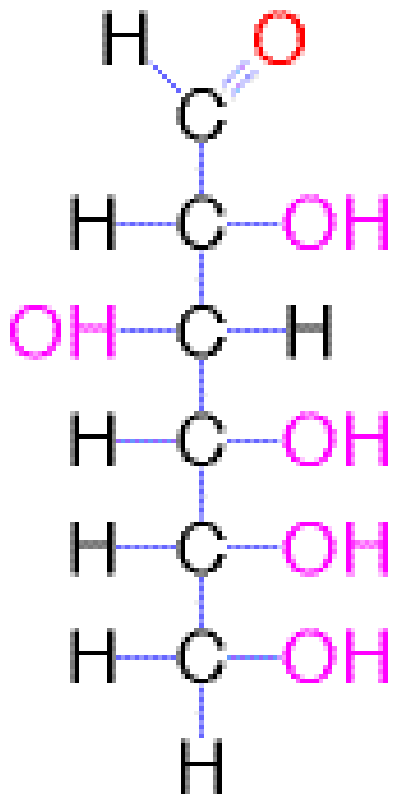
CARBOHYDRATES

- Produce energy for living things
- Atoms?
  - Carbon, hydrogen, and oxygen in 1:2:1 ratio
- Monomer—
- Examples?
  - Sugars, starches

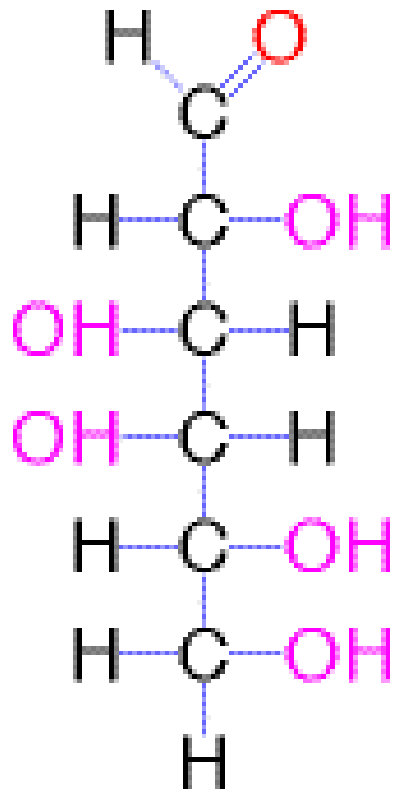
- MONOSACCHARIDES---
  main source of energy for cells
  - Glucose Know formula?
  - Fructose—
  - Galactose--

**These are considered isomers—

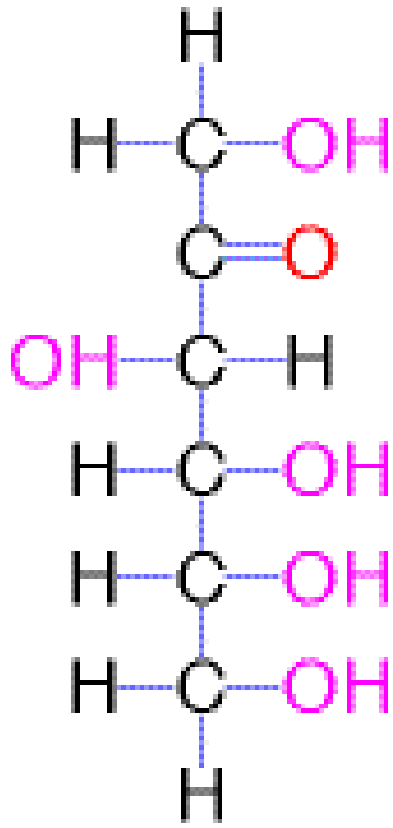
Hexose Sugars



Glucose



Galactose



Fructose

- DISACCHARIDES—condensation reaction of 2 monosaccharides combine to form a double sugar

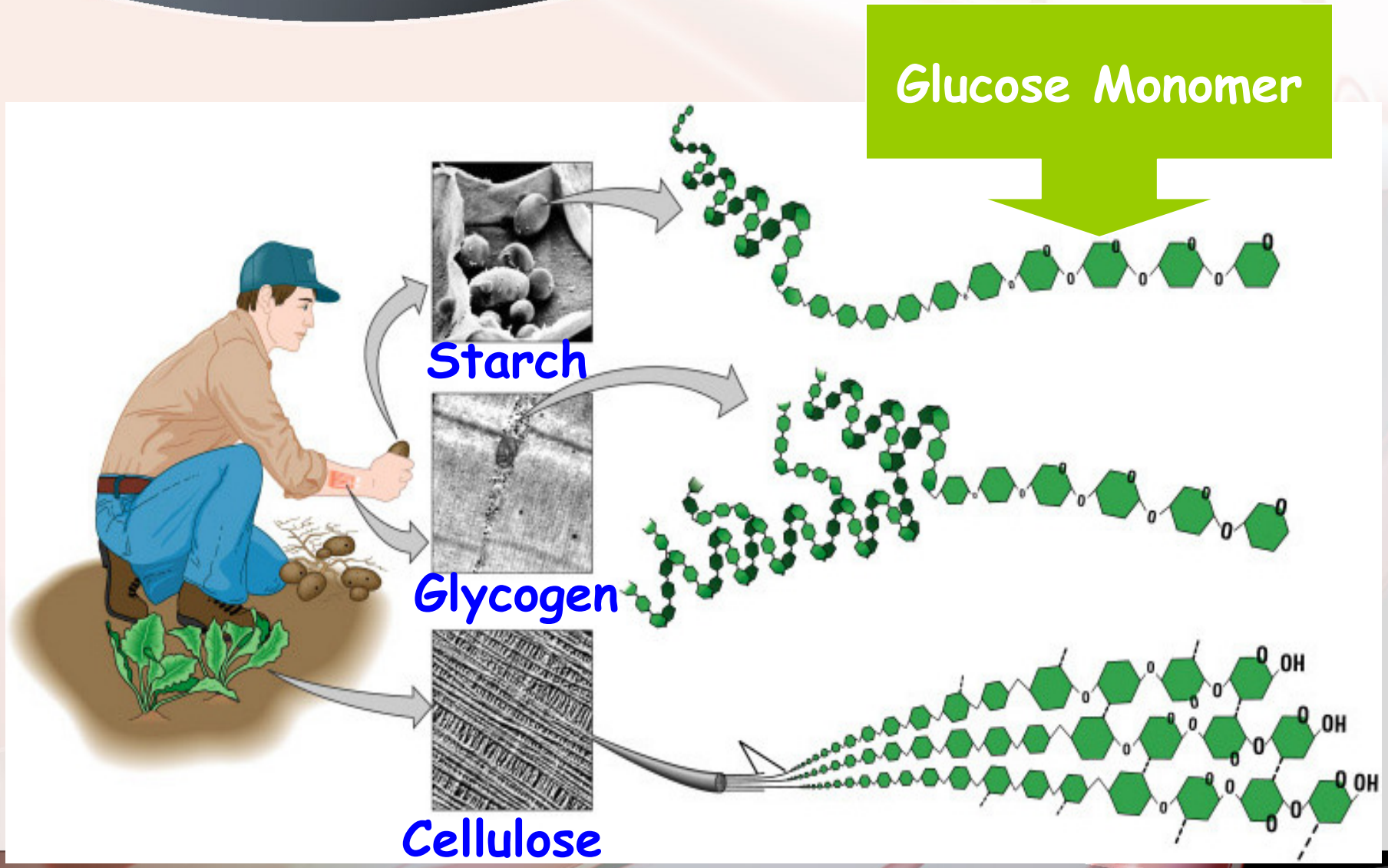
  Common disaccharides include:

  - Sucrose (table sugar)
  - Lactose (Milk Sugar)
  - Maltose (Grain sugar)

Bond called a GLYCOSIDIC bond

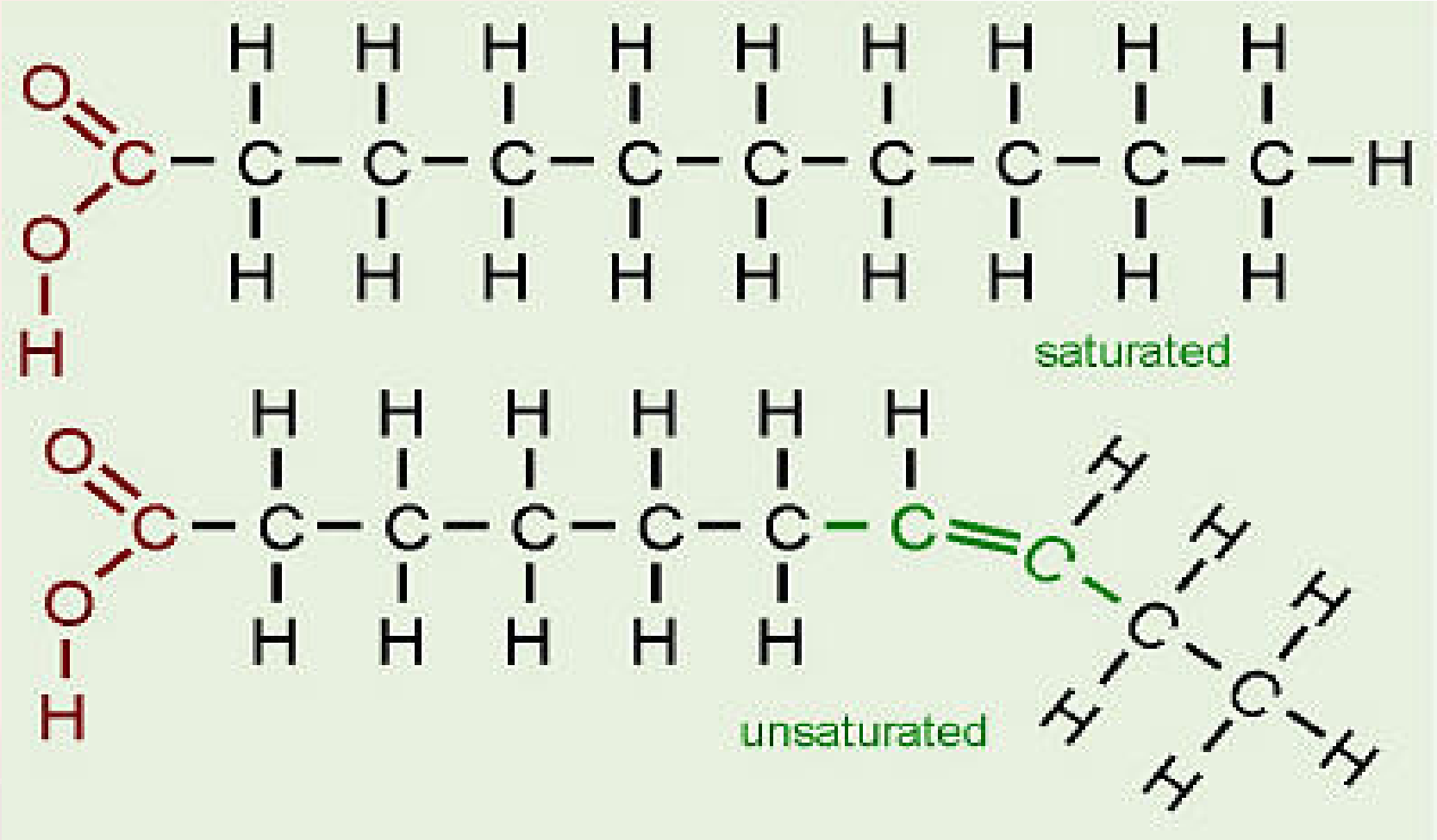
- POLYSACCHARIDES—many sugars bonded together; Example? Starch
  - Glycogen—stored in animal cells only (liver)
  - Cellulose—stored in plant cells only (cell wall)

Examples of Polysaccharides



LIPIDS

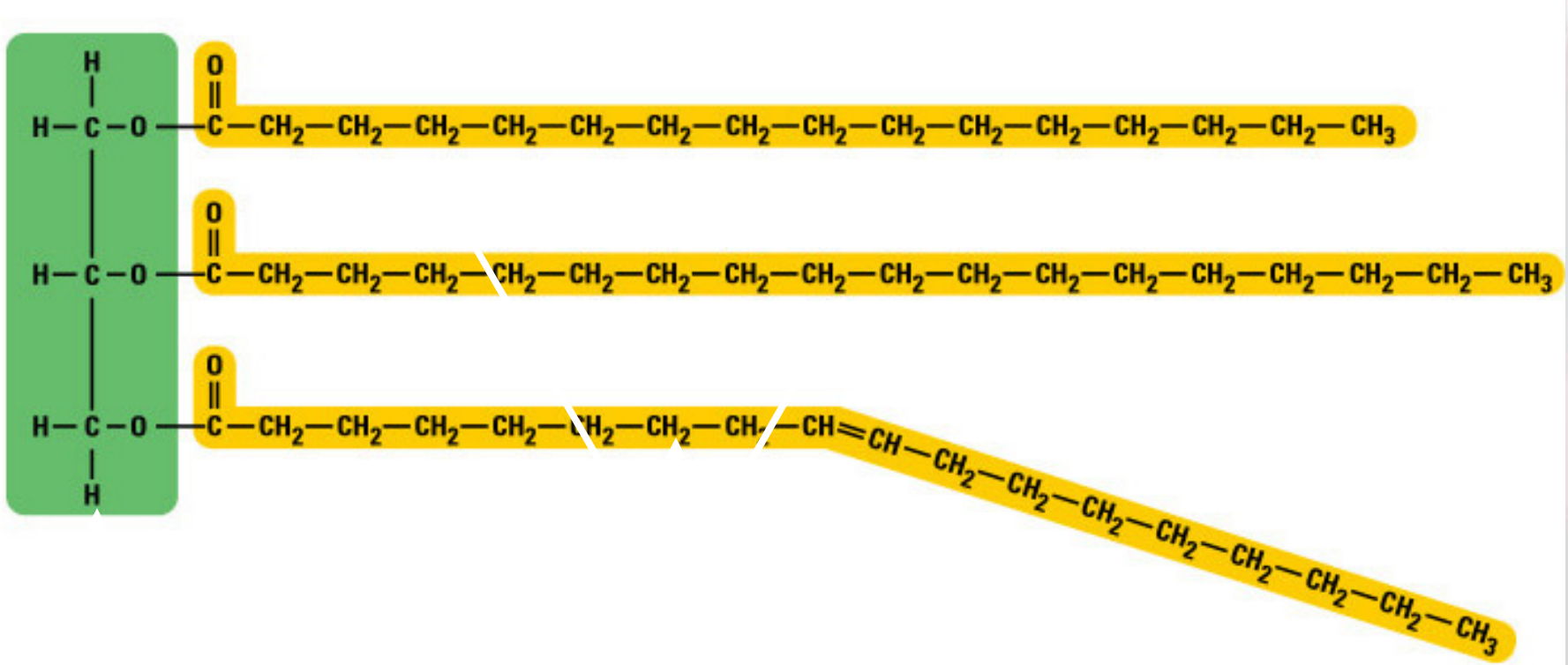
- Store energy (long-term) due to many C-H bonds (hydrocarbons)
- Atoms?
- Monomer—
- Nonpolar
- Difference in saturated & unsaturated fats?


saturated
unsaturated

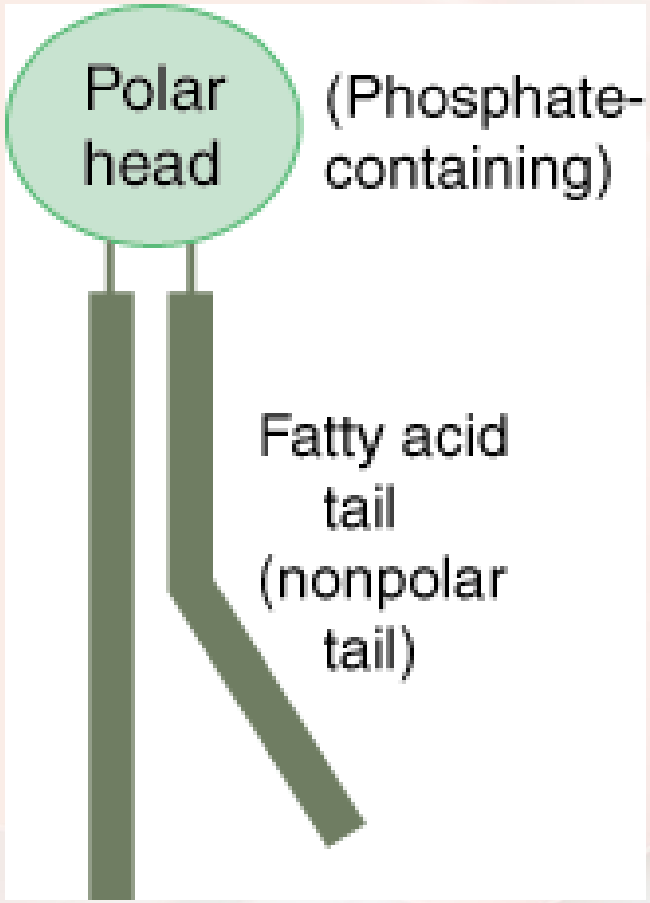
3 Categories of Lipids

- Triglycerides—monomer
- Waxes—fatty acid chain bonded to an alcohol (very polar); protective coatings
- Phospholipids—two fatty acid tails (nonpolar) attached to a phosphate head (polar); found in cell membranes

Triglyceride



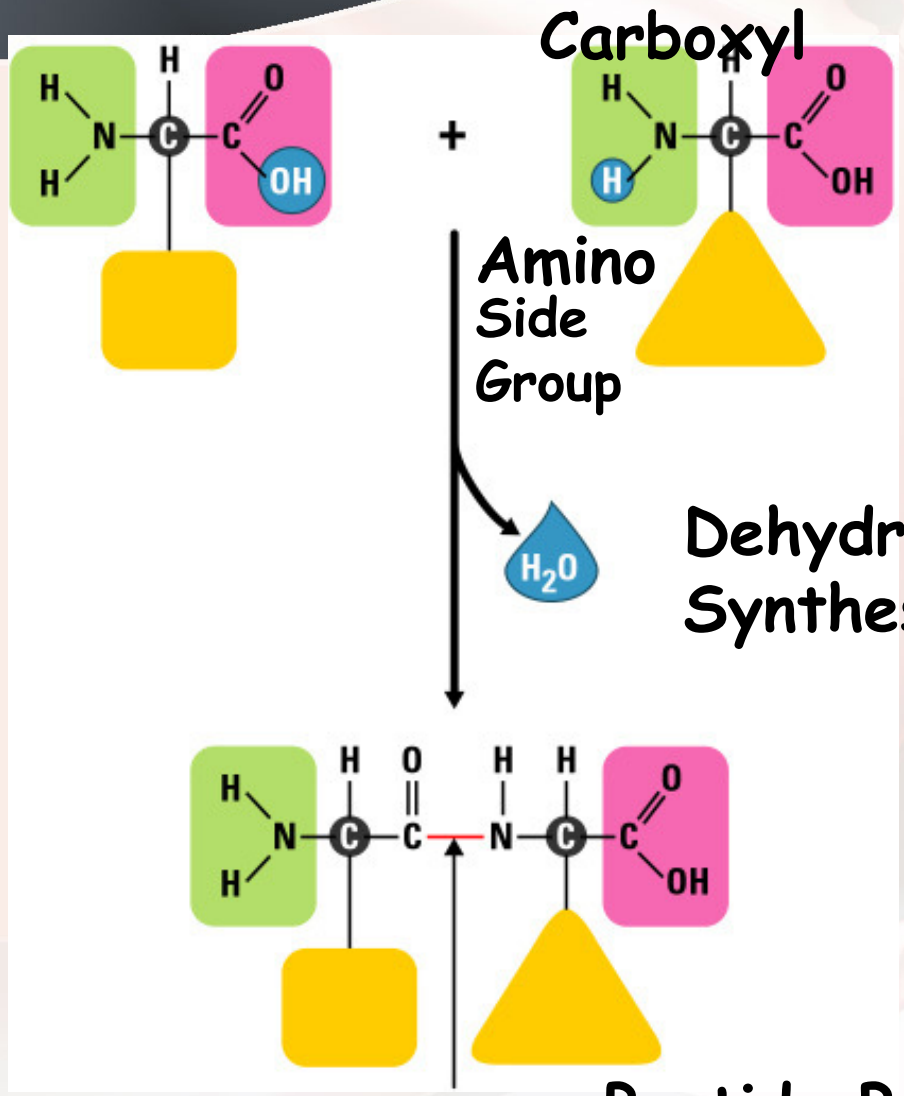
Phospholipid



PROTEINS

- Provide structural support for cells, transport, contraction
- Atoms?
- Monomers—amino acids
- There are 20 different amino acids
- Structure of AA? (Fig. 3-11)
- Peptide bonds—bonds formed b/t amino acids (dipeptide/polypeptide)

Linking Amino Acids

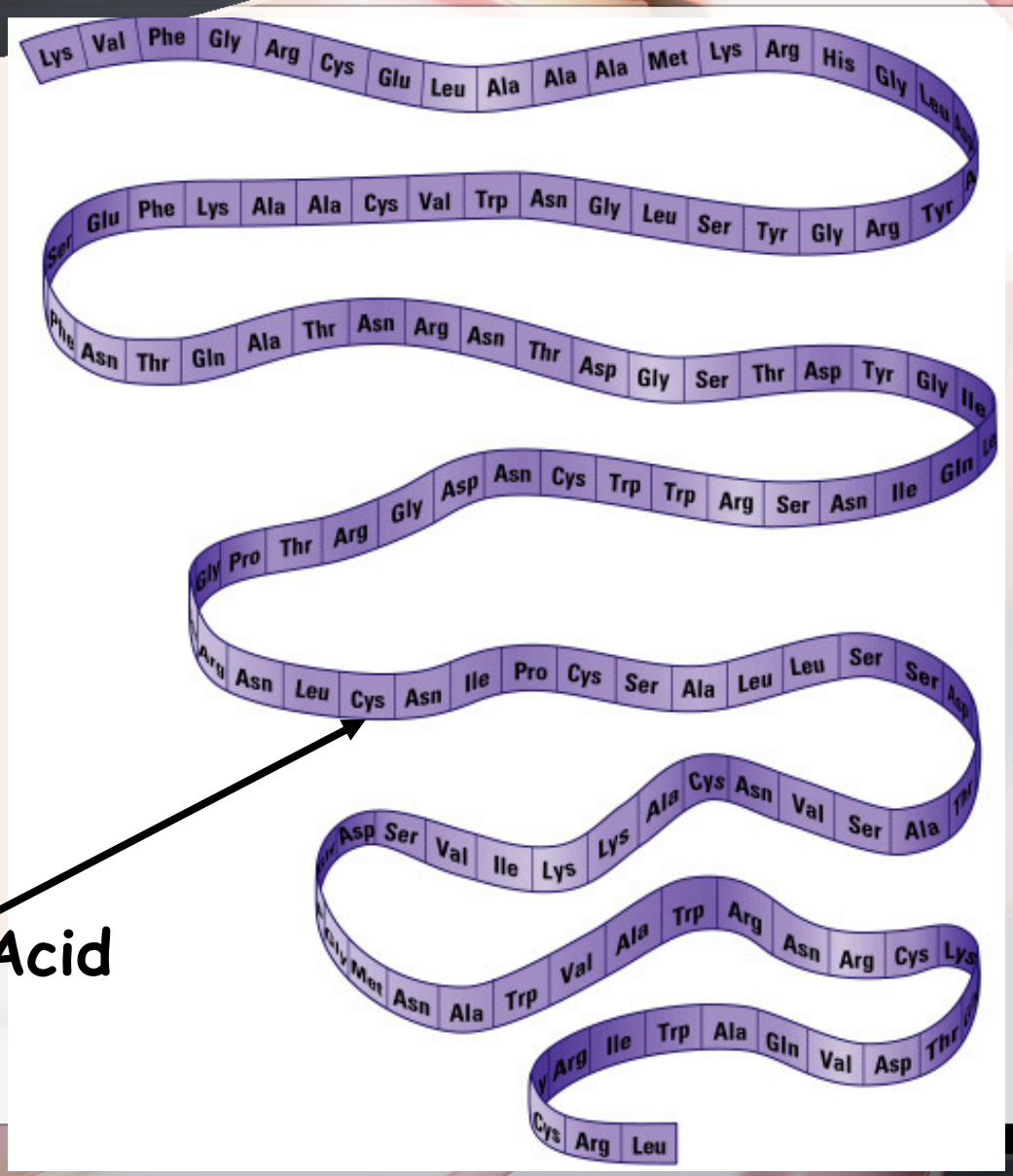


4 SHAPES OF PROTEINS

- Primary— amino acid structure
- Secondary— alpha-helix or beta-pleated sheet
- Tertiary--2° structure folds over
- Quarternary—2 or more polypeptides

Primary Protein Structure

The primary structure is the specific sequence of amino acids in a protein



Amino Acid

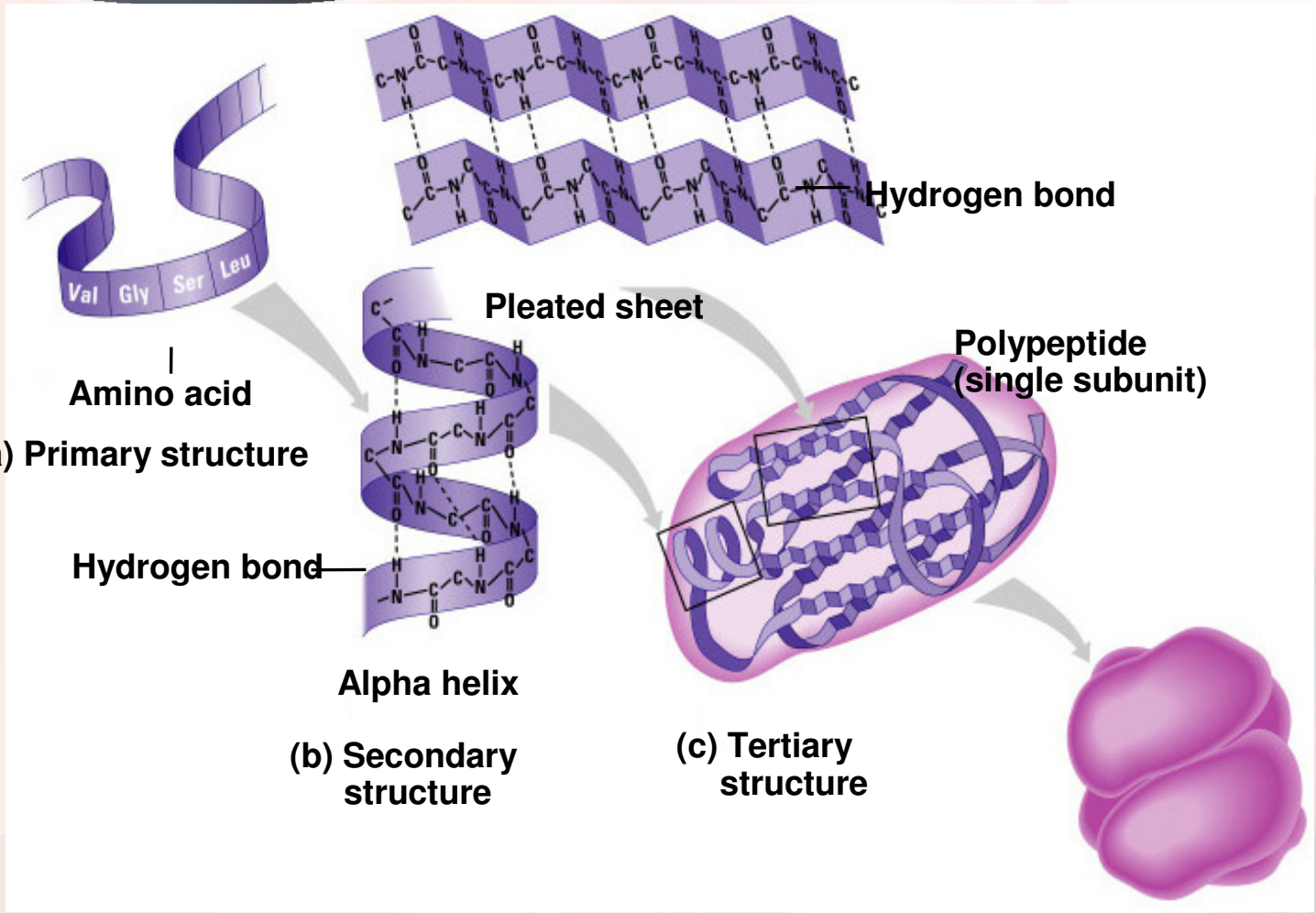
Protein Structures

Secondary protein structures occur when protein chains coil or fold

When protein chains called polypeptides join together, the tertiary structure forms because R groups interact with each other

In the watery environment of a cell, proteins become globular in their quaternary structure

Protein Structures or CONFORMATIONS



(d) Quaternary structure

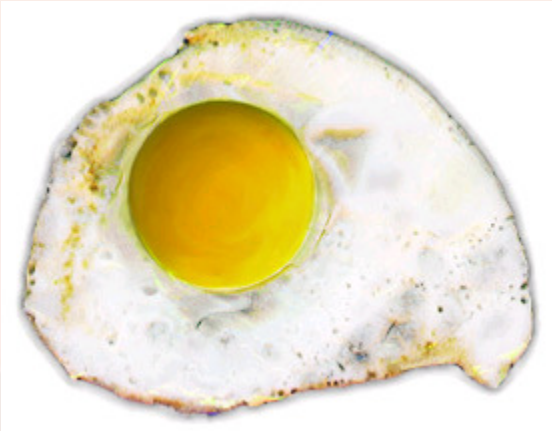
Shape determines function

Changing the shape of a protein is called denaturation and can be caused by different factors.

Denaturating Proteins

Changes in temperature & pH can denature (unfold) a protein so it no longer works

Cooking denatures protein in eggs



Milk protein separates into curds & whey when it denatures

ENZYMES

- A type of protein that control the rate of chemical reactions by weakening bonds, thus lowering the amount of activation energy needed for the reaction
- Substrate—substance being catalyzed; enzyme binds to it
- Active site—area on enzyme that "fits" into an area on the substrate (lock & key model vs. induced fit)

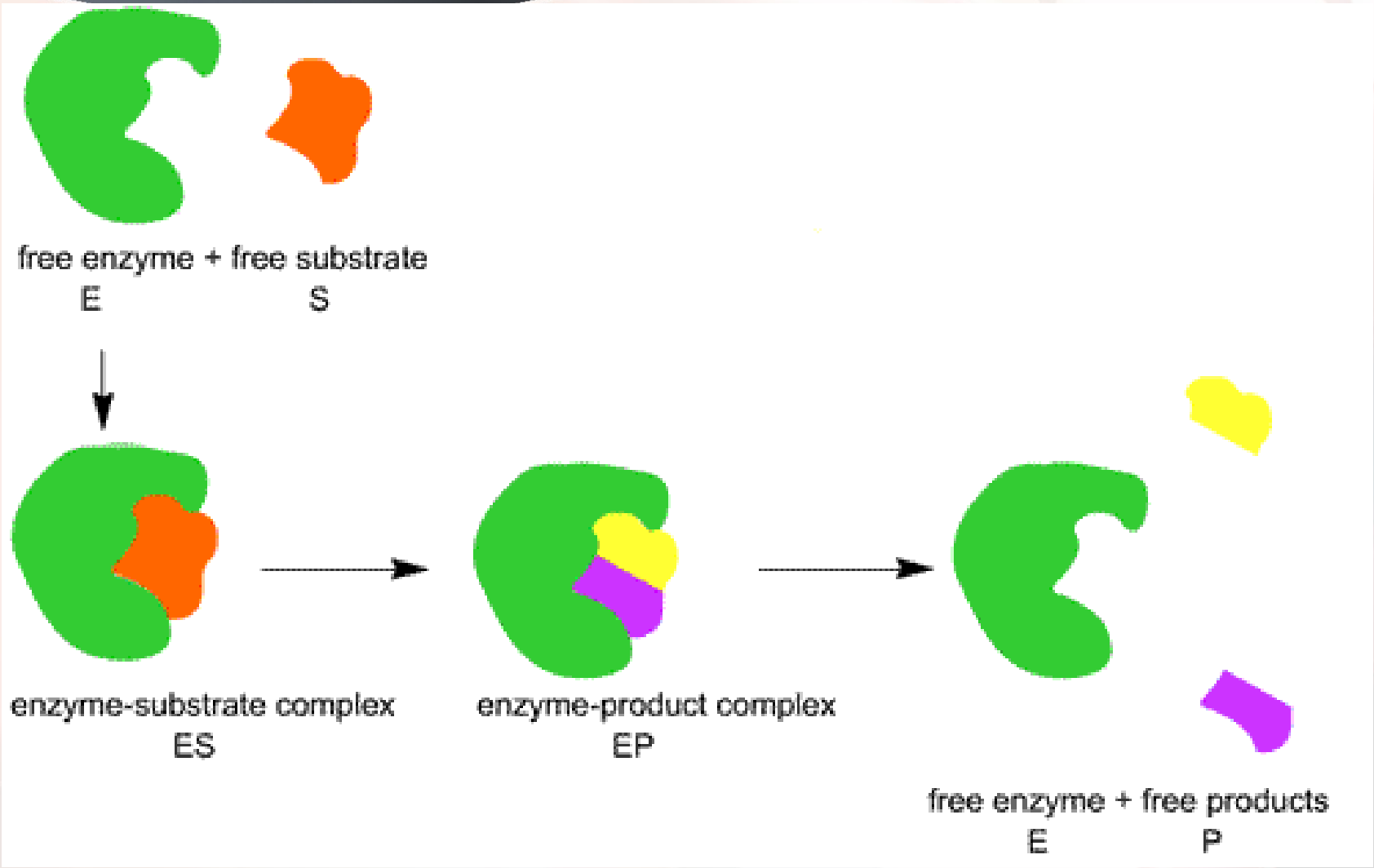
Enzymes

Enzymes are globular proteins.

Their folded conformation creates an area known as the active site.

The nature and arrangement of amino acids in the active site make it specific for only one type of substrate.

Enzyme + Substrate = Product

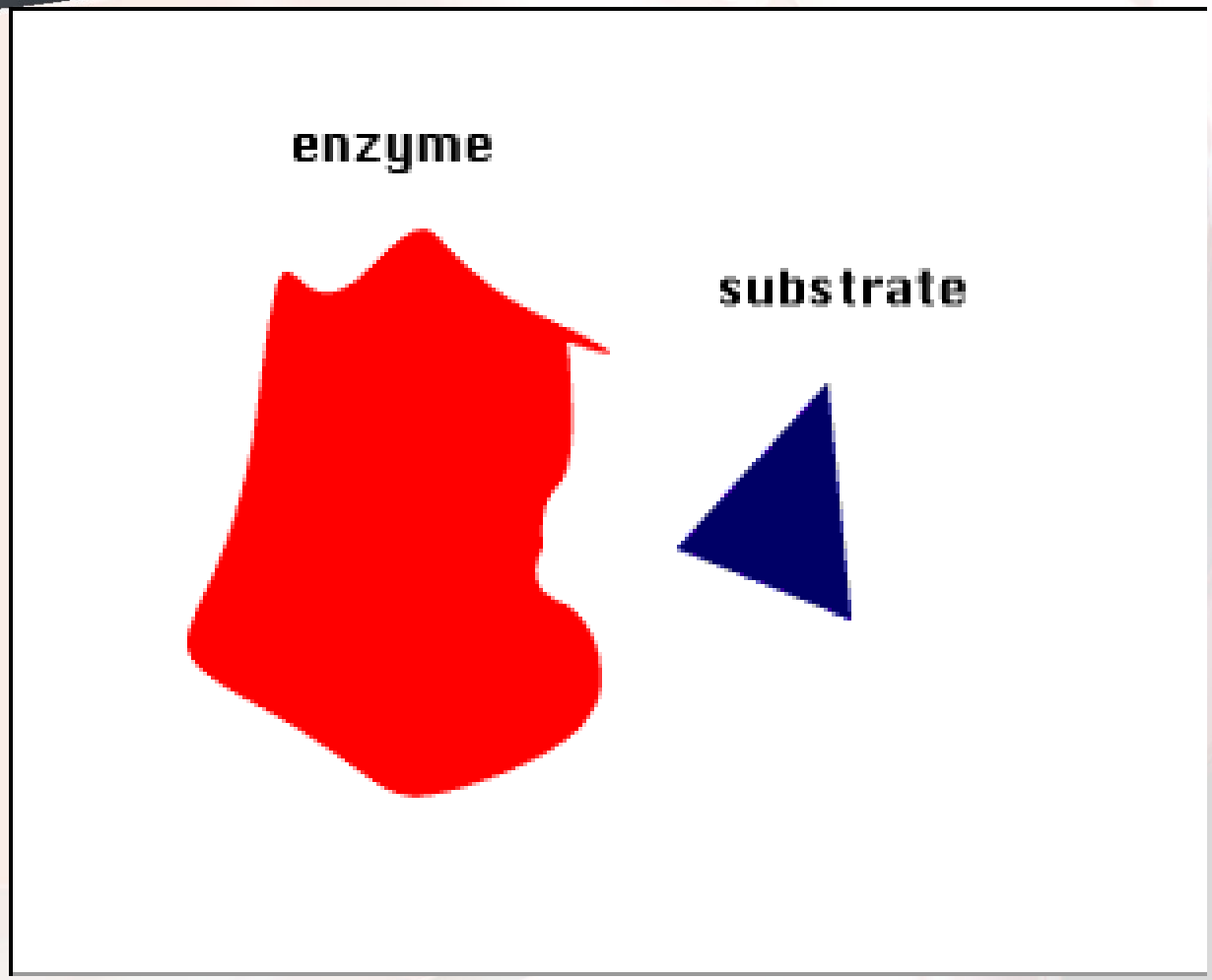


How the Enzyme Works

Enzymes are reusable!!!

Active site changes SHAPE

Called INDUCED FIT



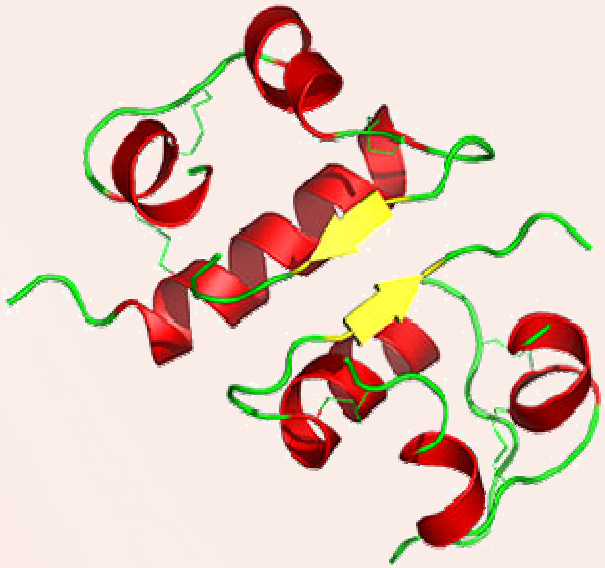
FACTORS AFFECTING ENZYME ACTIVITY

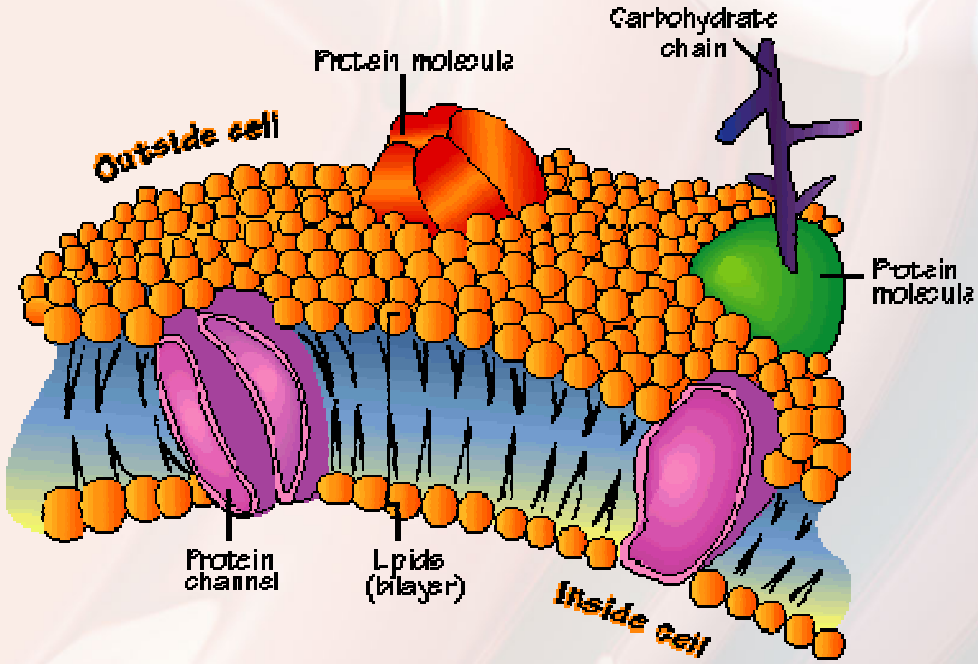
- Temperature
- pH
- Concentration of enzymes
- Concentration of substrates

Other Important Proteins

- Blood sugar level is controlled by a protein called insulin
- Insulin causes the liver to uptake and store excess sugar as Glycogen
- The cell membrane also contains proteins
- Receptor proteins help cells recognize other cells

INSULIN



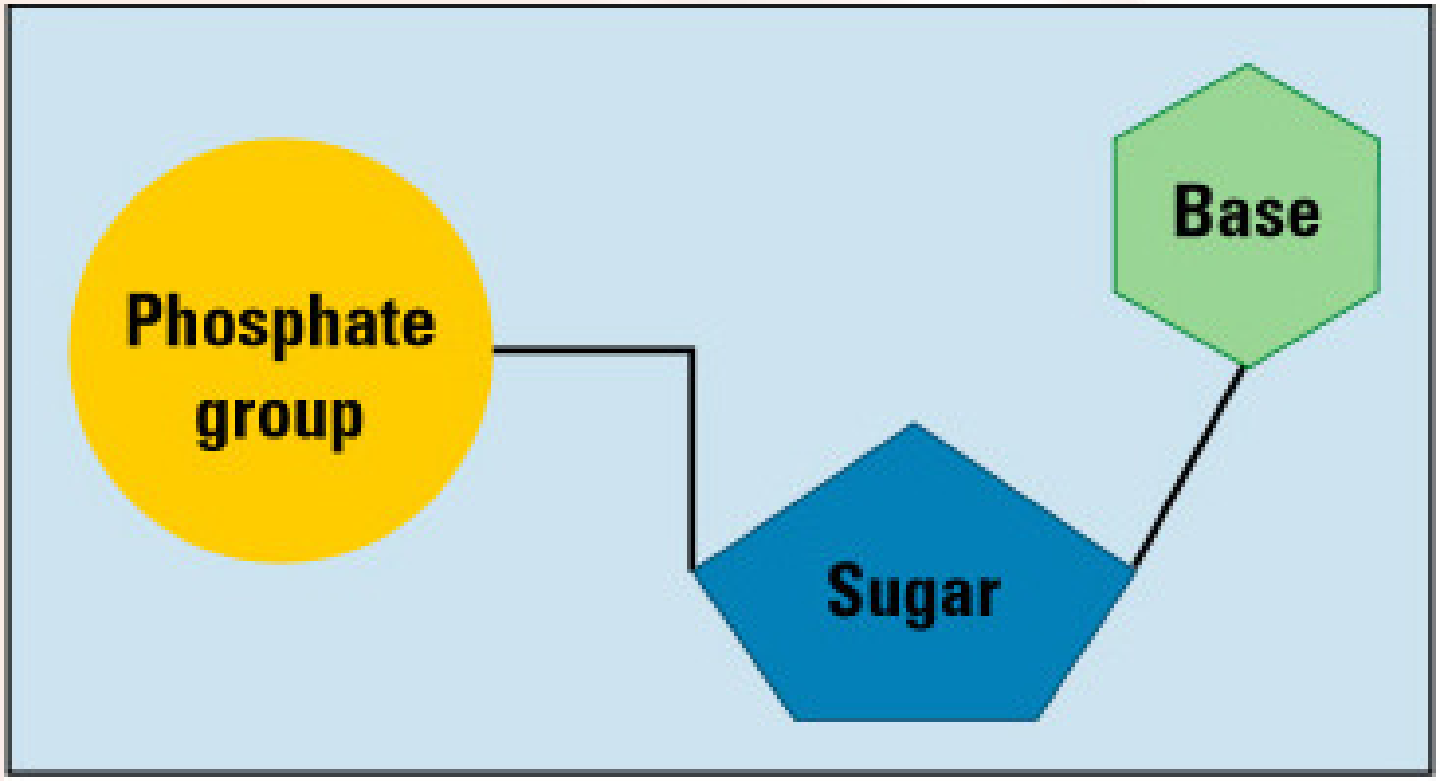


Cell membrane with proteins & phospholipids

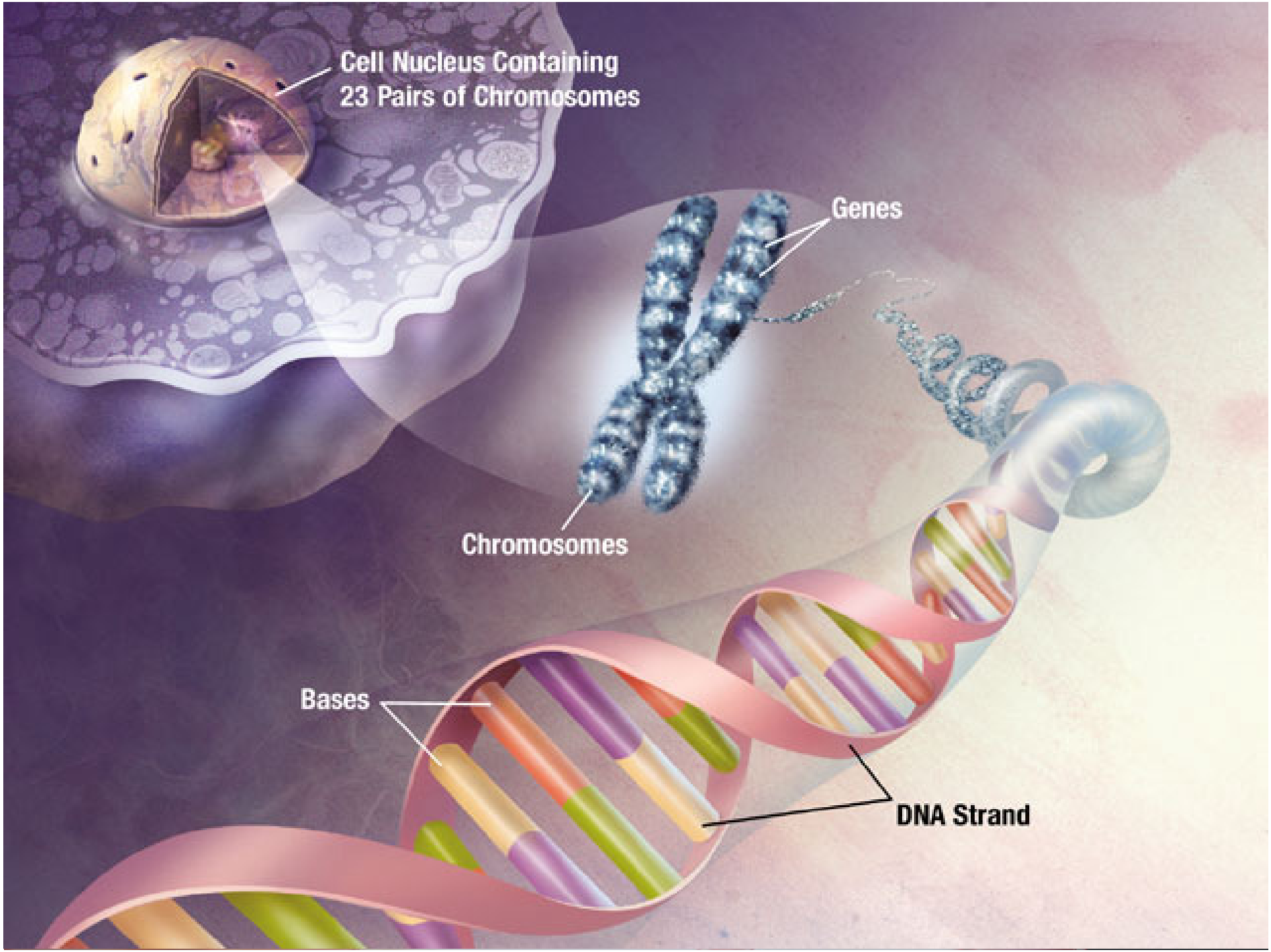
NUCLEIC ACIDS

- Monomer—
- Atoms?
- Very large and complex
- 2 kinds:

Nucleotide – Nucleic acid monomer



DNA nucleotide

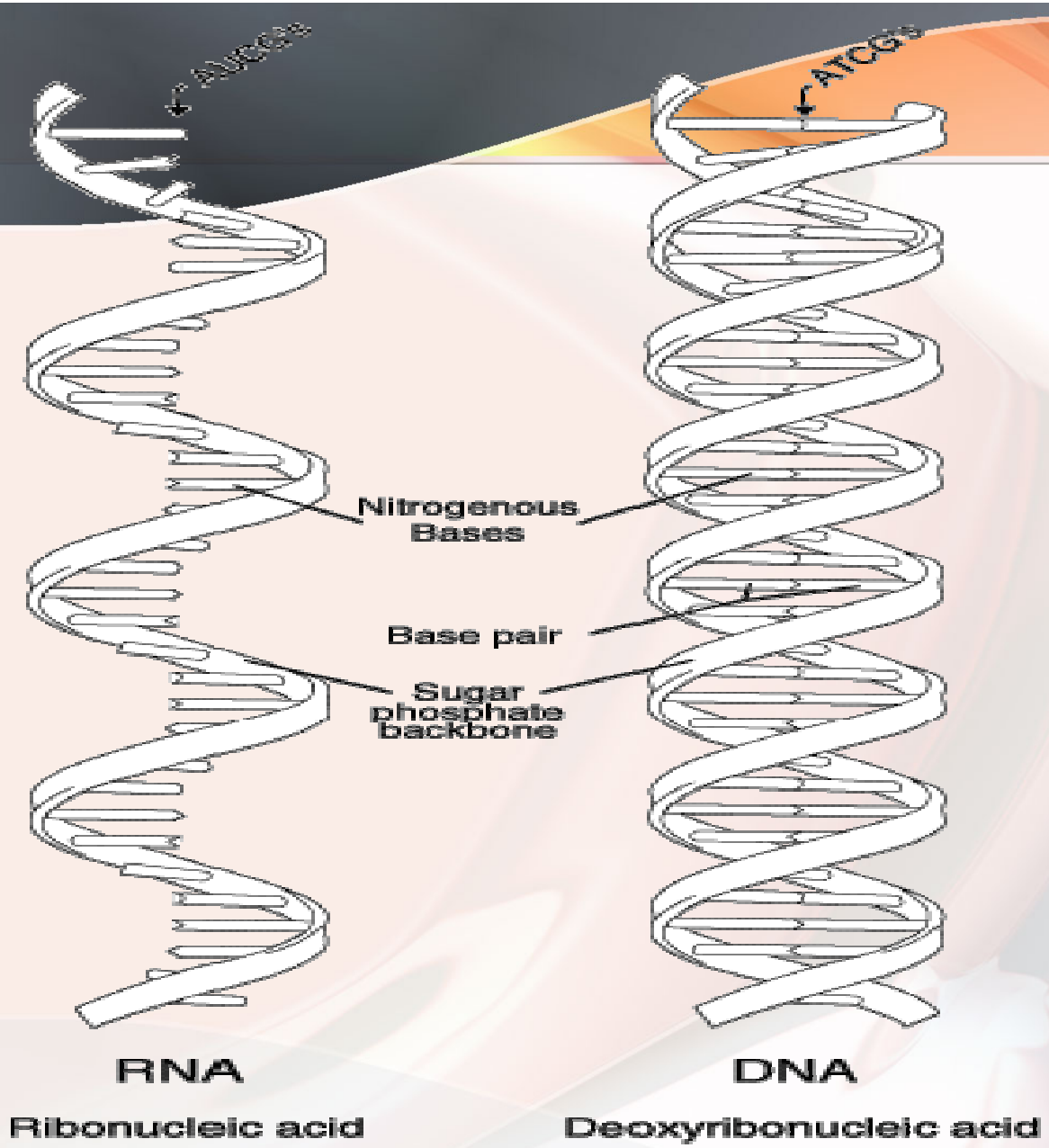

Cell Nucleus Containing
23 Pairs of Chromosomes
Genes
Chromosomes
Bases
DNA Strand

DNA

- Deoxyribonucleic acid
- Carries hereditary information that is important for all cell activity
- Contains the sugar DEOXYRIBOSE
- Contains four bases:
  - Adenine (A)
  - Guanine (G)
  - Thymine (T)
  - Cytosine (C)

RNA

- Ribonucleic Acid
- Stores and transfers information necessary for making proteins
- Contains the sugar RIBOSE
- Contains the same bases as DNA EXCEPT that RNA has <u>uracil</u> instead of thymine.


AUGCG
ATCG
Nitrogenous Bases
Base pair
Sugar phosphate backbone
RNA
Ribonucleic acid
DNA
Deoxyribonucleic acid

The End