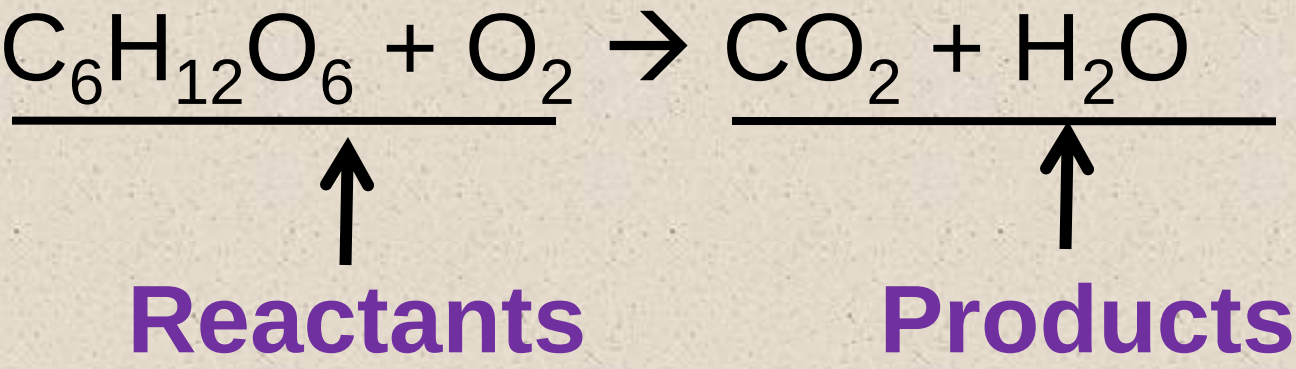
2-A Chemical Compounds of Life

I. Chemical reactions

A. Process of rearranging atoms or groups of atoms into new substances



B. Activation energy: the minimum amount of energy required for reactants to form products

C. Catalyst: a substance that lowers the activation energy needed to start a chemical reaction

- Makes the reaction *faster*

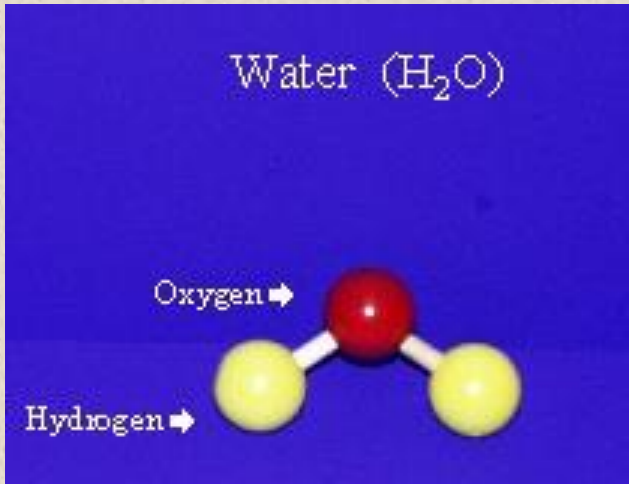
II. Inorganic compounds

A. Usually do *not* contain carbon

B. CO_2 is an exception

C. Water is an important inorganic compound

1. Essential for chemical reactions
2. 65-70% of your body
3. Universal solvent



III. Organic compounds

A. Contain the element carbon, in chains or rings, and hydrogen.

B. Built by combining ***monomers*** (single molecules) into ***polymers*** (many molecules)

1. ***Dehydration synthesis***: when combining monomers, a water molecule is **removed**
   - monomer + monomer $\longrightarrow$ polymer + H_2O

2. ***Hydrolysis***: when large molecules are broken down, water must be **added**
   - Polymer + H_2O $\longrightarrow$ monomer + monomer

C. 4 major groups of organic compounds:

Carbohydrates
Lipids
Proteins
Nucleic Acids

1. Carbohydrates (sugars)
   a) Used to store energy and for structure in plants & some animals
   b) H:O ratio = 2:1
   c) Monosaccharide = simple sugar
      - glucose, galactose & fructose
      - These are all ***isomers***: chemicals with the same formula ($C_6H_{12}O_6$) but atoms arranged differently

d. Dissacharides = 2 simple sugars joined together

monosaccharide+monosaccharide $\longrightarrow$ disaccharide + H_2O

1. What are the two basic types of compounds discussed in this unit?
2. What does it mean to be organic?
3. What process removes water to bond monomers?
4. What are the 4 types of organic compounds?
5. What is the definition of a monosaccharide?

Examples of disaccharides: sucrose (table sugar), maltose (grain sugar), lactose (milk sugar)

glucose + fructose → sucrose + H_20

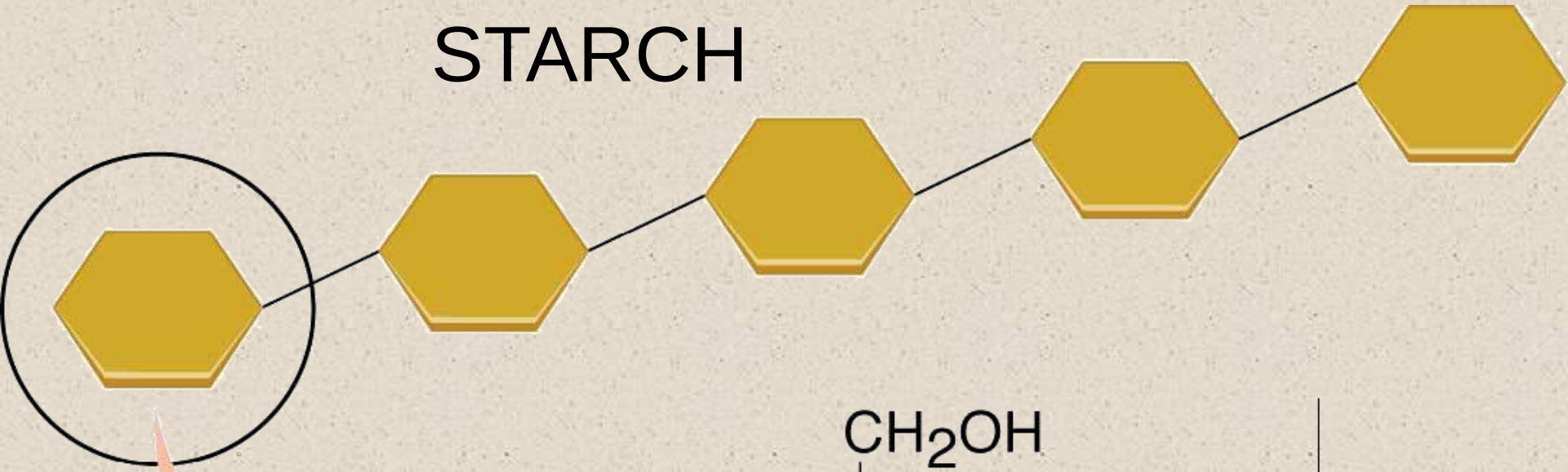
glucose + glucose → maltose + H_20

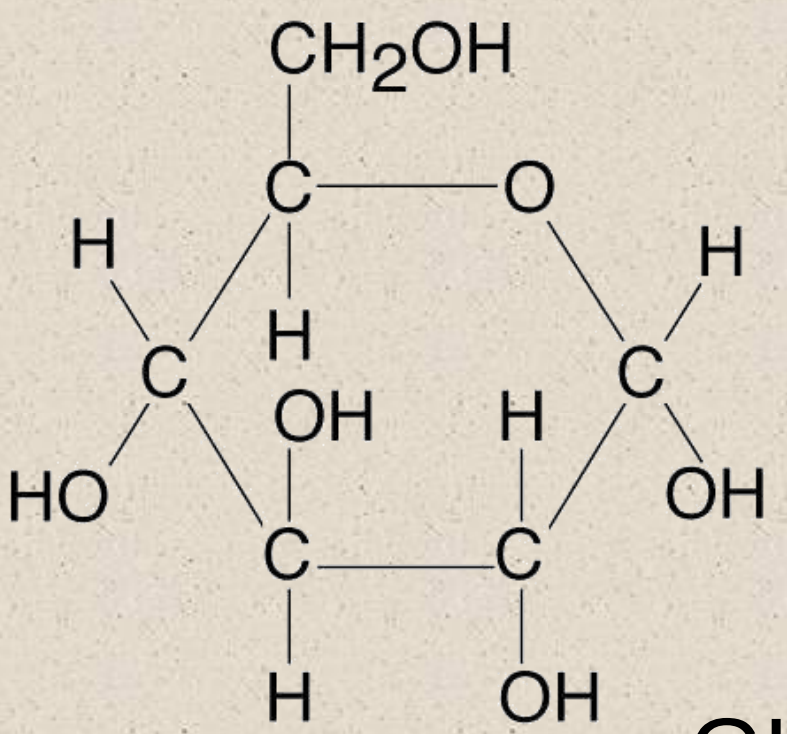
glucose + galactose → lactose + H_20

e)Polysaccharides: many sugars, complex carbohydrates

- Starch & cellulose in plants
- Glycogen & chitin in animals
- can be thousands of sugars long

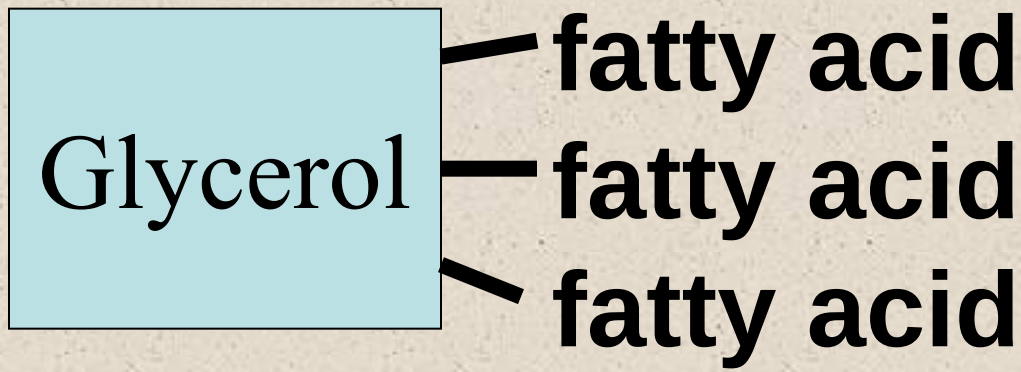
STARCH



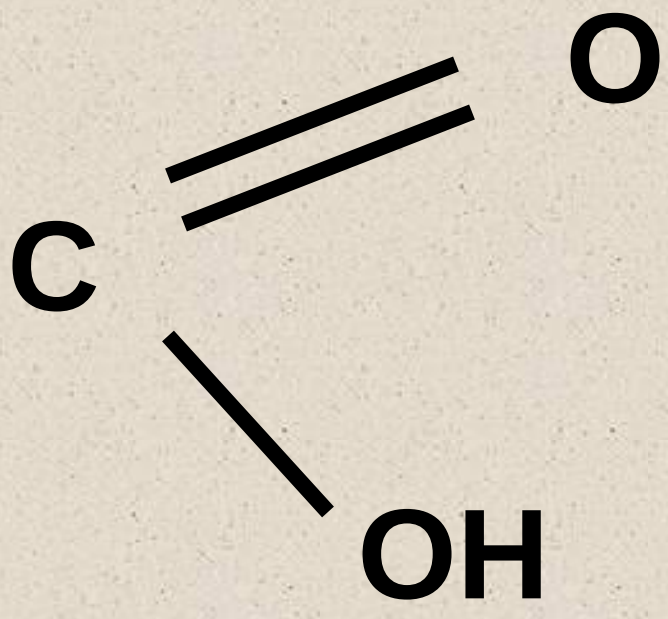


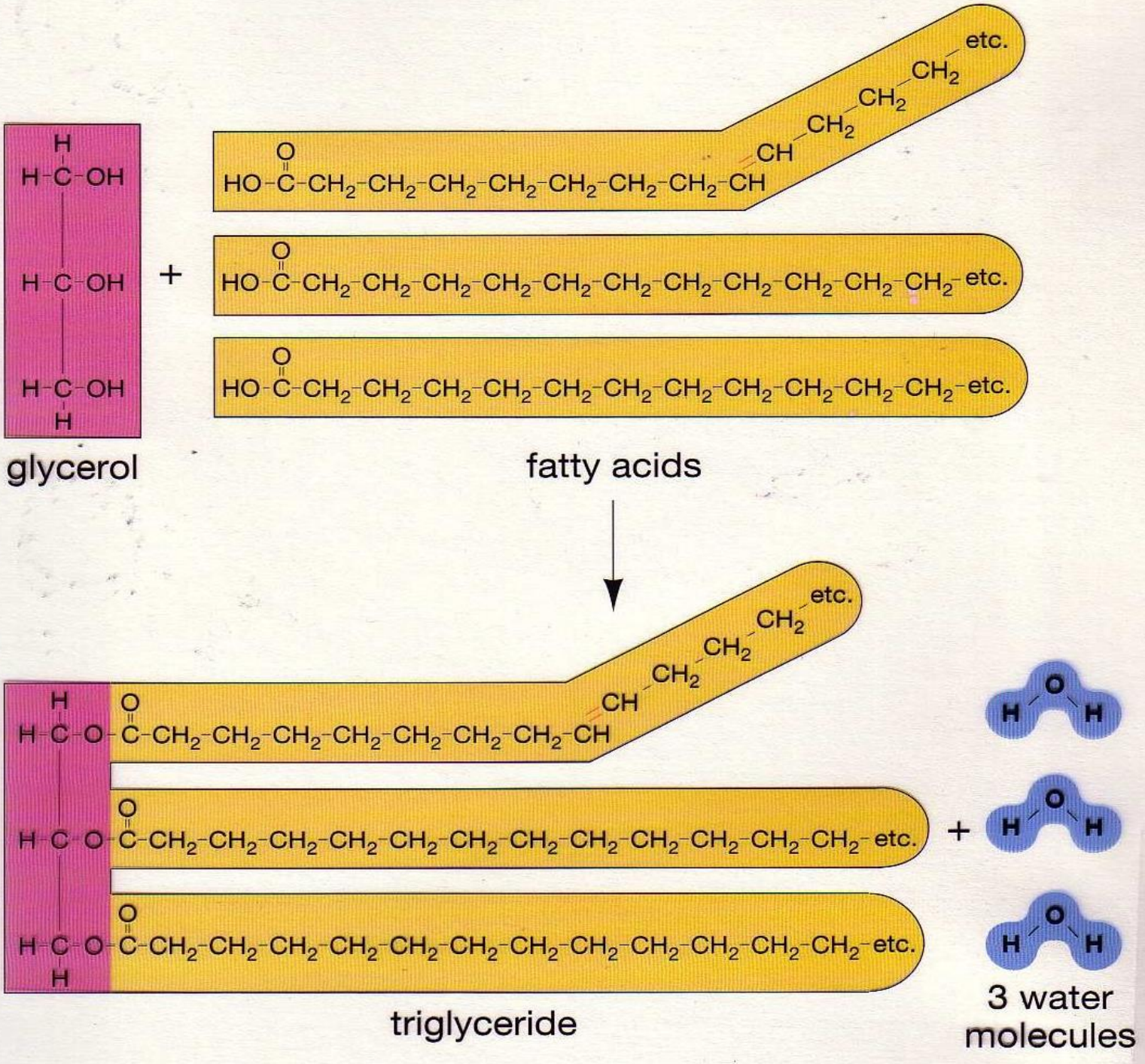
GLUCOSE

2. Lipids (Fat)
   a) Used to store energy & for building cell structures
   b) Built from 1 glycerol & 3 fatty acids
   c) During dehydration synthesis three H_2O molecules are released (1 for each fatty acid)



d) Fatty acids can be recognized by the carboxyl group (COOH)



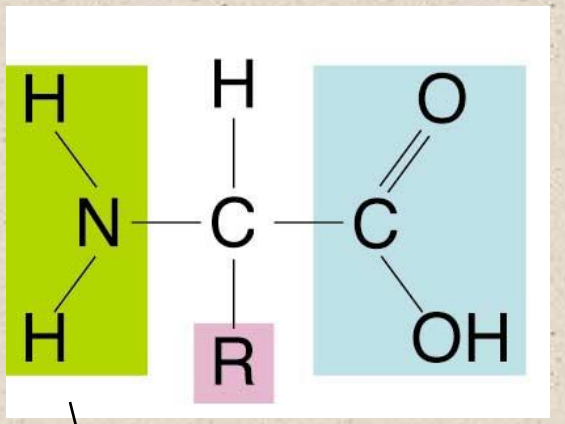

glycerol
+
fatty acids
triglyceride
+
3 water molecules

e) Examples of lipids

- Waxes, oils, and fats
- Phospholipids: makes up the structure of the cell membrane; does not dissolve in water!
- Steroids: serve as chemical signals in our bodies (hormones)

3. Proteins
   a) Provide structure, transport substances, act as chemical messengers, control chemical reactions, and control cell growth
   b) Built from amino acids
      - Each has a carboxyl group (COOH) & amino group (NH_2)
      - variable group makes one a.a. different from another
   c) Polypeptide: made from <u>many</u> a.a.

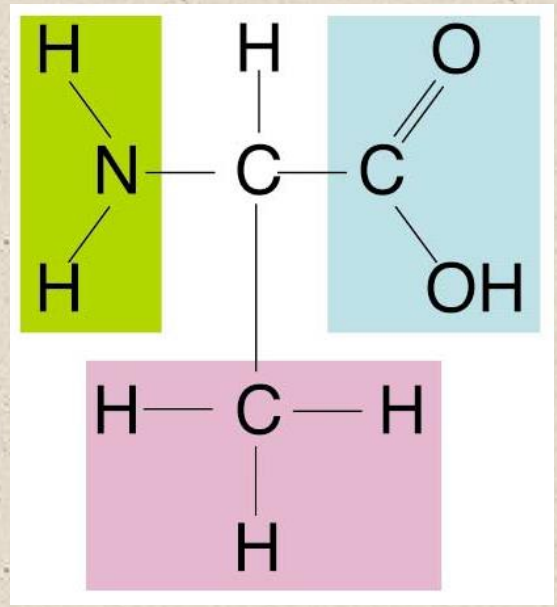
General structure



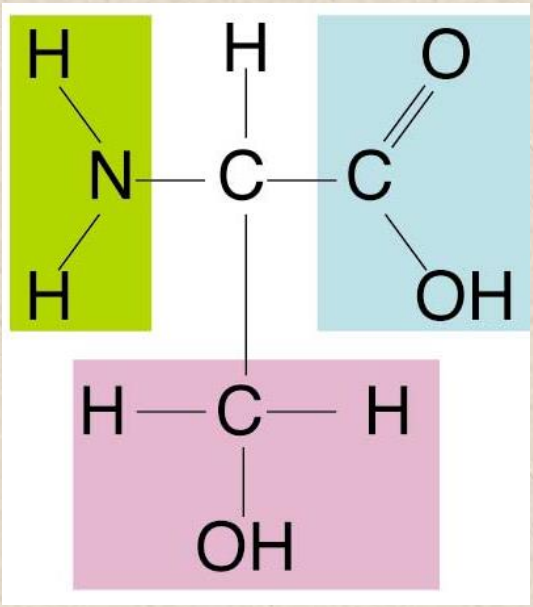
Carboxyl group

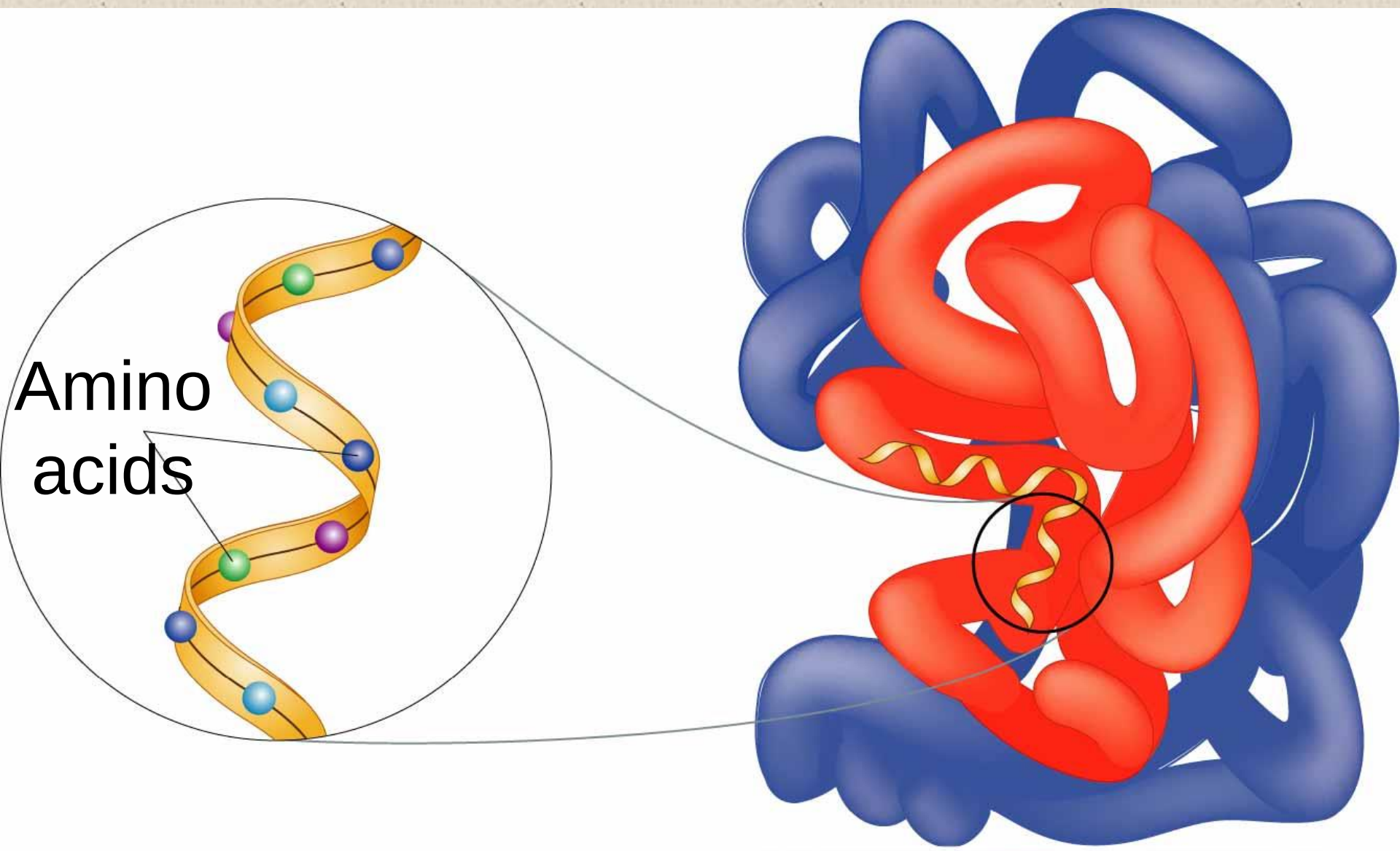
Amino group

Alanine



Serine




Amino
acids

d) Enzyme: specialized protein that acts as a catalyst

- *Substrate*: substance being acted on
- *Active site*: part of the enzyme that binds to substrate
- e.g. lactase in Lactaid pills

Enzyme Links

- http://highered.mcgraw-hill.com/sites/0072495855/student_view0/chapter2/animation__how_enzymes_work.html

- https://paul-andersen.squarespace.com/048-enyzmes

Mechanism of enzyme activity