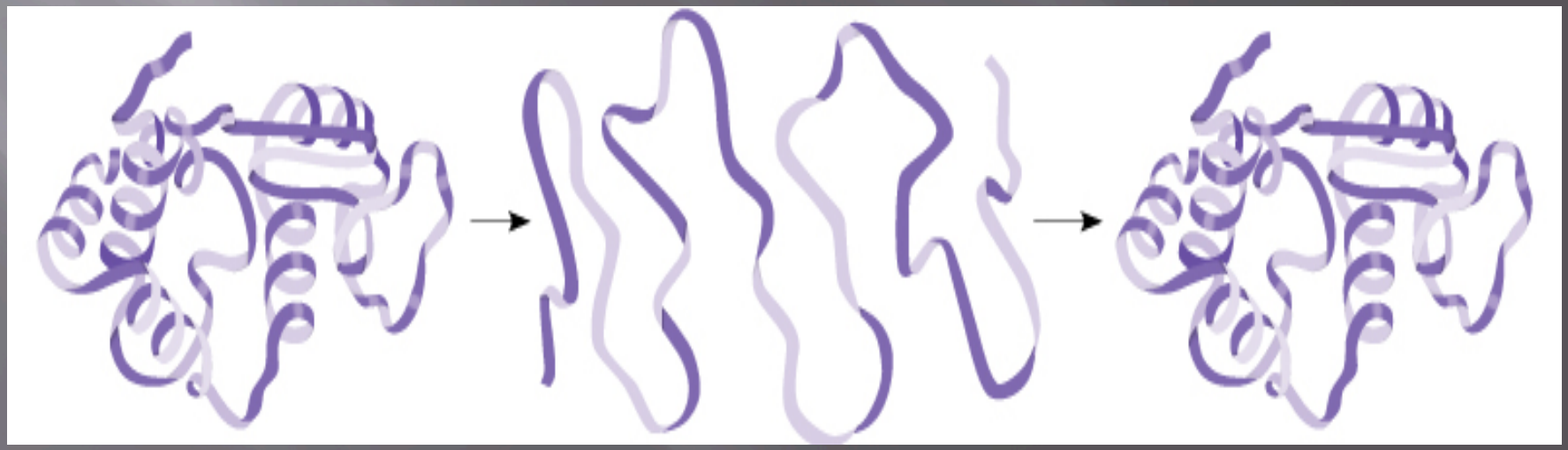
Quaternary Structure

- Composed of 2 or more "subunits"
- Globular in shape
- Form in Aqueous environments
- Example: enzymes (hemoglobin)



Factors That Determine Protein Conformation

- pH, temperature, salinity, etc.
- Change in environment may lead to denaturation of protein



Nucleic Acids

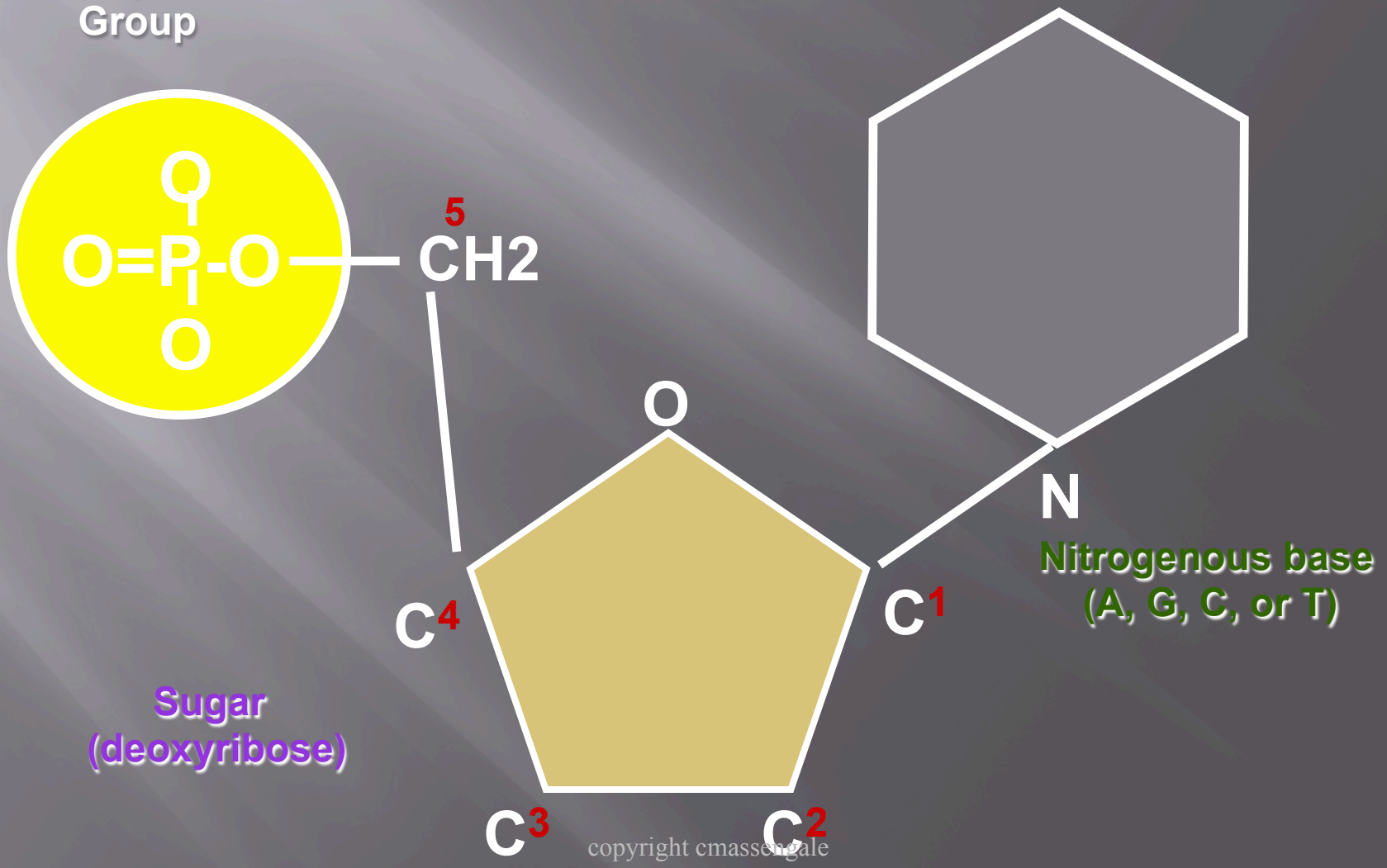
Nucleic acids

- **Two types:**
  a. Deoxyribonucleic acid (DNA-double helix)
  b. Ribonucleic acid (RNA-single strand)
- **Nucleic acids** are composed of long chains of **nucleotides** linked by **dehydration synthesis**.

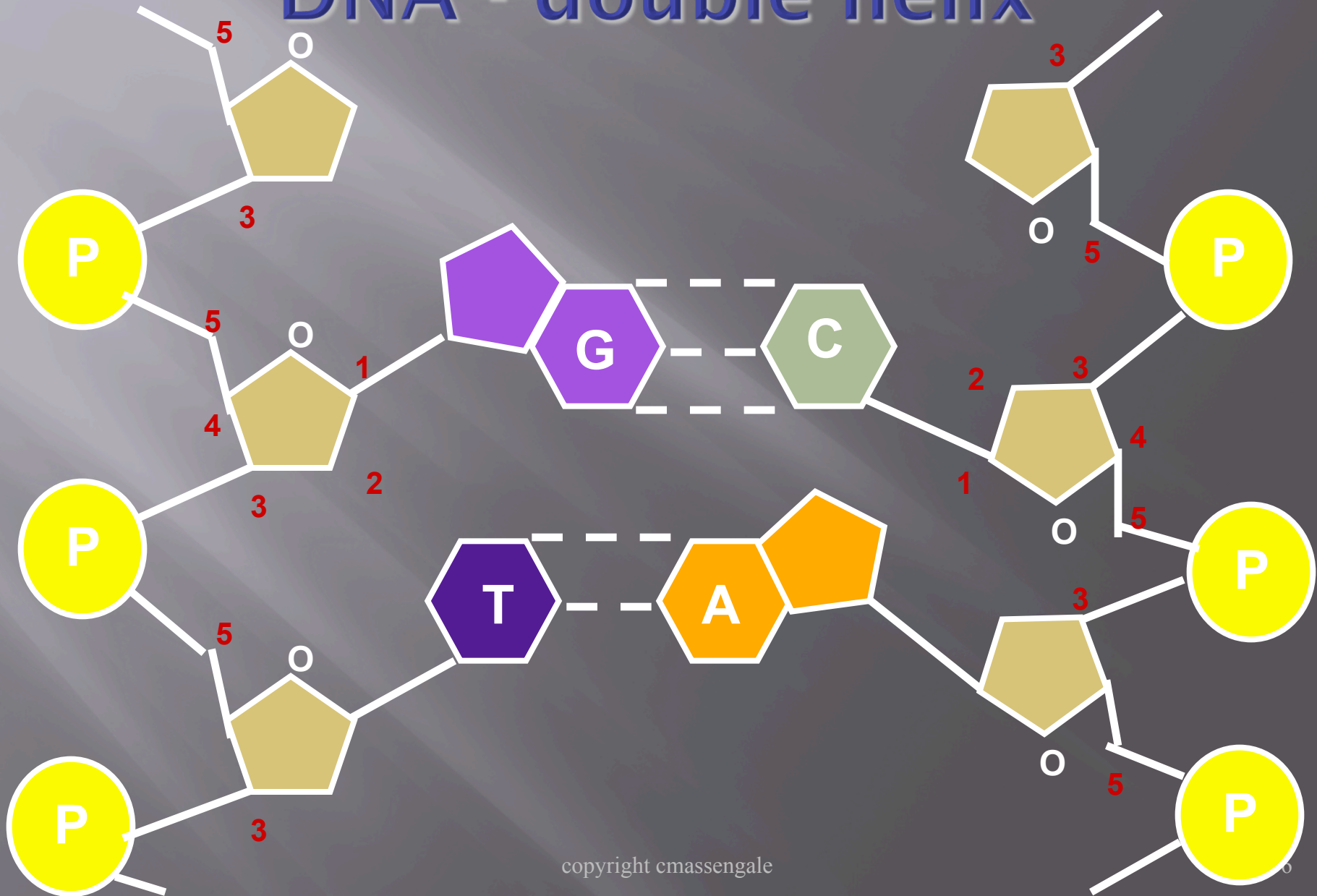
Nucleic acids

- Nucleotides include:
  - phosphate group
  - pentose sugar (5-carbon)
  - nitrogenous bases:
    - adenine (A)
    - thymine (T) DNA only
    - uracil (U) RNA only
    - cytosine (C)
    - guanine (G)

Nucleotide



DNA - double helix



Summary of the Organic Molecules: