

# *Macromolecules*

A faint, light blue wireframe illustration of a branched polymer chain structure is visible in the background. It consists of several interconnected, roughly spherical clusters of atoms or molecules, connected by thin lines representing bonds. The structure is complex and multi-dimensional, typical of a macromolecule.

# Organic Compounds

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

# Carbon (C)

- 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.
- **Example:**  $\text{CH}_4$ (methane)

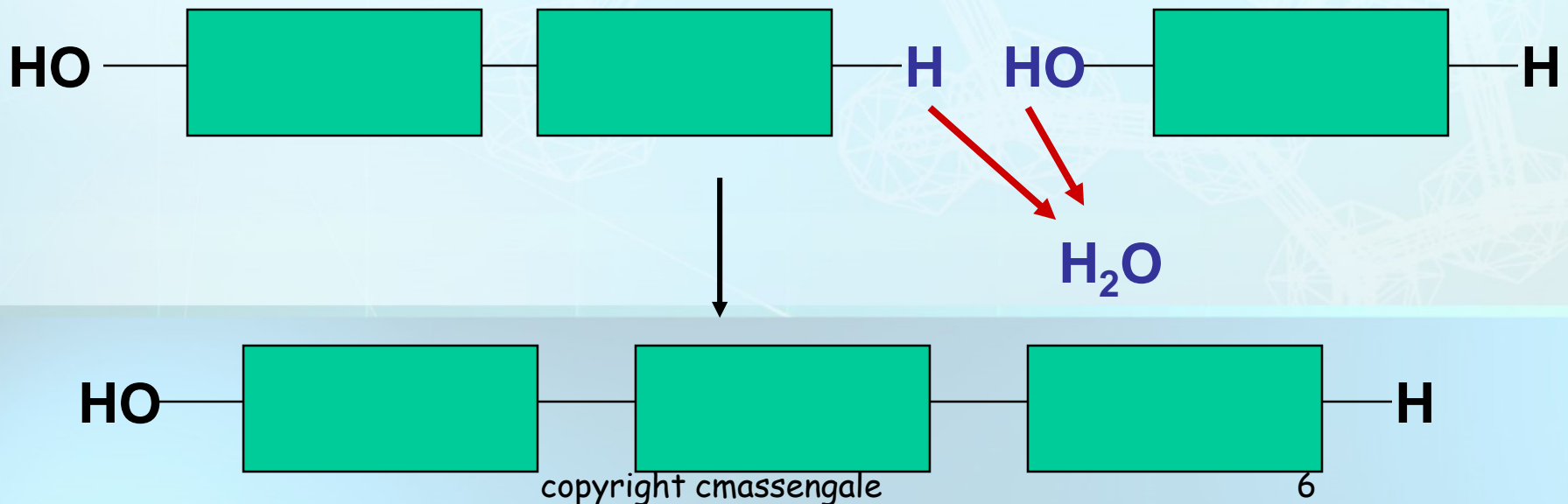
# Macromolecules

- Large organic molecules.
- Also called POLYMERS.
- Made up of smaller “building blocks” called MONOMERS.
- Examples:
  1. Carbohydrates
  2. Lipids
  3. Proteins
  4. Nucleic acids (DNA and RNA)

***Question:  
How Are  
Macromolecules  
Formed?***

# Answer: Dehydration Synthesis

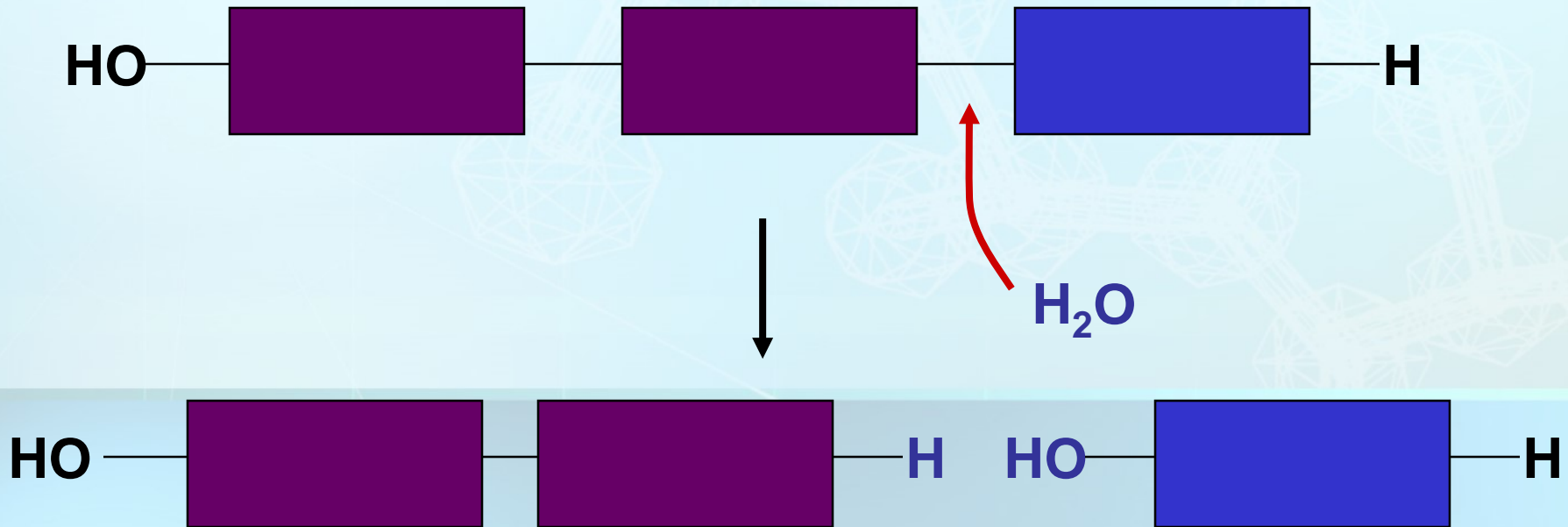
- Also called "condensation reaction"
- Forms polymers by combining monomers by "removing water".



**Question:**  
How are  
Macromolecules  
separated or  
digested?

# Answer: Hydrolysis

- Separates monomers by "adding water"





# Carbohydrates



# Carbohydrates

- Small sugar molecules to large sugar molecules.
- Examples:
  - A. monosaccharide
  - B. disaccharide
  - C. polysaccharide

# Carbohydrates

Monosaccharide: one sugar unit

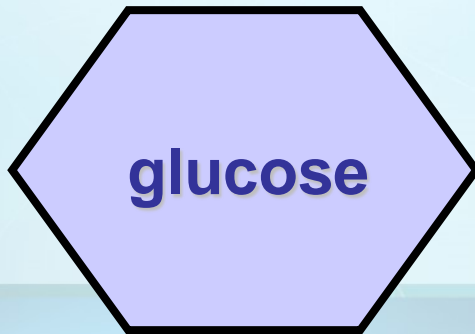
Examples: glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)

deoxyribose

ribose

Fructose

Galactose

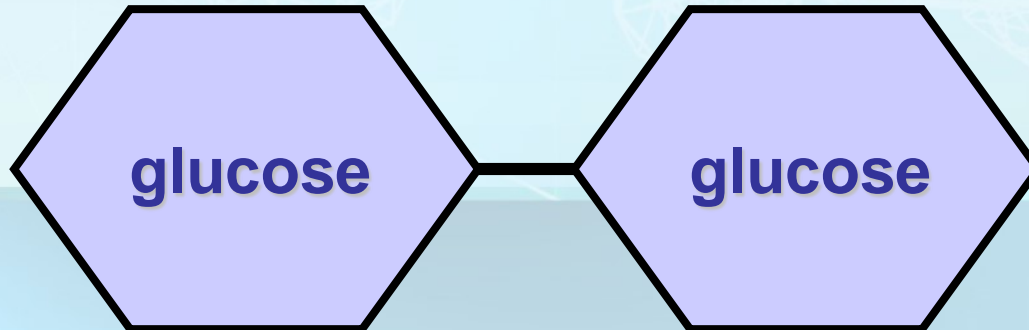


# Carbohydrates

Disaccharide: two sugar unit

Examples:

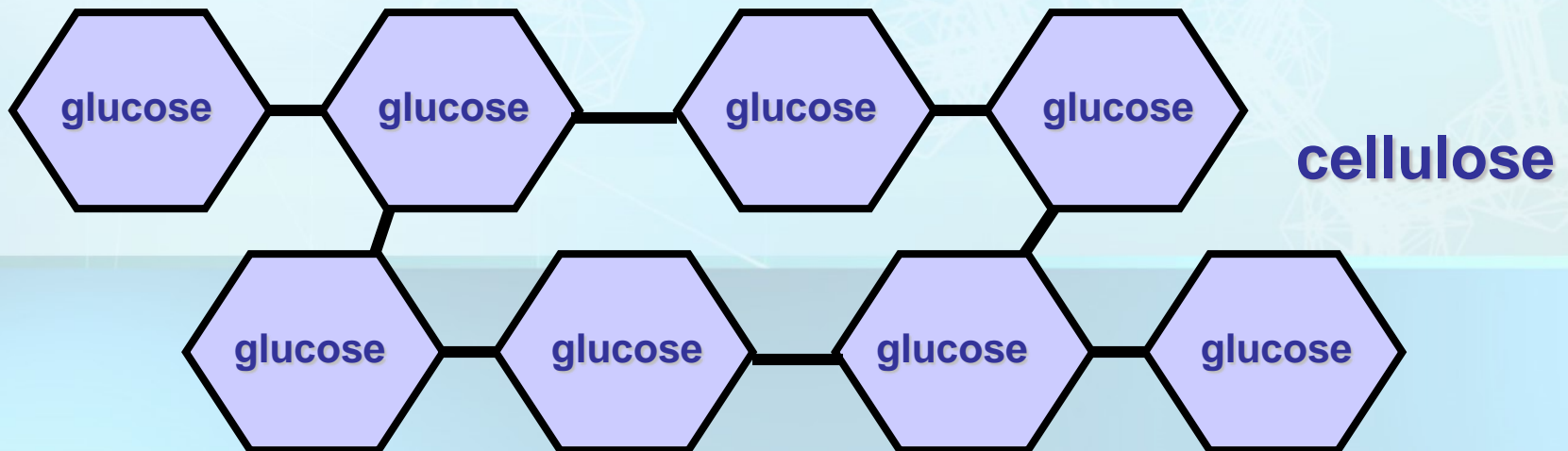
- Sucrose (glucose+fructose)
- Lactose (glucose+galactose)
- Maltose (glucose+glucose)



# Carbohydrates

Polysaccharide: many sugar units

Examples: starch (bread, potatoes)  
glycogen (beef muscle)  
cellulose (lettuce, corn)



# Lipids

The background of the slide features several white wireframe models of lipid molecules. Each molecule consists of a spherical head group connected to two hydrophobic tails. The spheres are composed of interconnected lines forming a complex, geometric pattern. The tails are represented by multiple parallel lines extending from the head groups. The overall appearance is that of a molecular simulation or a stylized representation of biological structures.

# Lipids

- General term for compounds which are not soluble in water.
- Lipids are soluble in hydrophobic solvents.
- Remember: “stores the most energy”
- Examples:
  1. Fats
  2. Phospholipids
  3. Steroid hormones
  4. Triglycerides
  5. Waxes
  6. Oils

# Lipids

## Six functions of lipids:

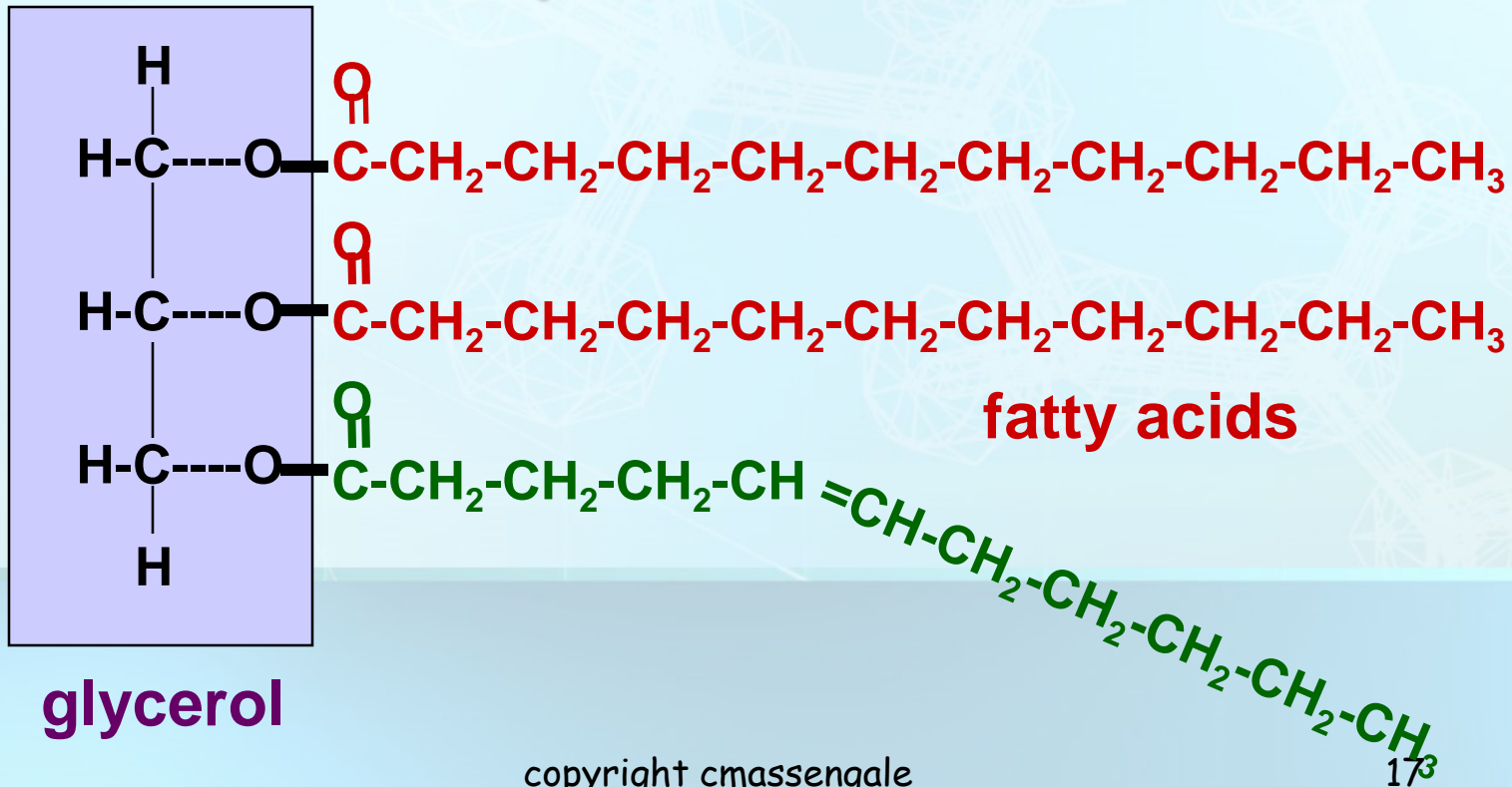
1. Long term energy storage
2. Protection against heat loss (insulation)
3. Protection against physical shock
4. Protection against water loss
5. Chemical messengers (hormones)
6. Major component of membranes



# Lipids

## Triglycerides:

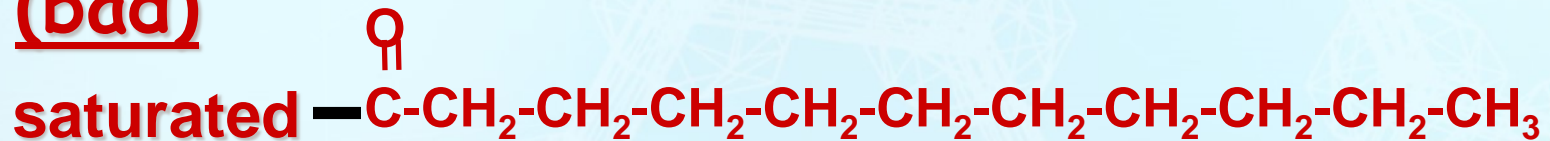
composed of 1 glycerol and 3  
fatty acids.



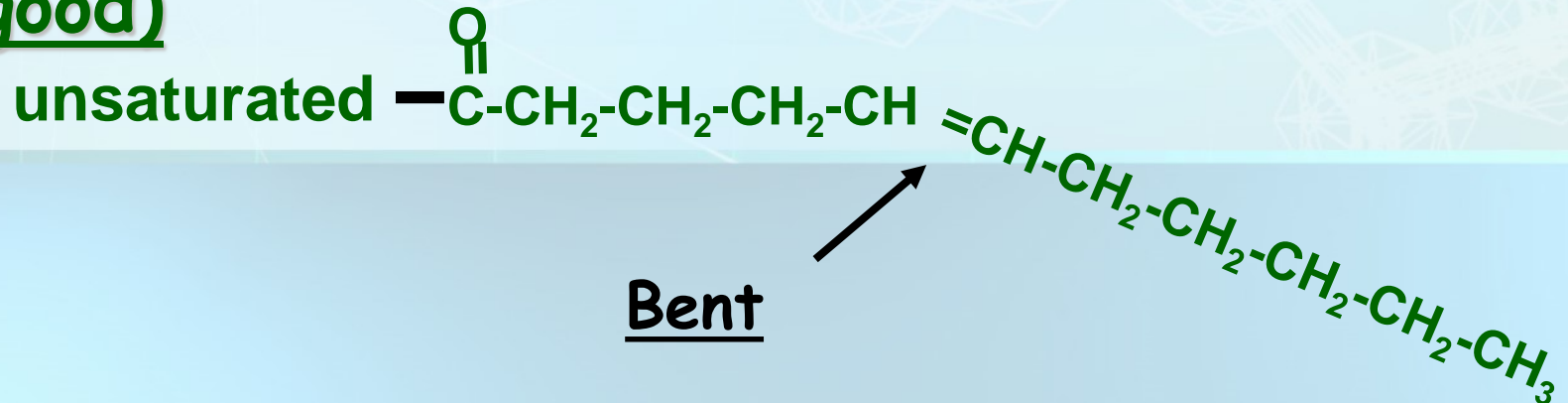
# Fatty Acids

There are two kinds of fatty acids you may see these on food labels:

1. Saturated fatty acids: no double bonds  
(bad)



2. Unsaturated fatty acids: double bonds  
(good)



# Proteins

The background features a light blue gradient with a faint grid pattern. Overlaid on this are several white, wireframe models of protein structures, showing complex 3D shapes with interconnected lines and surfaces, representing the molecular structure of proteins.

# Proteins (Polypeptides)

- Amino acids (20 different kinds of aa) bonded together by peptide bonds (polypeptides).

- Six functions of proteins:

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

# Proteins (Polypeptides)

## Four levels of protein structure:

A. Primary Structure

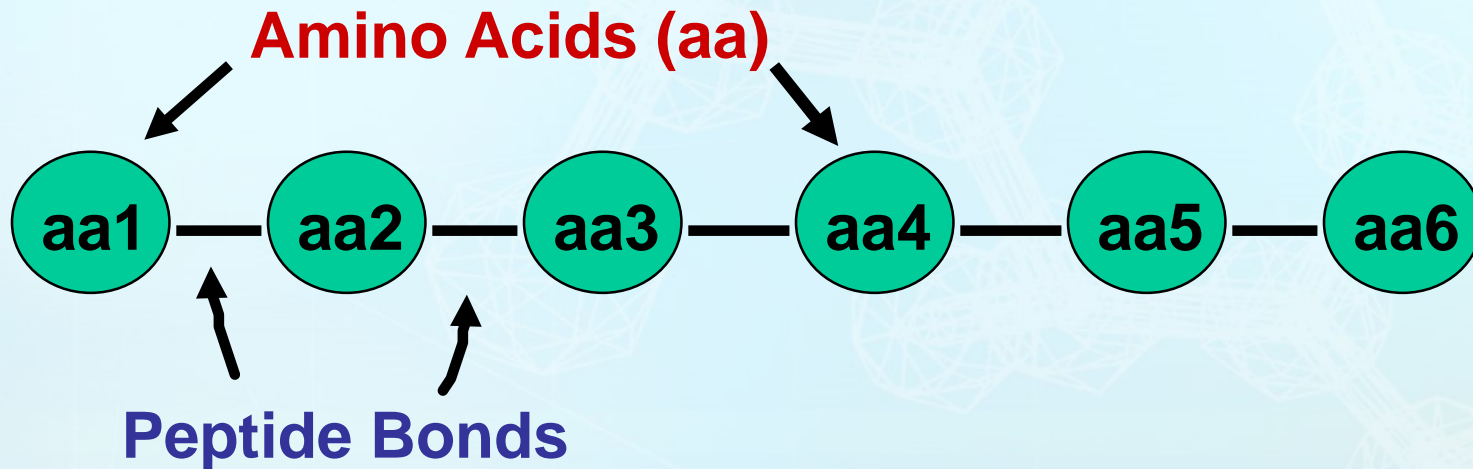
B. Secondary Structure

C. Tertiary Structure

D. Quaternary Structure

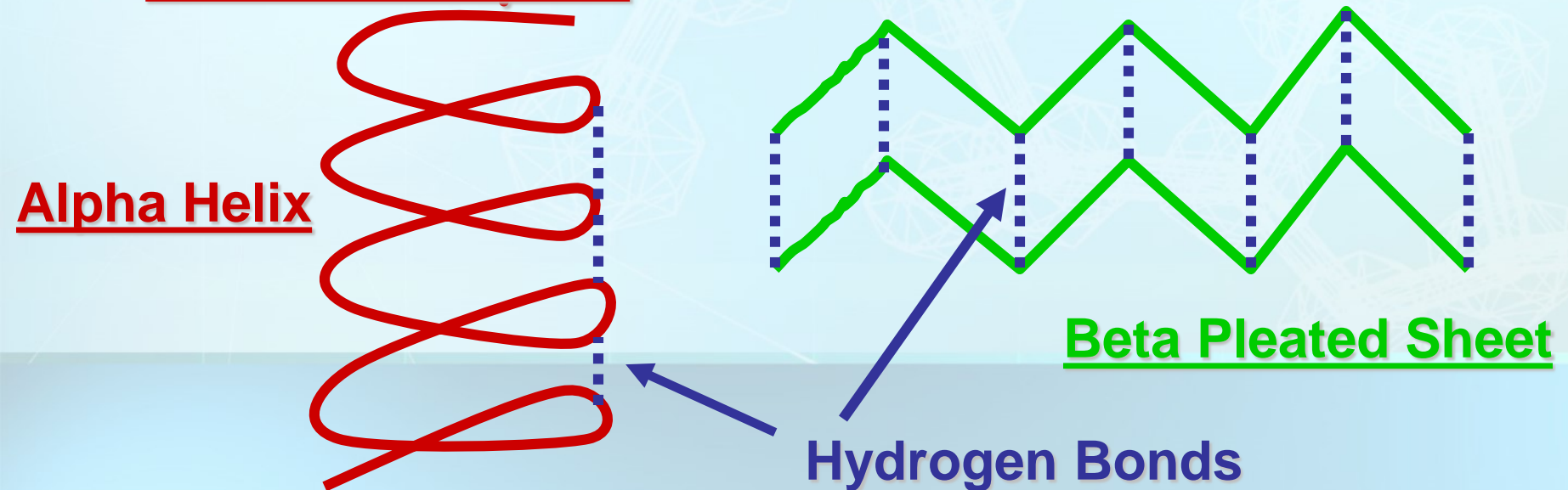
# Primary Structure

**Amino acids** bonded together by peptide bonds (straight chains)



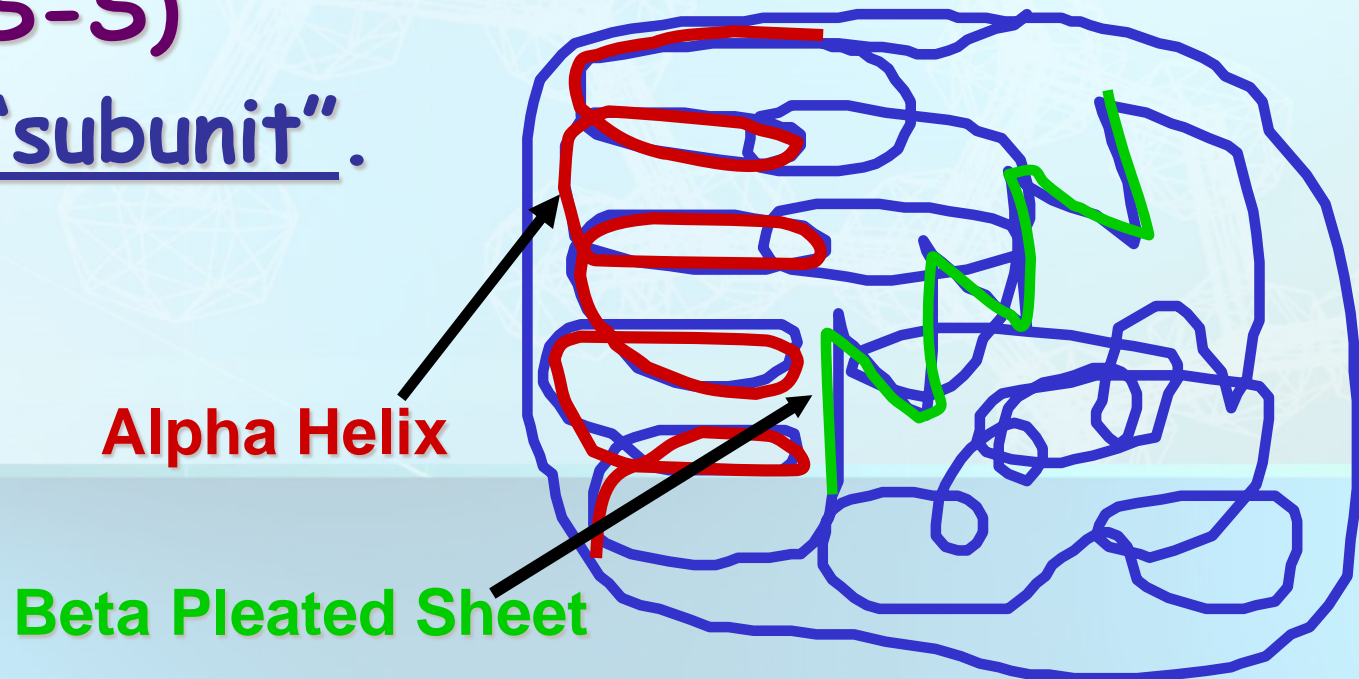
# Secondary Structure

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



# Tertiary Structure

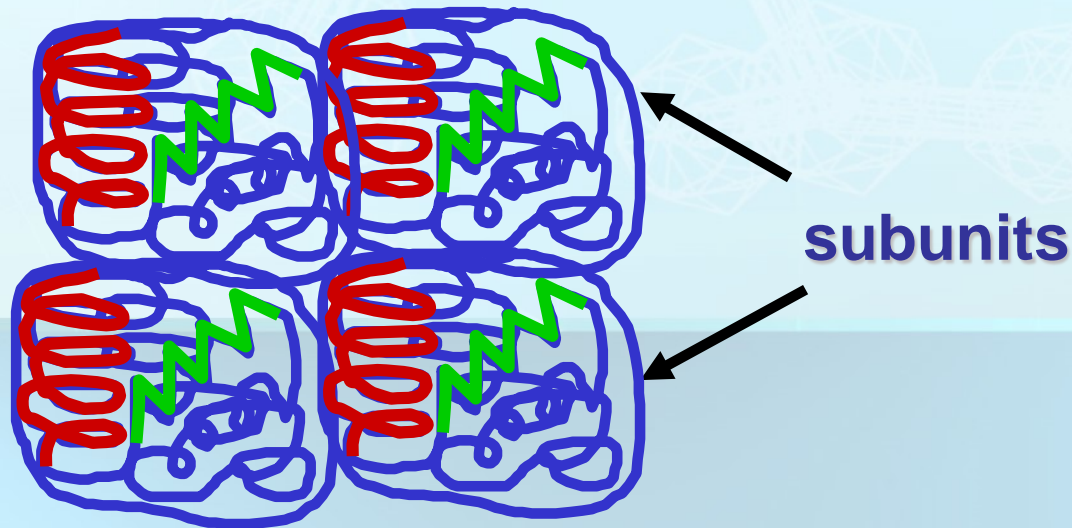
- Secondary structures **bent** and **folded** into a more complex 3-D arrangement of linked polypeptides
- Bonds: H-bonds, ionic, disulfide bridges (S-S)
- Called a "subunit".





# Quaternary Structure

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





# 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)

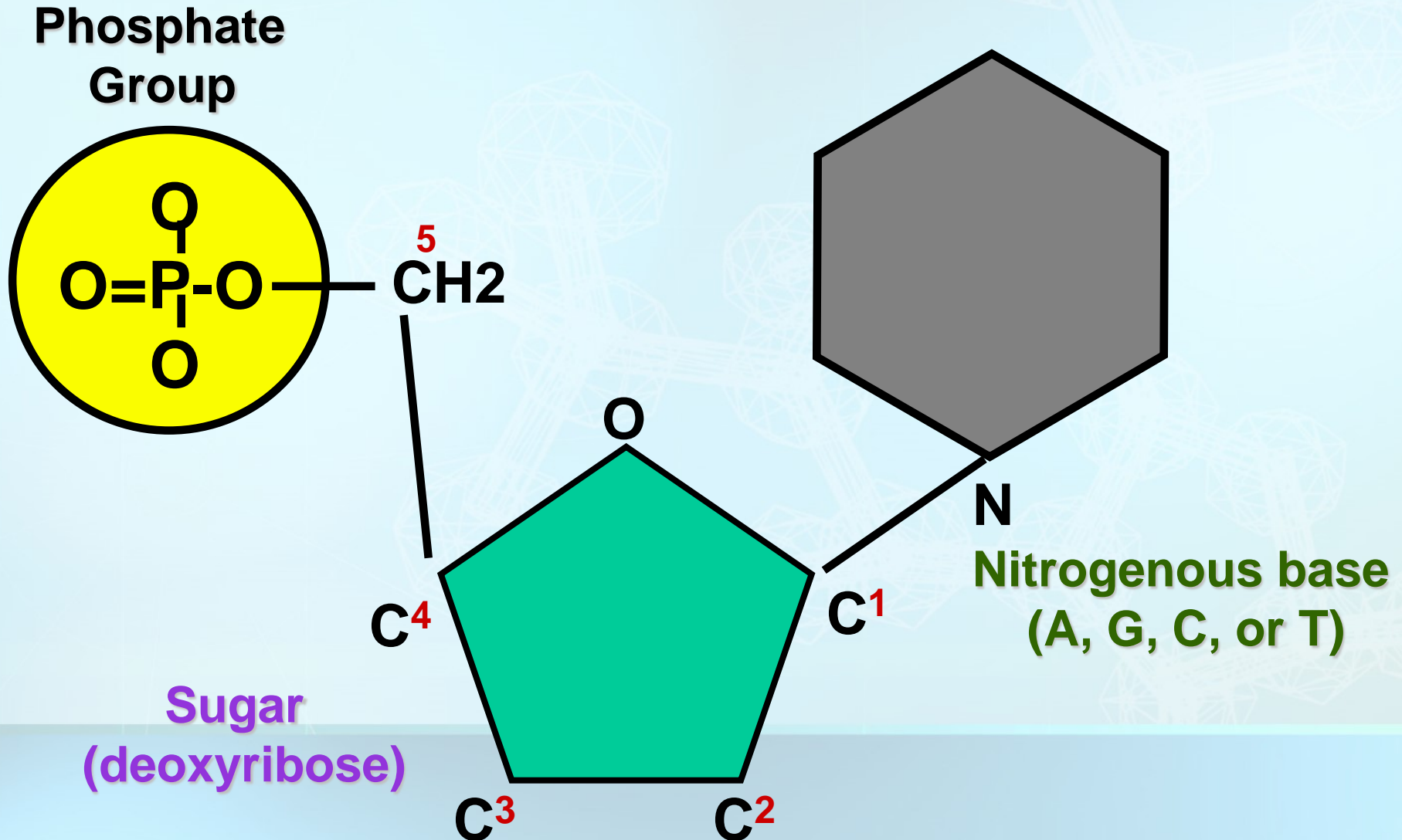
thymine (T) DNA only

uracil (U) RNA only

cytosine (C)

guanine (G)

# Nucleotide



# DNA - double helix

