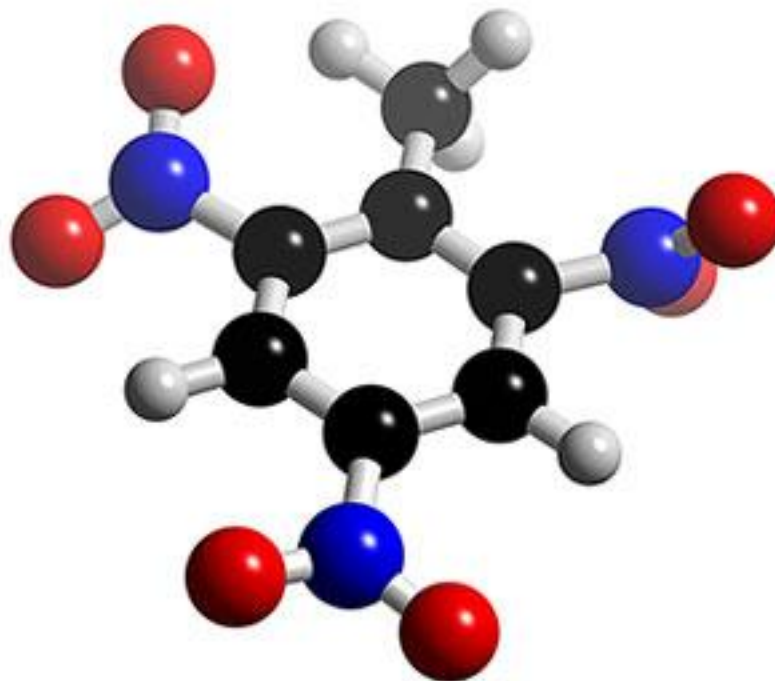
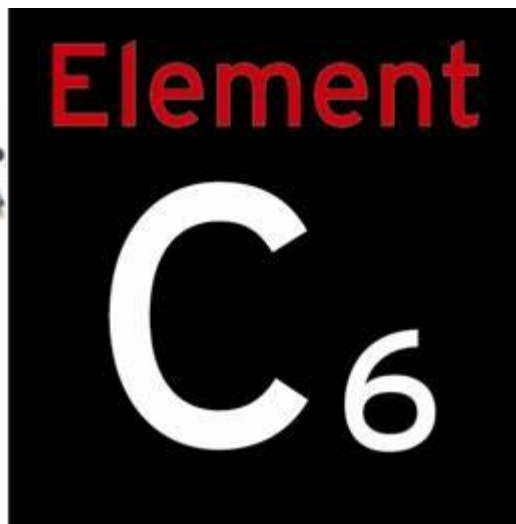


2–3 Carbon Compounds (Macromolecules)



Organic Chemistry

Organic chemistry is the study of all compounds that contain bonds between carbon atoms.



C

6

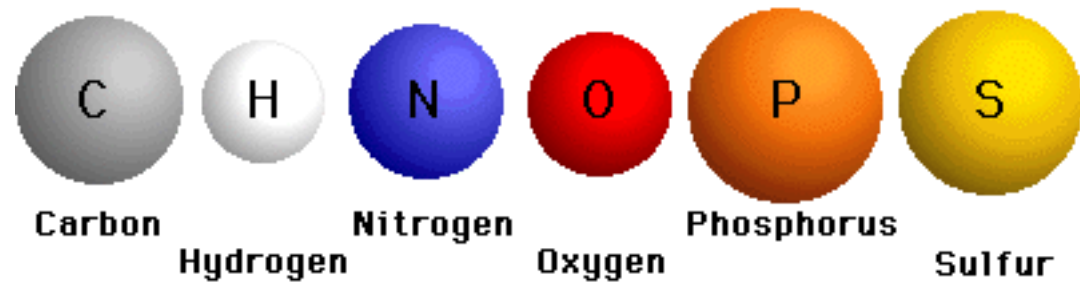
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Carbon

Carbon

- Living organisms are made up of six different elements:

1. Carbon
2. Hydrogen
3. Nitrogen
4. Oxygen
5. Phosphorus
6. Sulfur



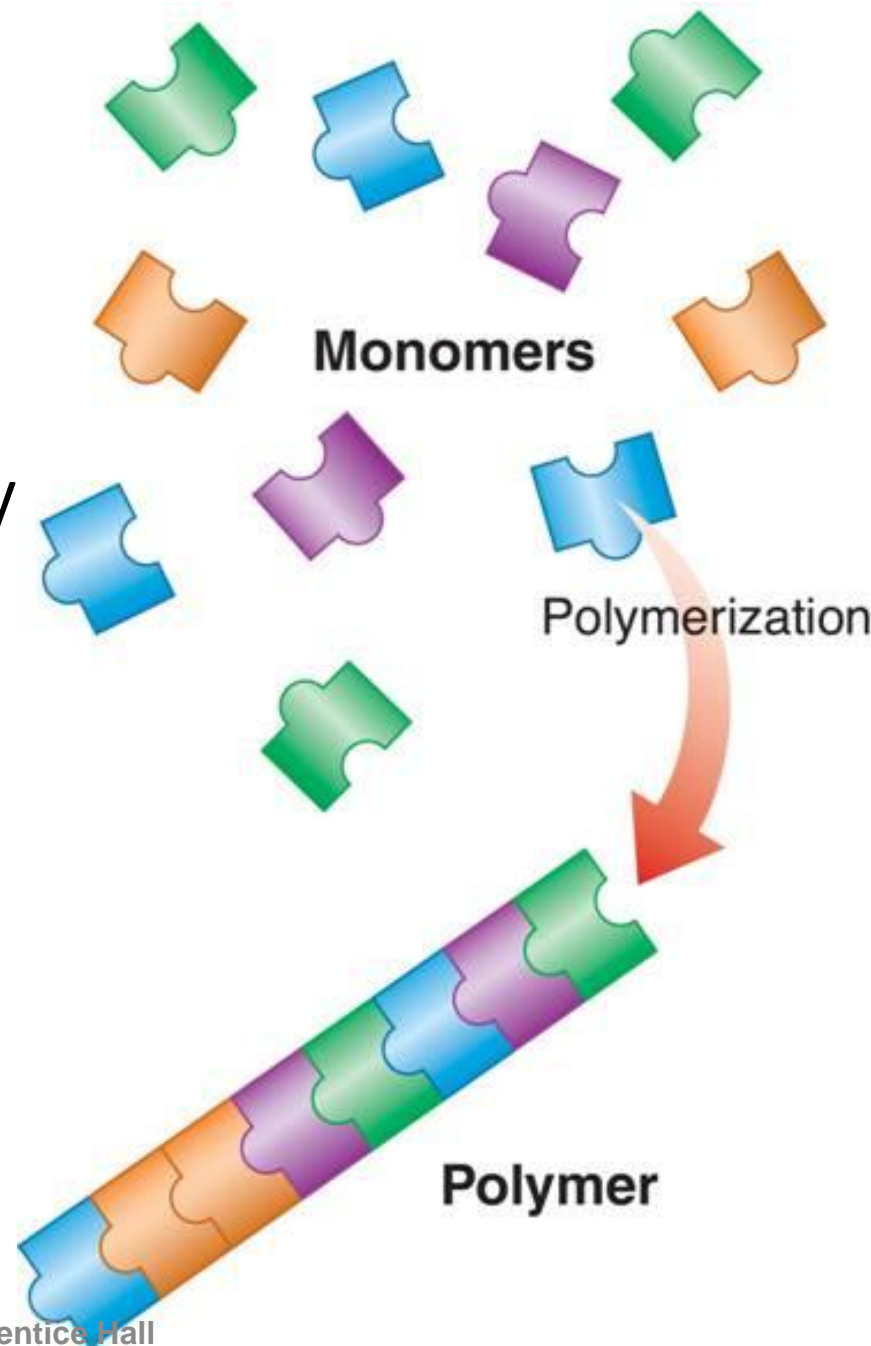
ALL LIVING THINGS HAVE CARBON!!

Carbon

- Compound = 2 or more elements chemically combined.
- Carbon Compound = anything that contains 2 or more carbon atoms.
- Carbon is very useful:
 - Can form 4 bonds with other atoms.
 - Can form single, double, triple bonds.
 - Can form LONG chains or rings.
- Carbon can form millions of large and complex structures – macromolecules.

Macromolecules

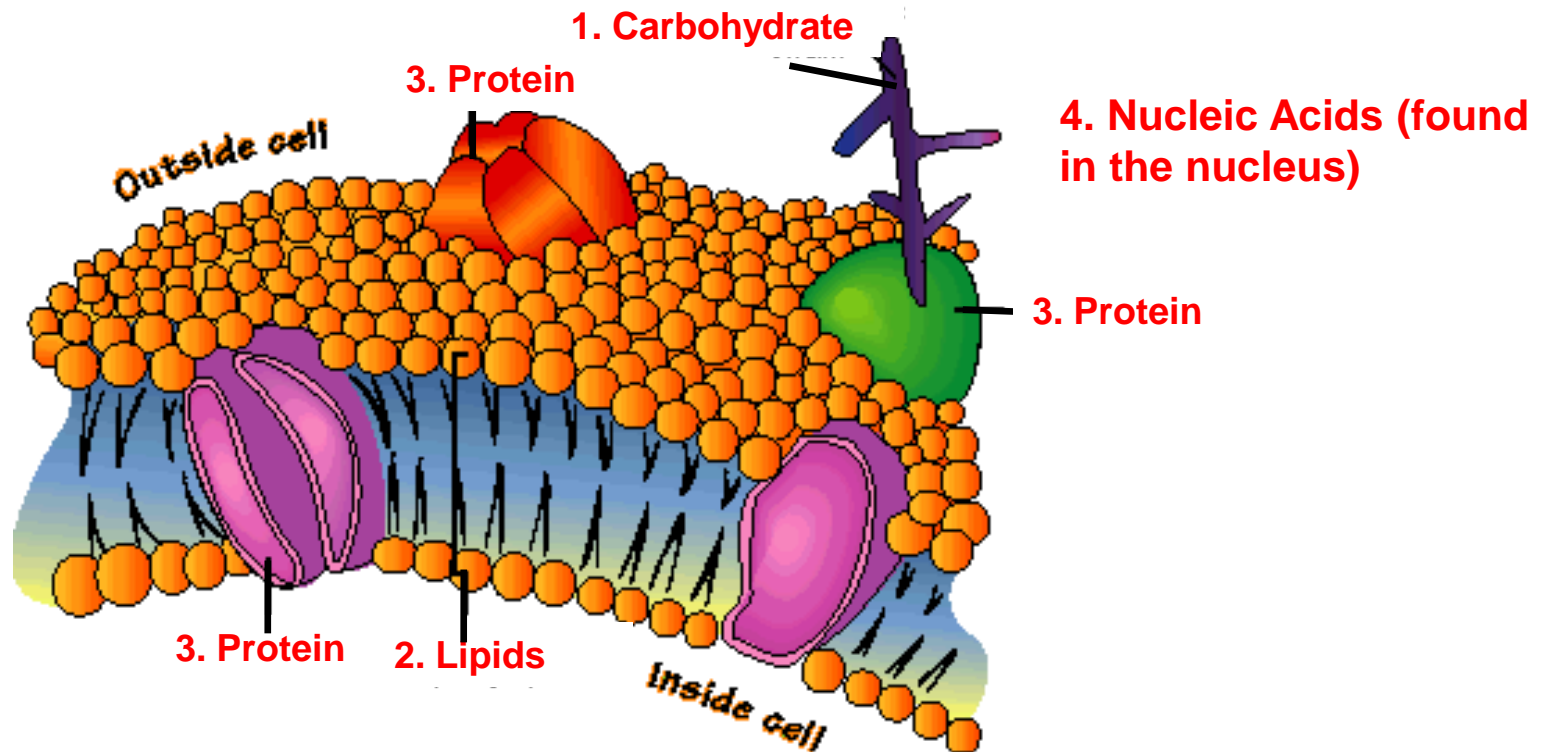
- Formed by a process known as **polymerization**.
- Monomers (single units) join together to form polymers (many units).
- There are 4 major macromolecules in our bodies:
 1. Carbohydrates
 2. Lipids
 3. Proteins
 4. Nucleic Acids



Macromolecules

- All 4 of these macromolecules (carbon compounds) are found in living organisms.

–They can all be found in the membranes of our cells:



Organic Compounds

Carbohydrates



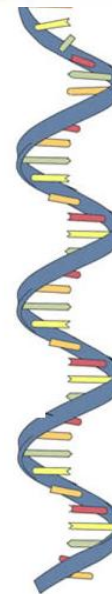
Lipids



Protein



DNA



Nucleic Acids

RNA

Type of Compound	Monomer (what it is made of)	Picture	Functions	Examples

Macromolecules

Four groups of organic compounds found in living things are:

- 1.carbohydrates**
- 2.lipids**
- 3.nucleic acids**
- 4.proteins**



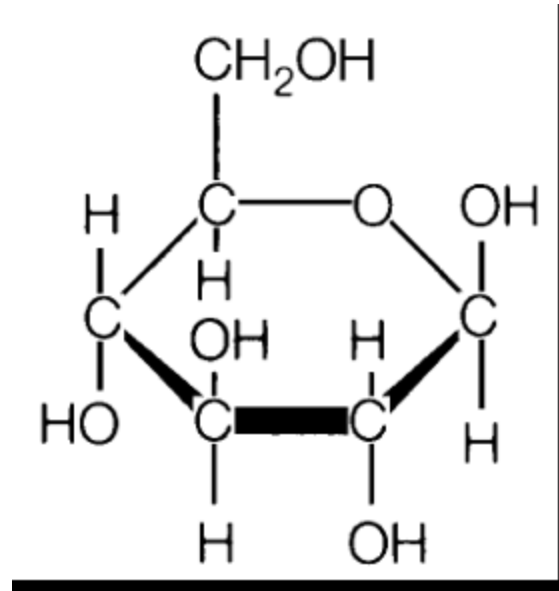
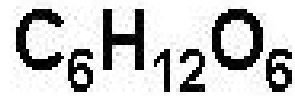
Carbohydrates

- What is the function of carbohydrates?
 - Source of Energy
 - Structure



Carbohydrates

Carbohydrates are compounds made up of *carbon, hydrogen, and oxygen atoms*, usually in a ratio of 1 : 2 : 1.



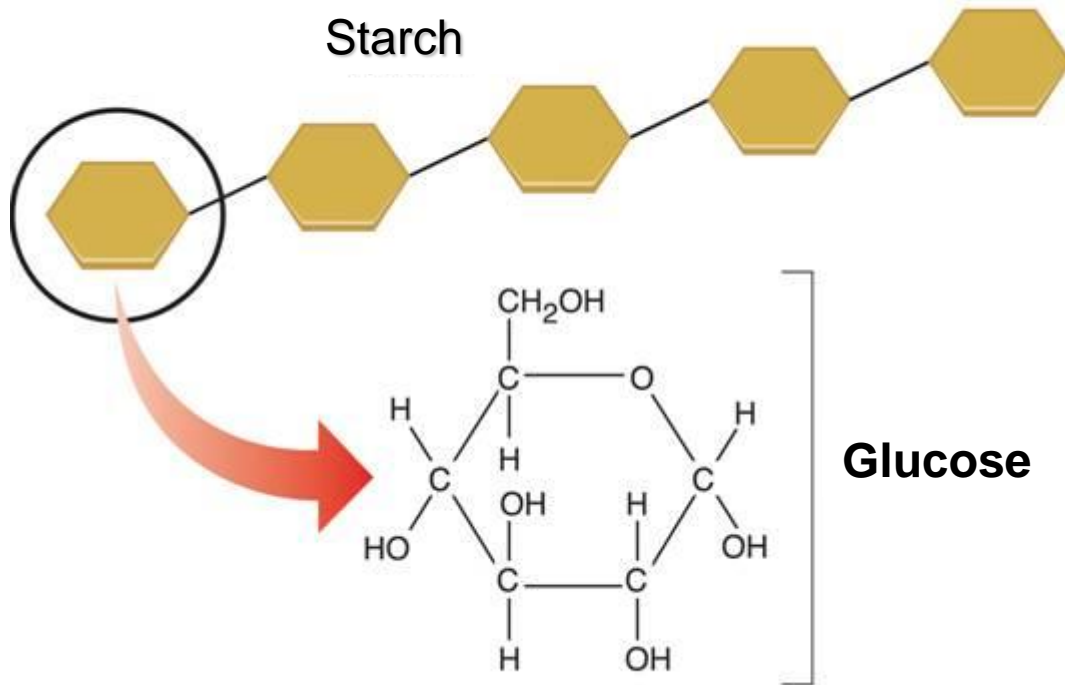
Carbohydrates

There are 3 different sizes of carbohydrates:

1. Monosaccharides (single sugar)
2. Disaccharides (two sugars)
3. Polysaccharides (many sugars)

Carbohydrates

Starches and sugars are examples of carbohydrates that are used by living things as a source of energy.



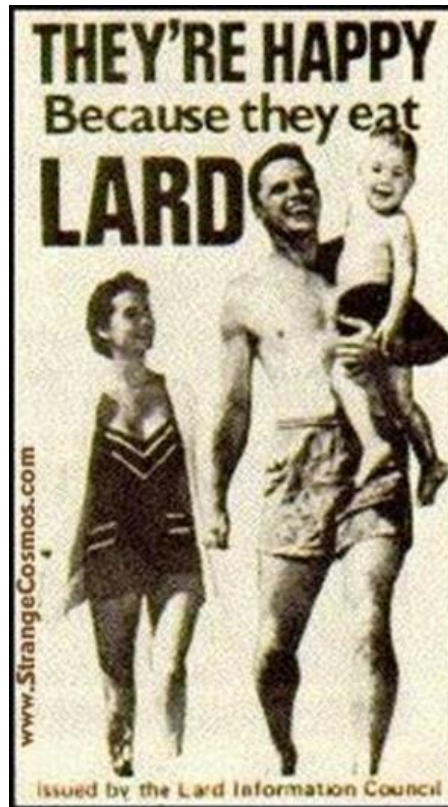
Examples:
Cellulose
Starch
Glycogen

Lipids

Lipids are generally not soluble in water.

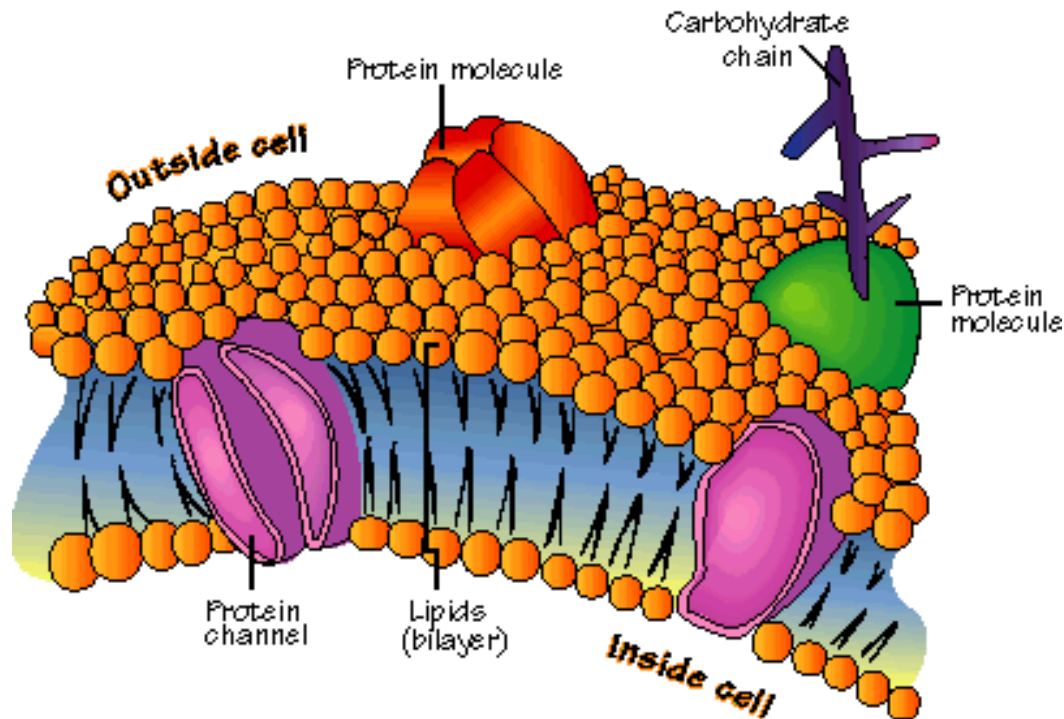
The common categories of lipids are:

- fats
- oils
- waxes
- steroids

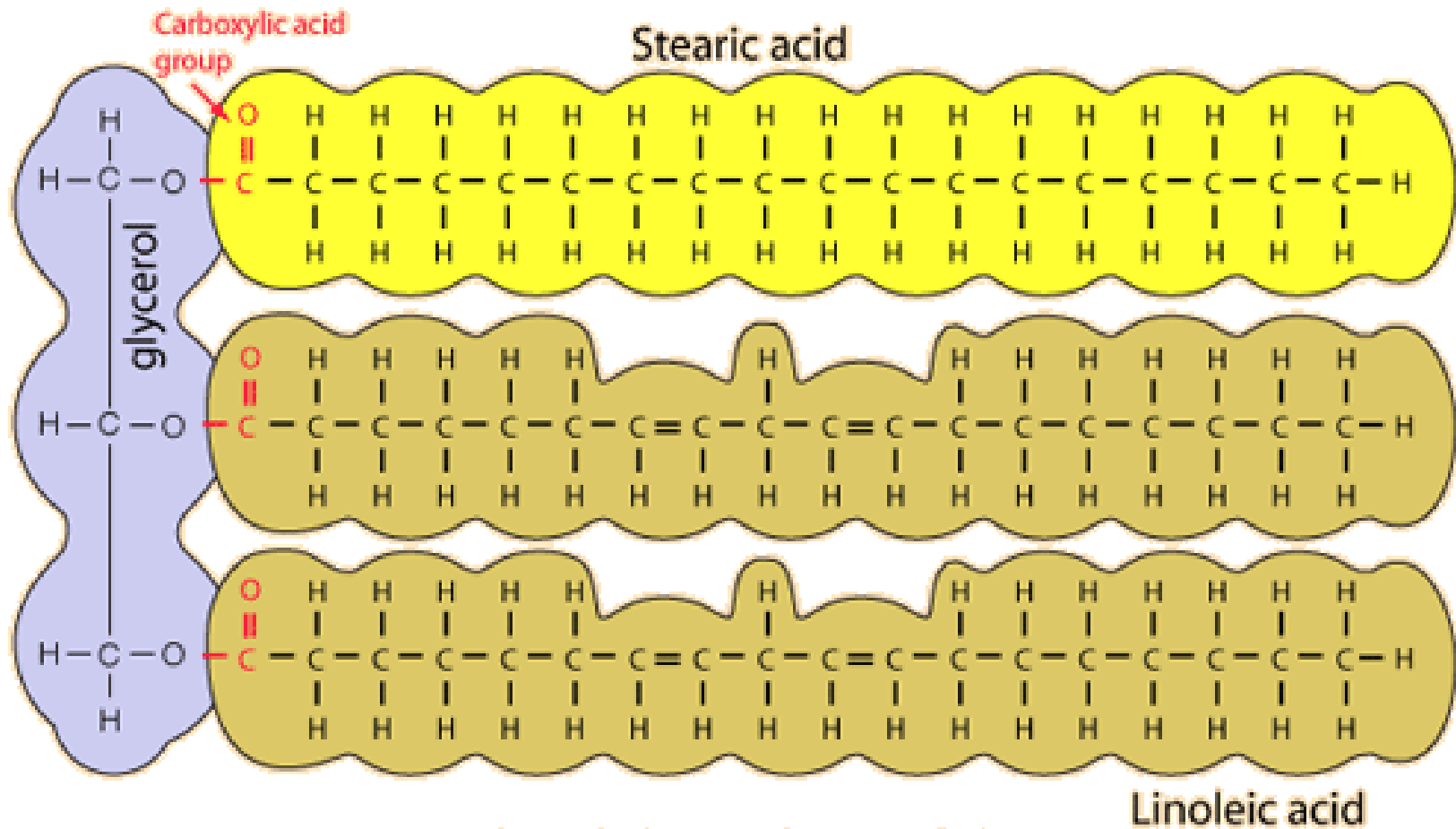


Lipids

- Can be used to store energy (long-term energy).
- Some lipids are important parts of biological membranes and waterproof coverings.



Lipid Molecule



Lipids



Fats

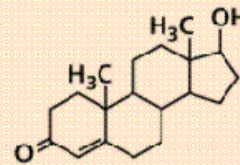


Oils

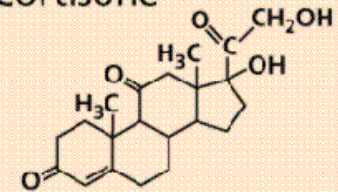


Waxes

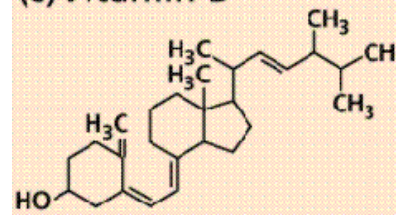
(a) Testosterone



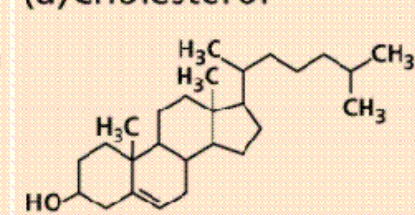
(b) Cortisone



(c) Vitamin D



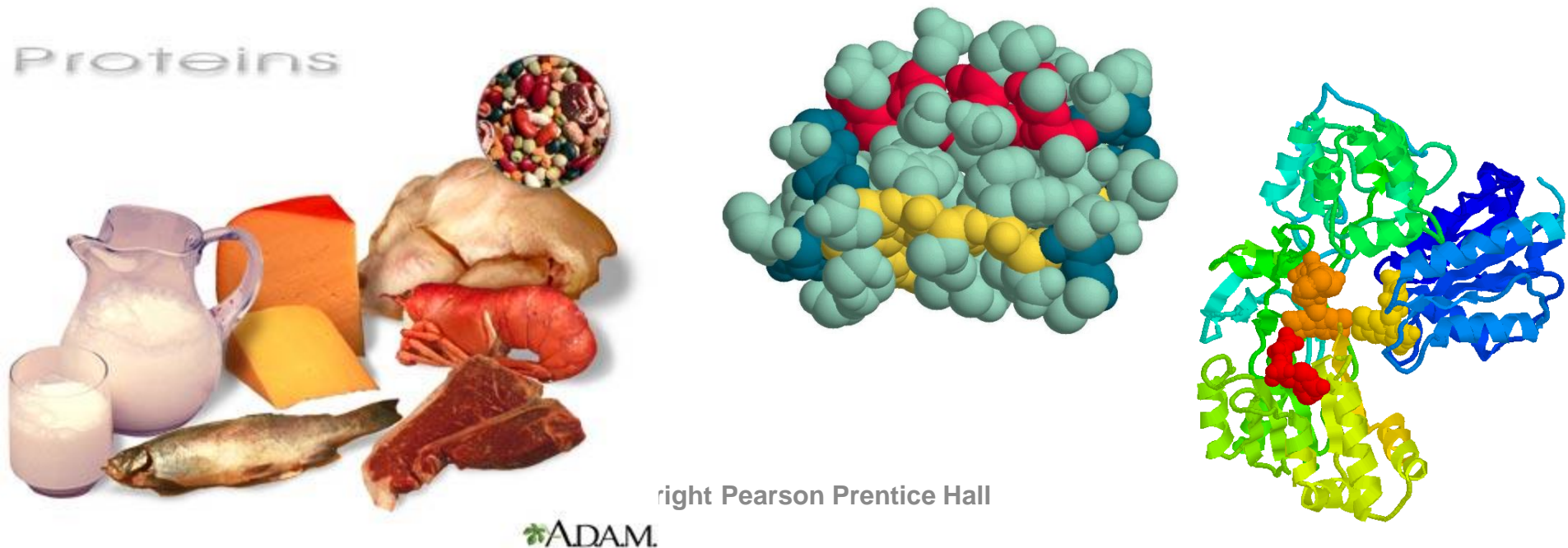
(d) Cholesterol



Steroids

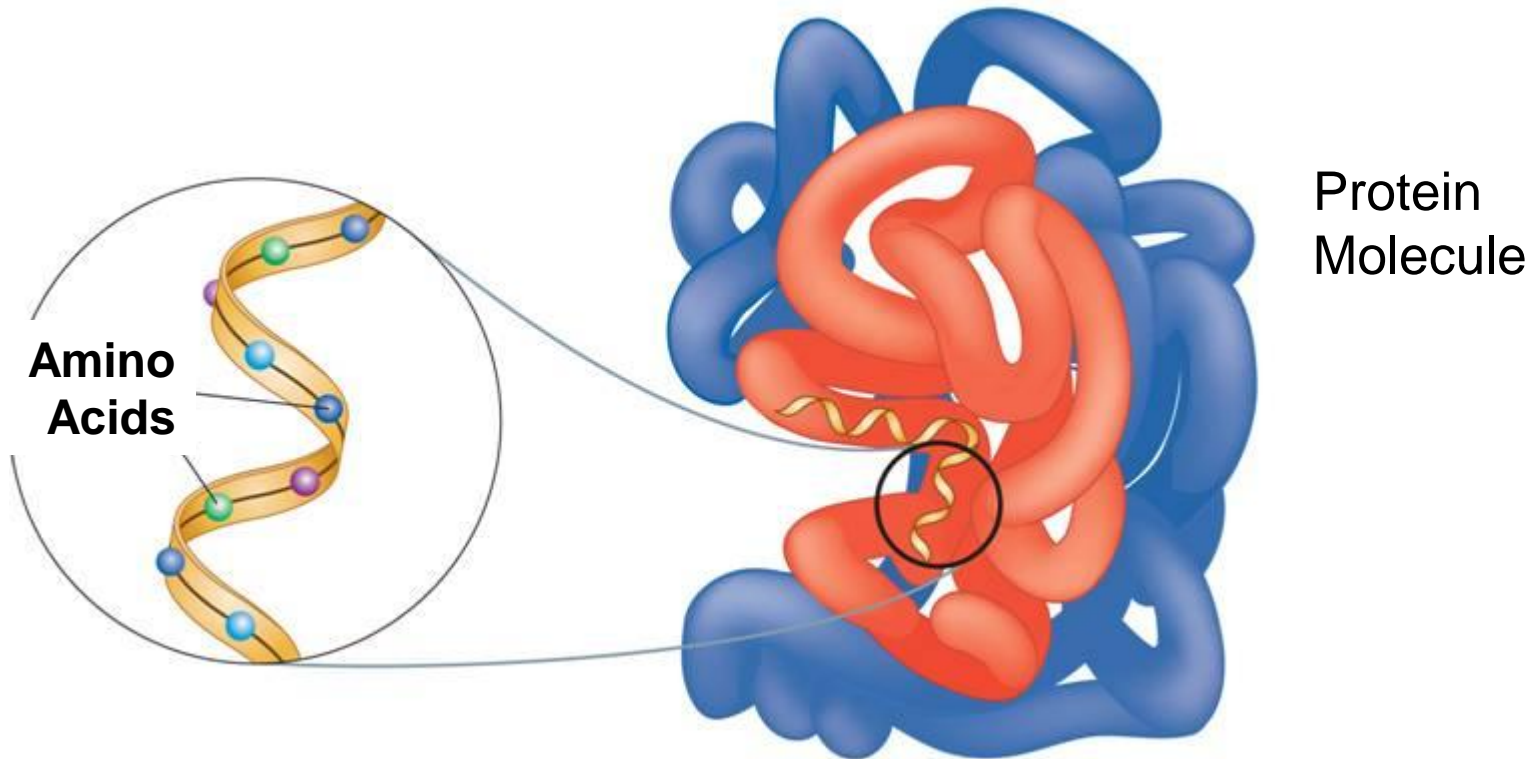
Proteins

- Proteins are macromolecules that contain nitrogen, carbon, hydrogen, and oxygen.
- **Monomer** = amino acid.
- **Polymer** = chain of amino acids.



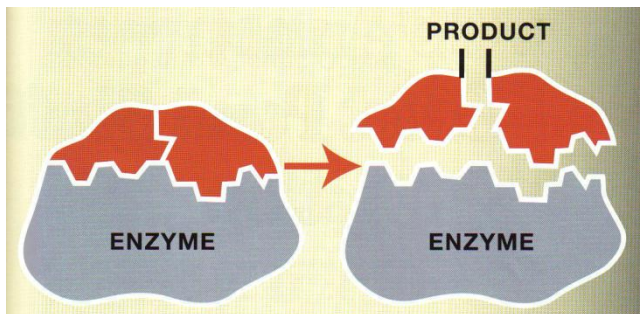
Proteins

- The instructions for arranging amino acids into many different proteins are stored in DNA.



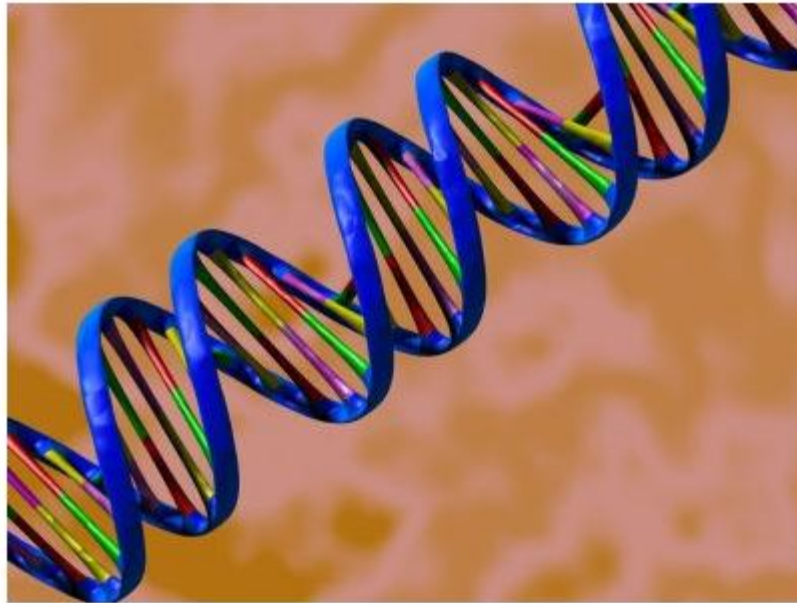
Protein Functions

- Control rate of reactions – enzymes
- Used to form bones and muscles
- Transport substances into or out of cells
- Help to fight disease - antibodies



Nucleic Acids

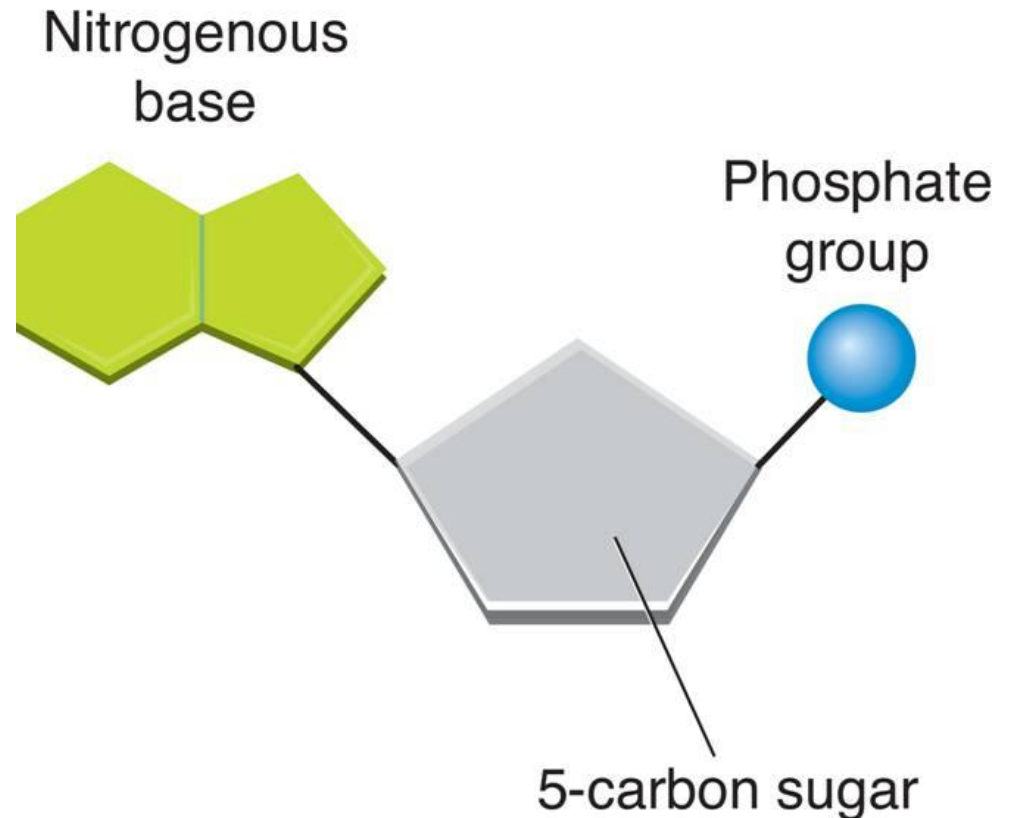
- Monomer = nucleotide.
- Nucleic acids are **polymers** of nucleotides.



Nucleic Acids

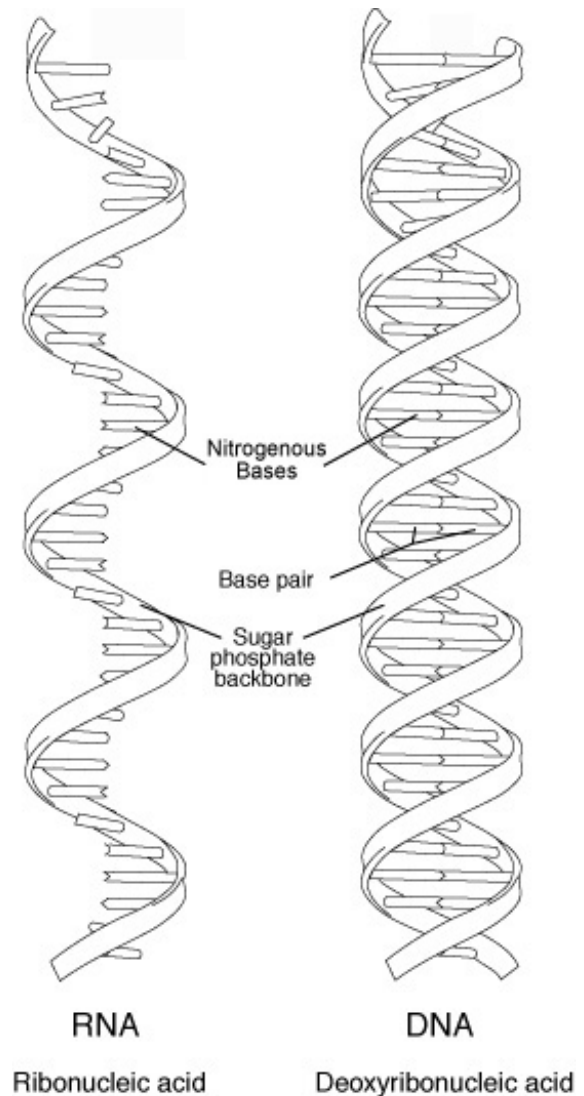
Nucleotides have **three parts**:

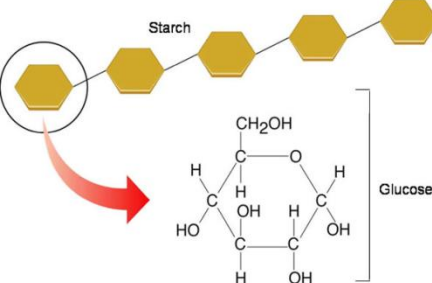
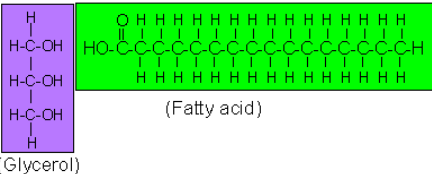
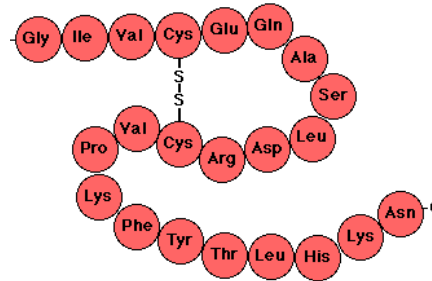
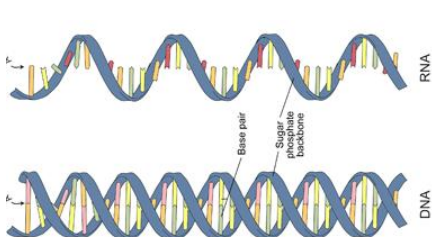
1. a 5-carbon sugar
2. a phosphate group
3. a nitrogenous base



Nucleic Acids

- Nucleic acids store and pass on genetic information.
- 2 types of Nucleic Acids:
 1. ribonucleic acid (RNA)
 2. deoxyribonucleic acid (DNA)



Type of Compound	Monomer (what it is made of)	Picture	Functions	Examples
Carbohydrates	Single sugar (glucose)	 <p>The diagram shows a chain of five yellow hexagons representing starch. One hexagon is circled in red, and a red arrow points from it to a detailed chemical structure of a glucose molecule. The structure shows a six-membered ring with an oxygen atom at the top vertex. The carbons are labeled with their respective bonds: C1 (right), C2 (down), C3 (down-left), C4 (left), C5 (up-left), and C6 (up). The groups attached are: C1-OH, C2-H, C3-OH, C4-H, C5-OH, and C6-CH₂OH.</p>	Short-term energy	Breads, sugars, pasta
Lipids	No true monomer – but made of glycerol and fatty acid.	 <p>The diagram shows a purple glycerol molecule on the left, consisting of a three-carbon chain with hydroxyl groups. It is linked via ester bonds to a long green fatty acid chain on the right. The fatty acid chain is shown as a zig-zag line representing hydrocarbon tails, with a carboxyl group at the end. Labels include '(Glycerol)' and '(Fatty acid)'.</p>	Long-term energy	Fats, oils, butter, waxes
Proteins	Amino Acid	 <p>The diagram shows a chain of red circles representing amino acids. The circles are labeled with their abbreviations: Gly, Ile, Val, Cys, Glu, Gln, Ala, Ser, Leu, Asp, Arg, Cys, Val, Pro, Lys, Phe, Tyr, Thr, Leu, His, Lys, and Asn. The Cys and another Cys are connected by a disulfide bridge (S-S). The chain is shown in a curved, non-linear arrangement.</p>	Bone, muscle building	Meats, legumes, cheese.
Nucleic Acids	Nucleotide	 <p>The diagram shows two types of nucleic acid structures. The top one is a single-stranded helix labeled 'RNA'. The bottom one is a double-stranded helix labeled 'DNA'. Labels include 'Base pair' pointing to the rungs between the two DNA strands, and 'Sugar-phosphate backbone' pointing to the outer structure of the DNA double helix.</p>	Carrying and transferring genetic information.	RNA DNA

2-3

1

Large carbohydrate molecules such as starch are known as

- lipids.
- monosaccharides.
- proteins.
- polysaccharides.

2-3

2

Many lipids are formed from glycerol and

- fatty acids.
- monosaccharides.
- amino acids.
- nucleic acids.

3 Proteins are among the most diverse macromolecules because

- they contain both amino groups and carboxyl groups.
- they can twist and fold into many different and complex structures.
- they contain nitrogen as well as carbon, hydrogen, and oxygen.
- their R groups can be either acidic or basic.

4

Which of the following statements about cellulose is true?

- Animals make it and use it to store energy.
- Plants make it and use it to store energy.
- Animals make it and use it as part of the skeleton.
- Plants make it and use it to give structural support to cells.

5 A major difference between polysaccharides and proteins is that

- plants make polysaccharides, while animals make proteins.
- proteins are made of monomers, while polysaccharides are not.
- polysaccharides are made of monosaccharides, while proteins are made of amino acids.
- proteins carry genetic information, while polysaccharides do not.