The Molecules of Life

Overview:

- Four Groups of Organic (Biological) Compounds
- Relationship Between the Structure and Function of Molecules
- Condensation and Hydrolysis Reactions (the typical way organic compounds are assembled and disassembled)

I. Major Groups of Organic Compounds

A. Carbohydrates

Elements-
Monomer-
Illustration-
Soluble in water?-
Types and Functions-

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Monomer-
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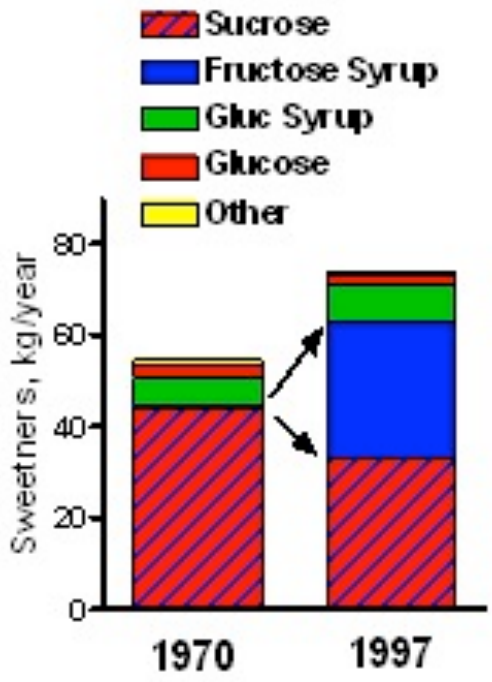
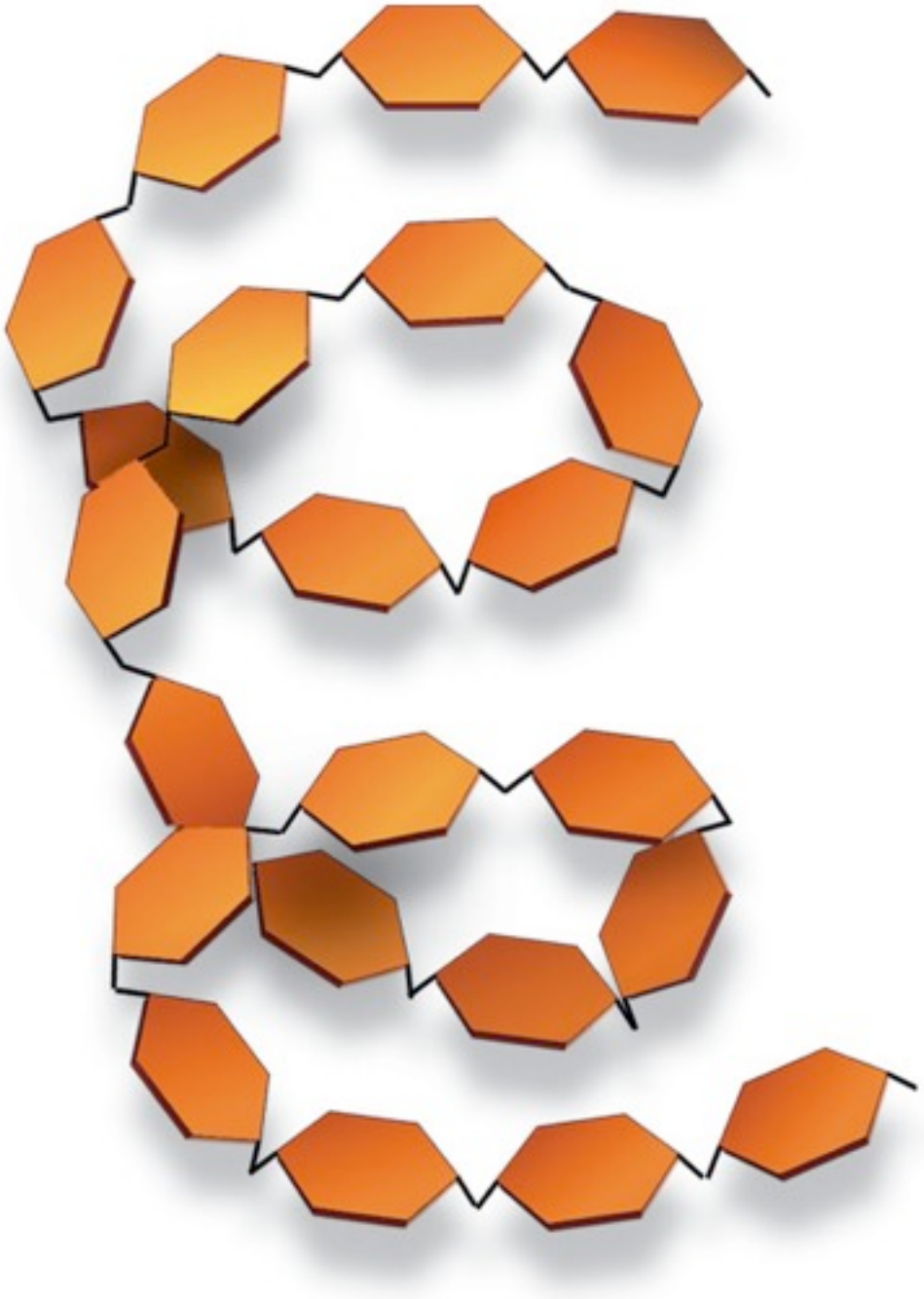
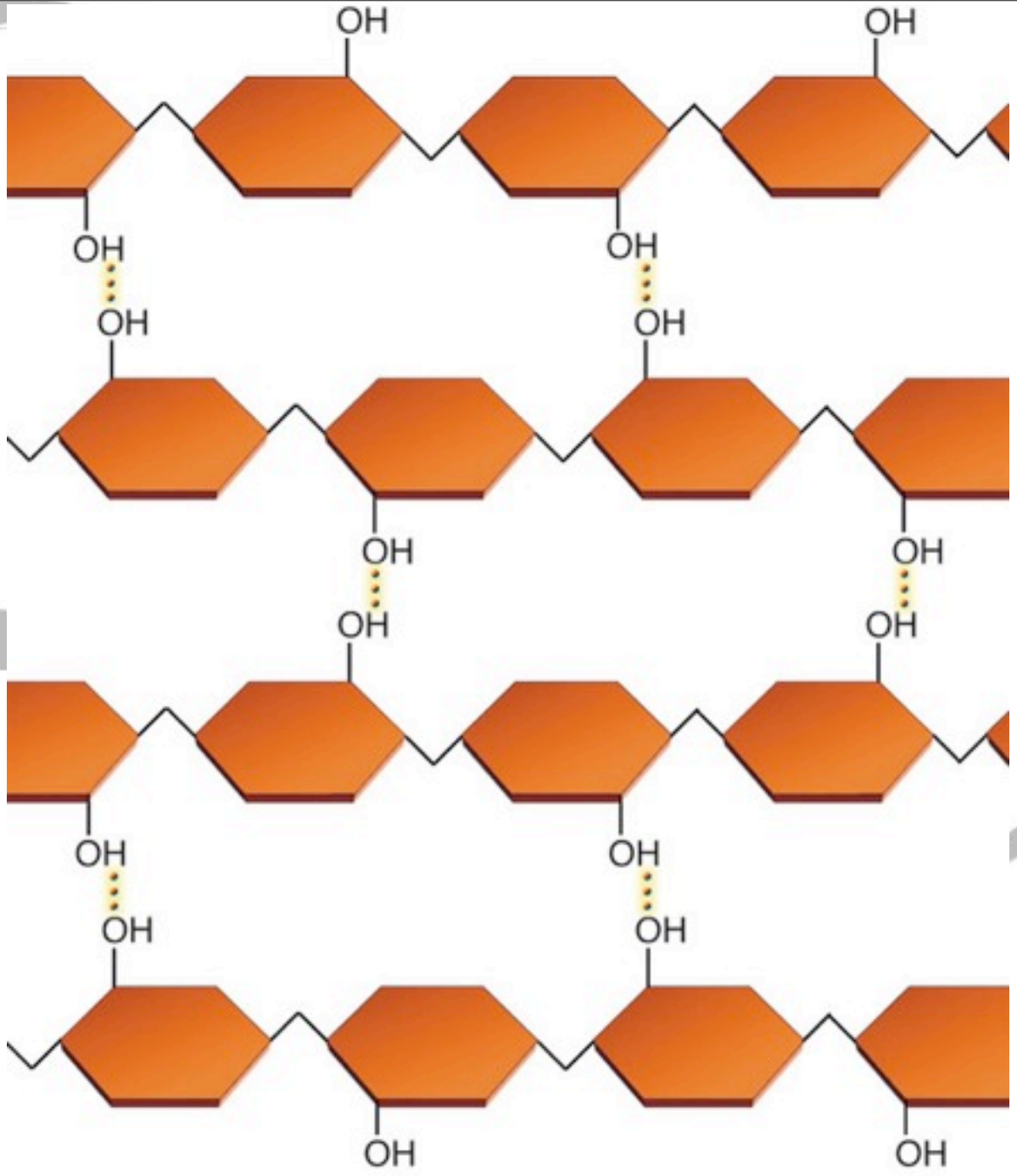


1. Monosaccharides-
   exs. glucose-
   fructose-
   ribose and deoxyribose-
2. Disaccharides-
   exs. sucrose-
   maltose-
   lactose-
3. Polysaccharides-ALL glucose polymers
   exs. starch-
   glycogen-
   cellulose-
   chitin-

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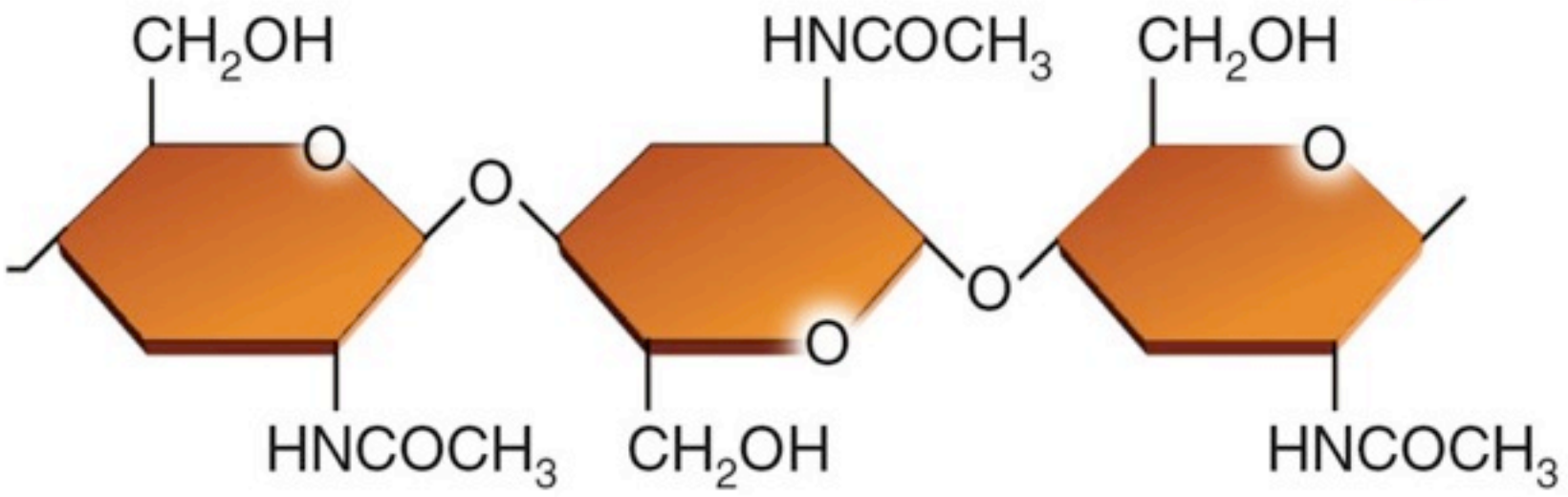
© 2006 Brooks/Cole - Thomson



B. Lipids

Elements-
Monomer-
Illustration-
Soluble in water?-
Is Carbon important?
Types and Functions-

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AN ESTROGEN

TESTOSTERONE

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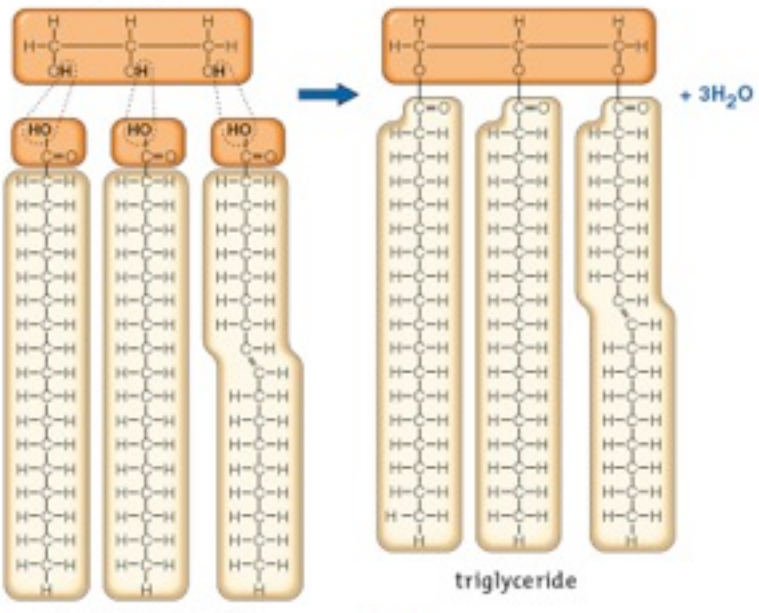
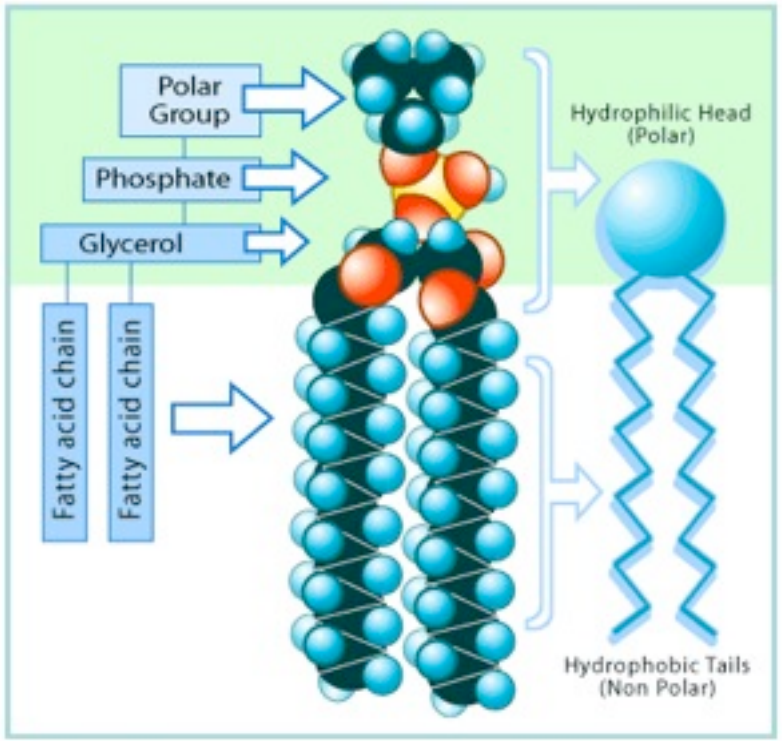


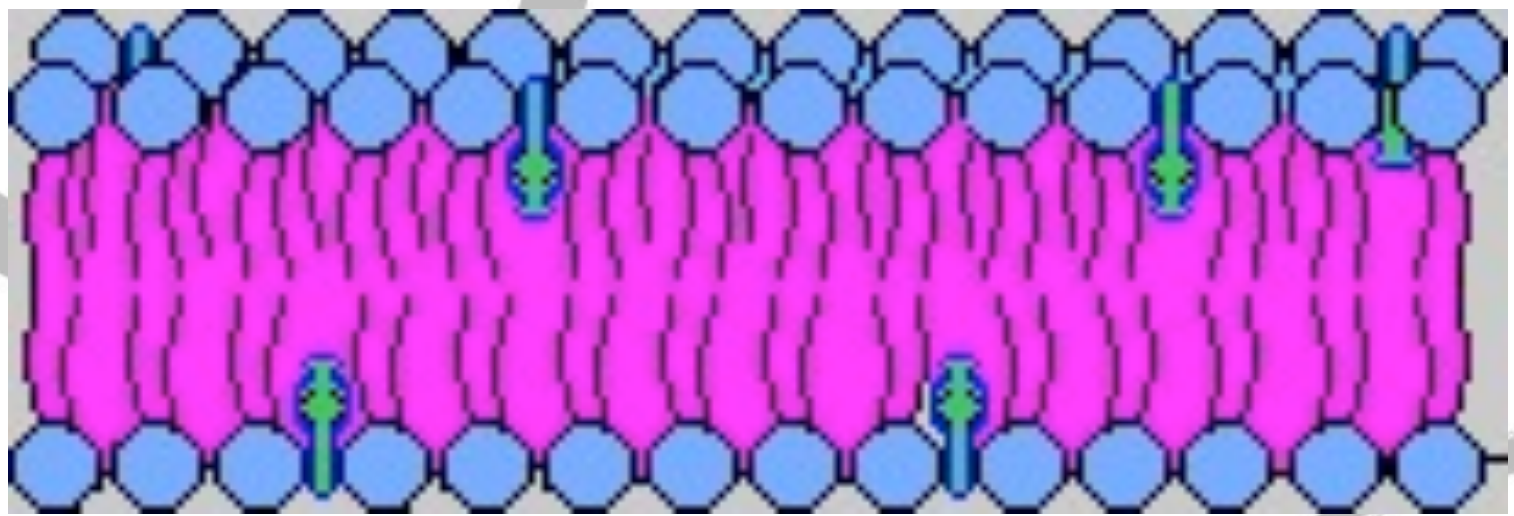
Fats - triglycerides, these make up the saturated and unsaturated fats in your cells.

-Fats are created by a dehydration reaction when a glycerol bonds with three fatty acid chains.

Steroids - hormones and cholesterol

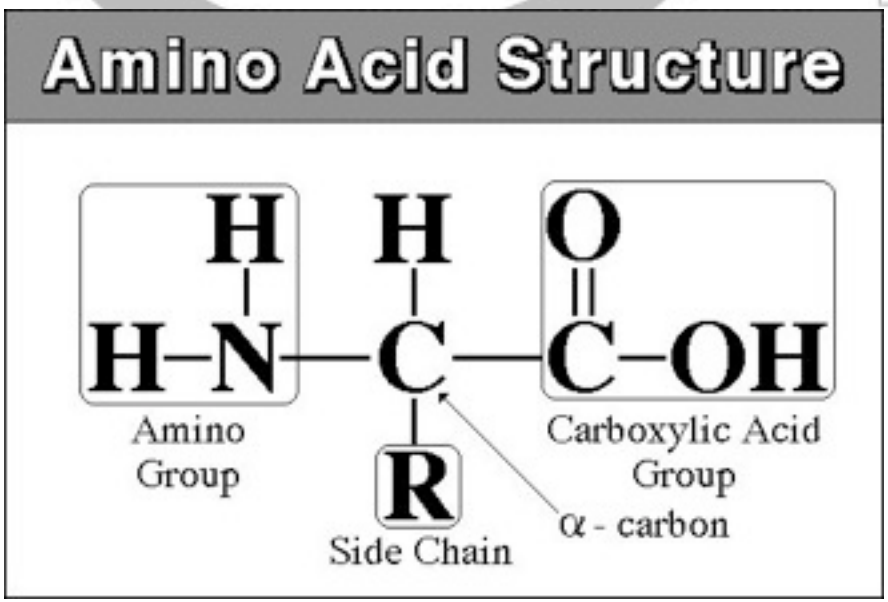
Phospholipids - responsible for forming the cell membrane

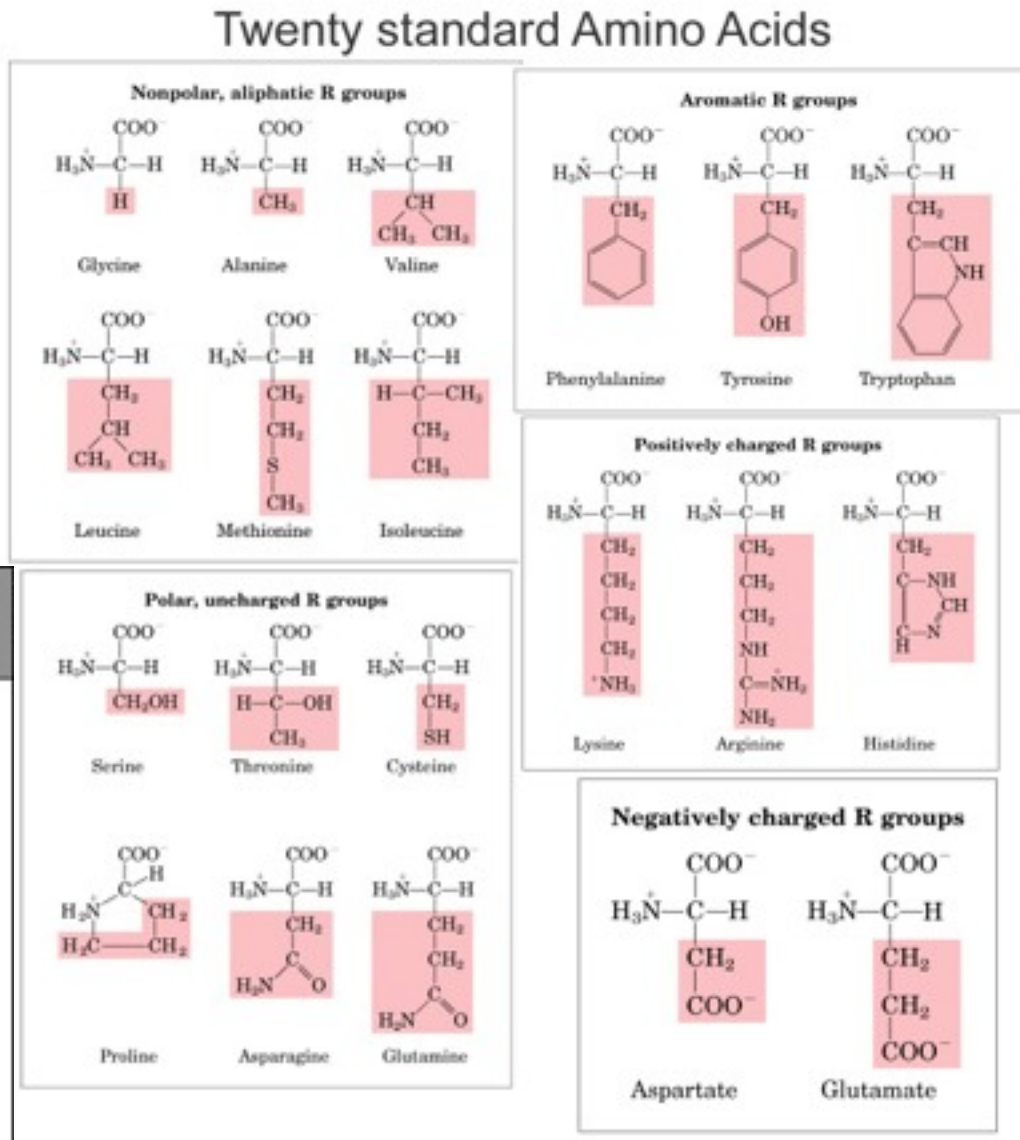




C. Proteins

Elements-
Monomer-
Illustration-
Soluble in water?-



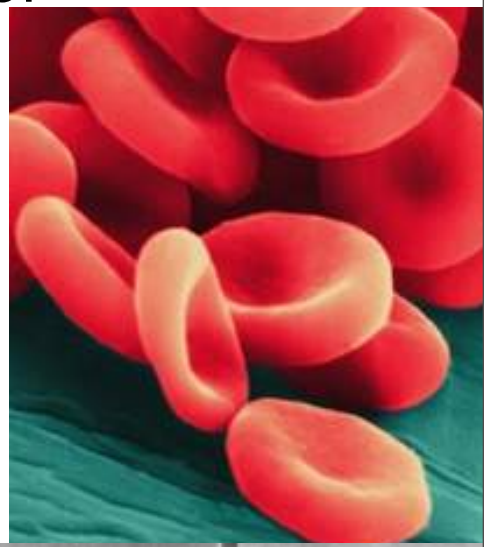


Types and Functions-

Greatest variation in function of all the groups of organic compounds! Why??

1. Amino acids-
2. Dipeptides-
3. Polypeptides-

exs. transport molecules- hemoglobin
hormones- growth hormone
enzymes- lactase
___ structure- hair, nails, muscle



D. Nucleic Acids

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Illustration-
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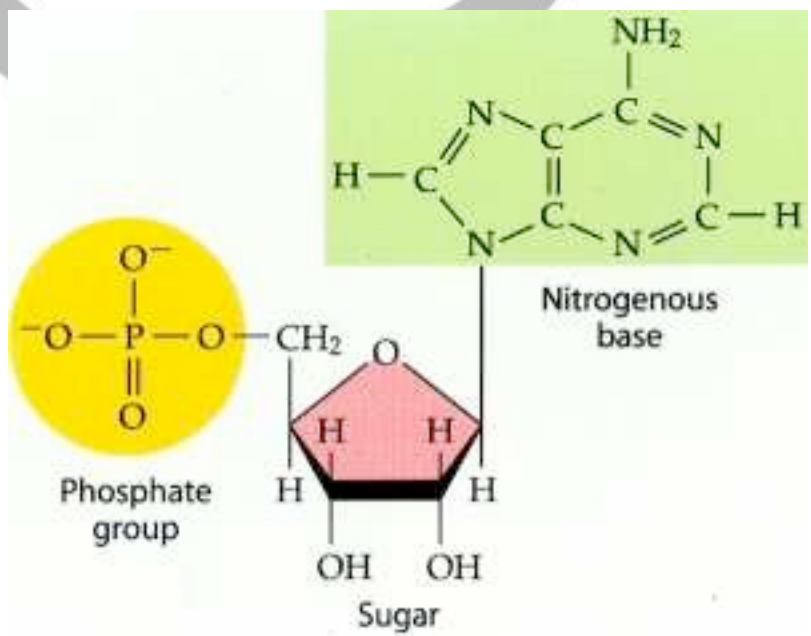
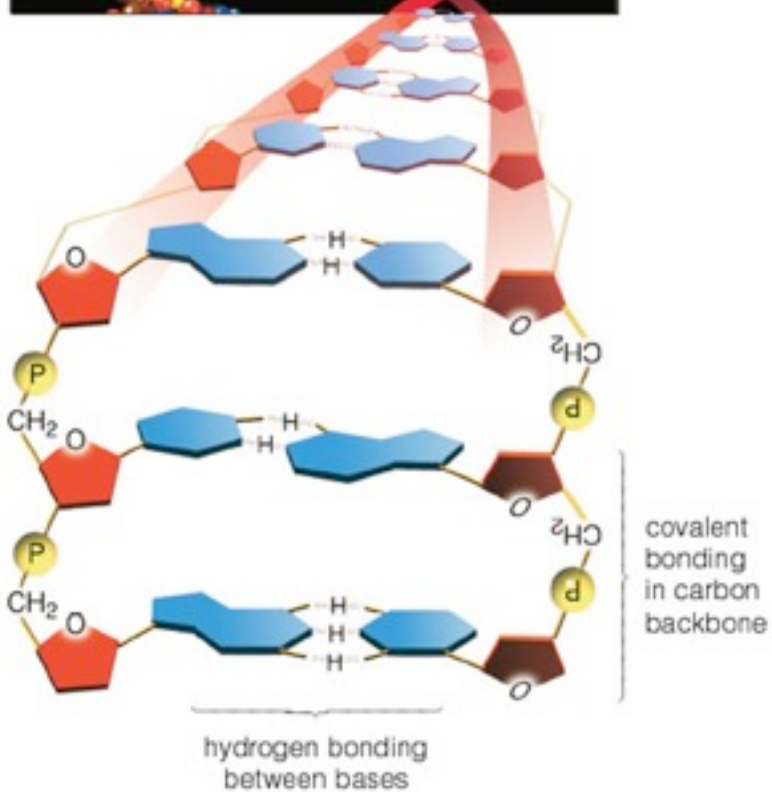
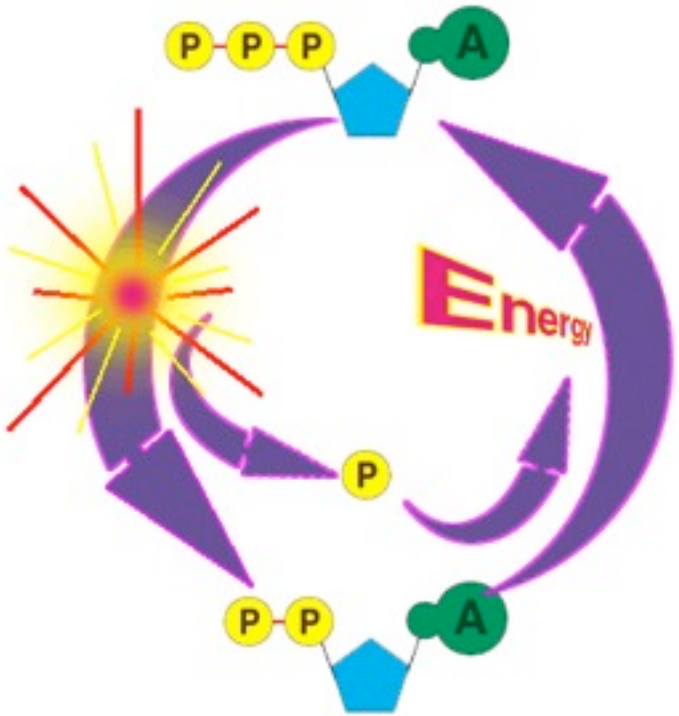




Types and Functions-

1. Nucleotides-
   ex. ATP-
2. Nucleic acids-
   exs. RNA
   DNA



II. Relationship Between Structure and Function

Three Examples

A. Small, polar molecules are ideal for moving around in living things and being used immediately in chemical reactions.

Why are sugars better for energy transport than fatty acids?

Coronary artery partially obstructed by plaque buildup.

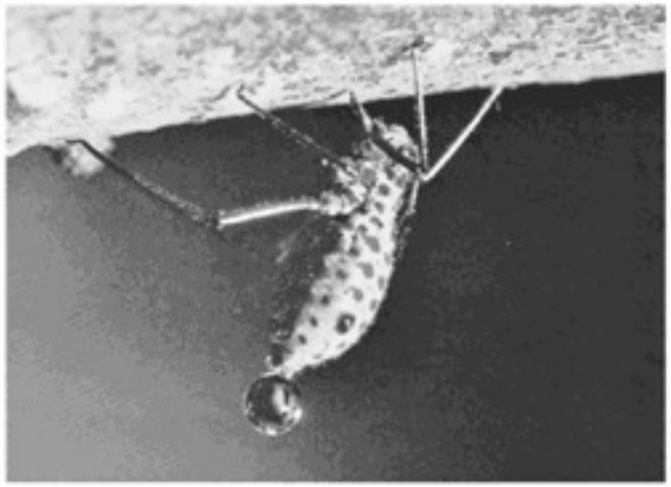
B. DNA is double-stranded for stability and long term storage. RNA is single stranded for immediate access to genetic code.

C. Carbohydrates are best for immediate energy use and short term storage and lipids are better for long term storage.

Why? Let's compare.

Carbohydrates	Lipids
More OH groups-	Few OH groups-
More O, more dense	Less O, less dense-
Fewer C-H bonds-	More C-H bonds-
Soluble in water-	Insoluble in water

(A)



(B)

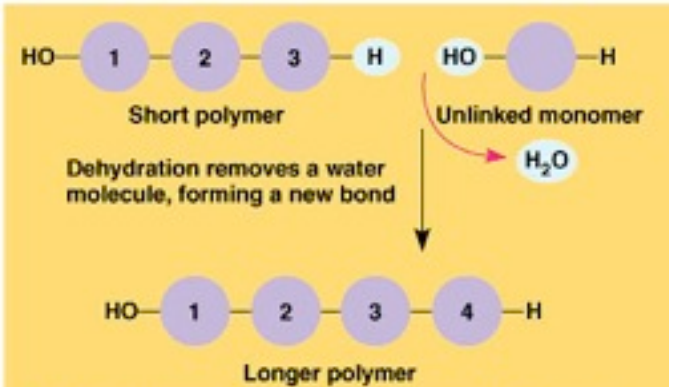
III. Condensation and Hydrolysis Reactions

A. Monomers combine to form polymers by condensation.

B. As polymers get larger they become less soluble in water.

C. Polymers are broken down into monomers by hydrolysis.

D. These reactions are controlled by enzymes.



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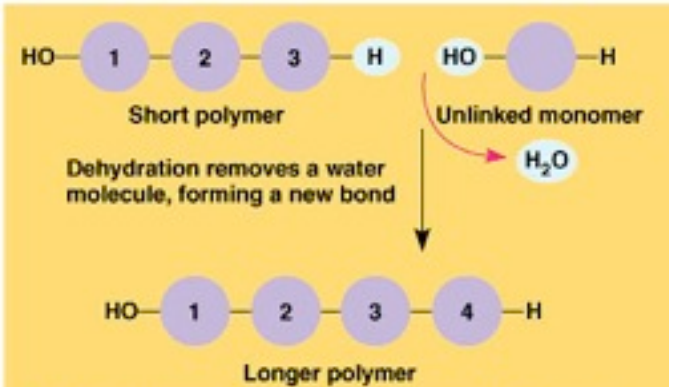

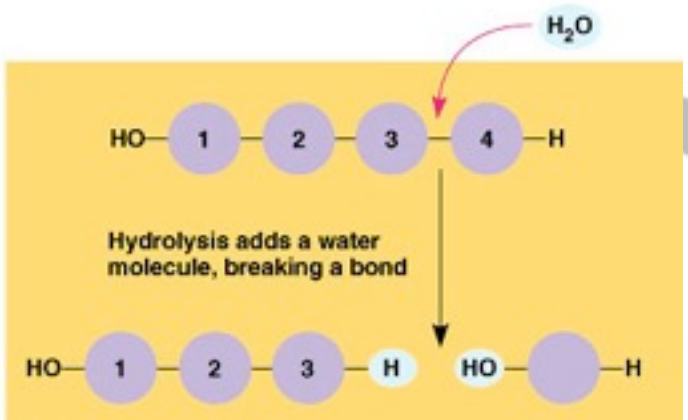

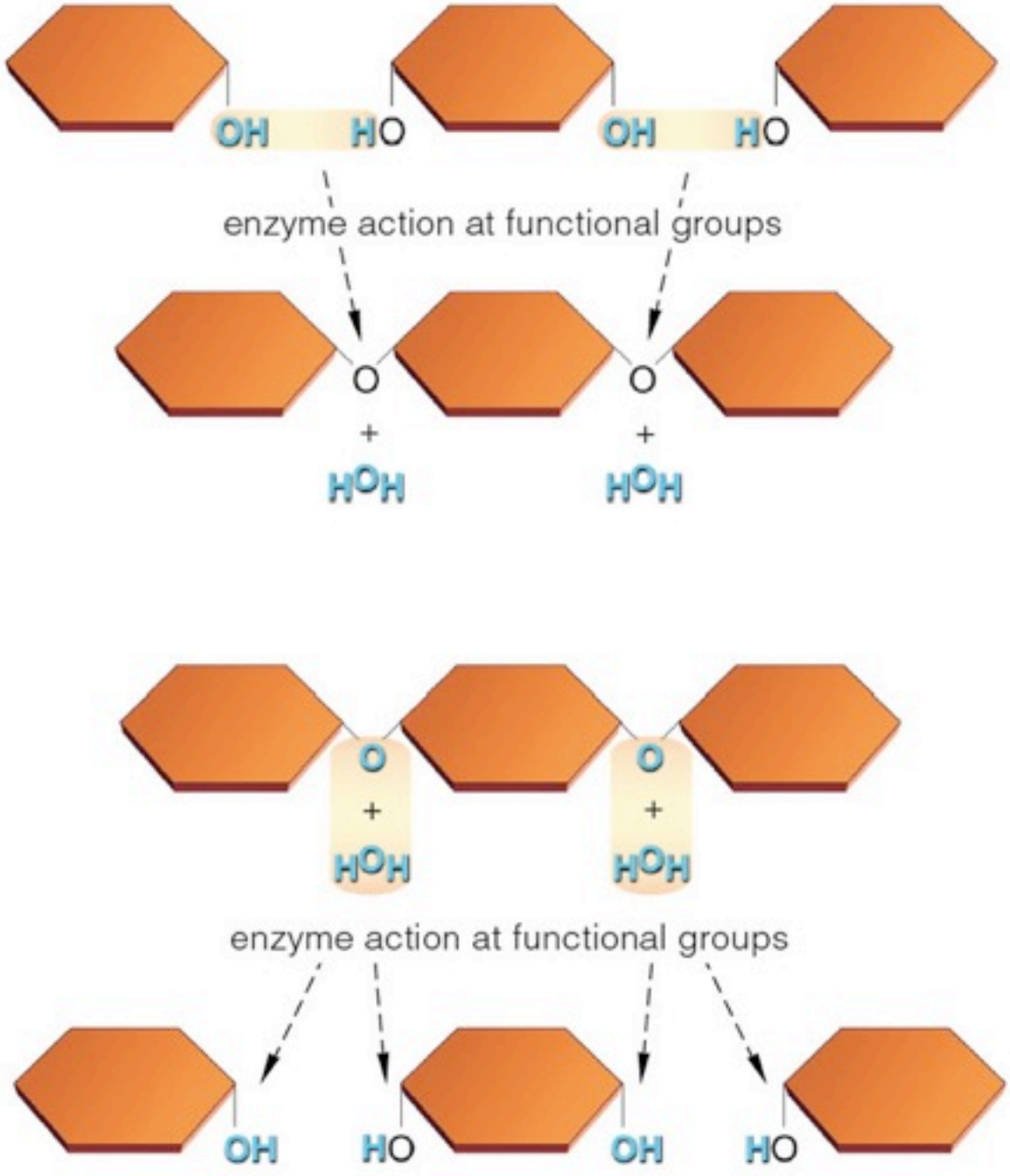

IV. Control of Chemical Reactions BY **ENZYMES**

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A. Characteristics

1. Mostly proteins

a. enzymes are H_2O soluble

b. substrates are H_2O soluble

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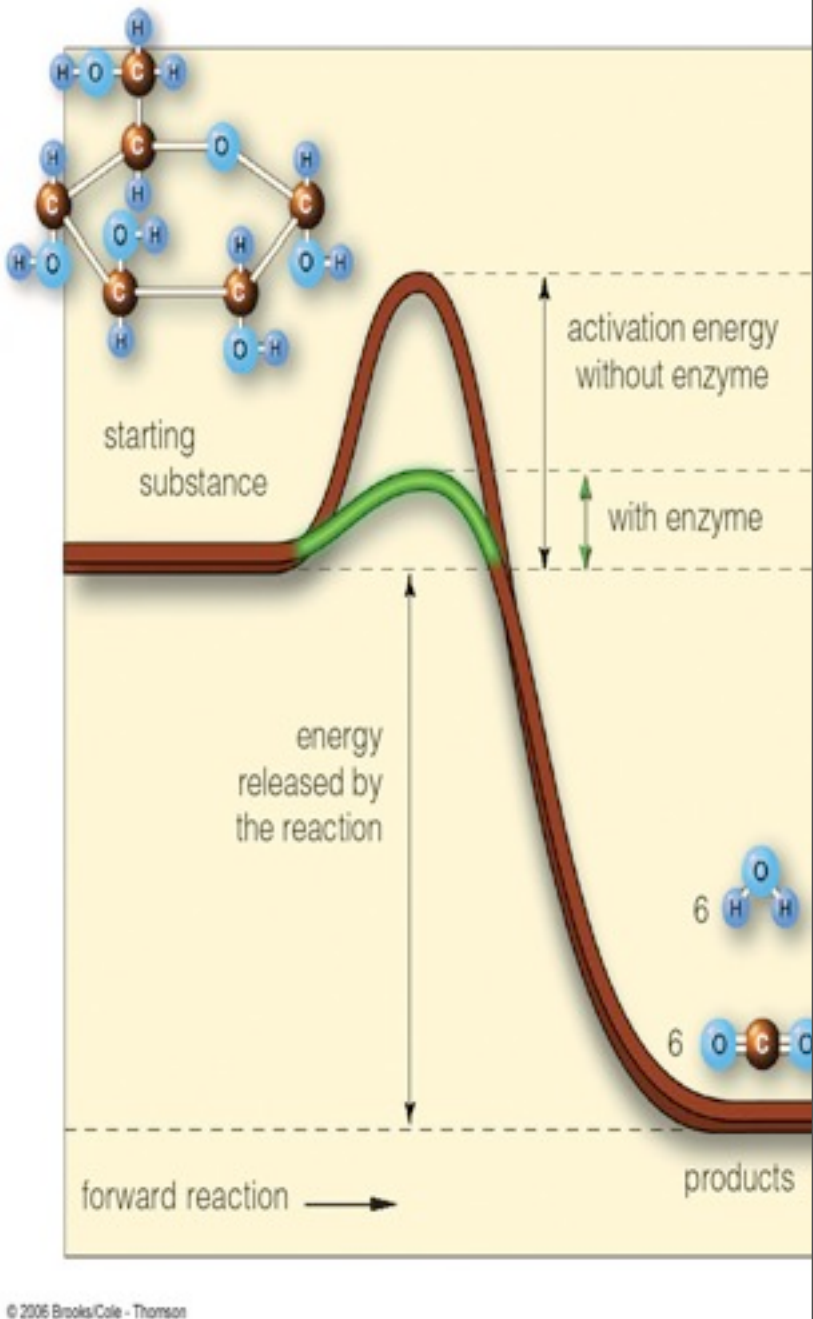

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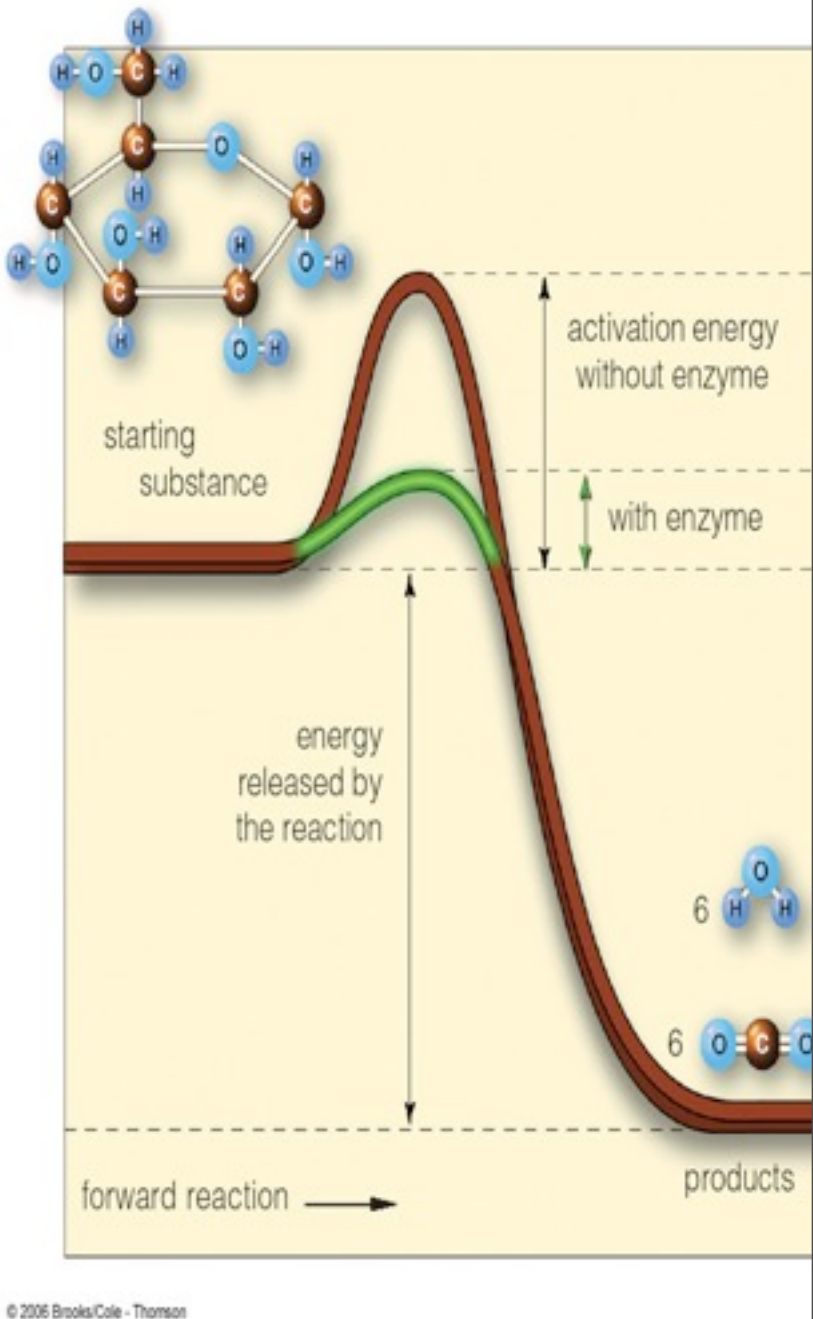
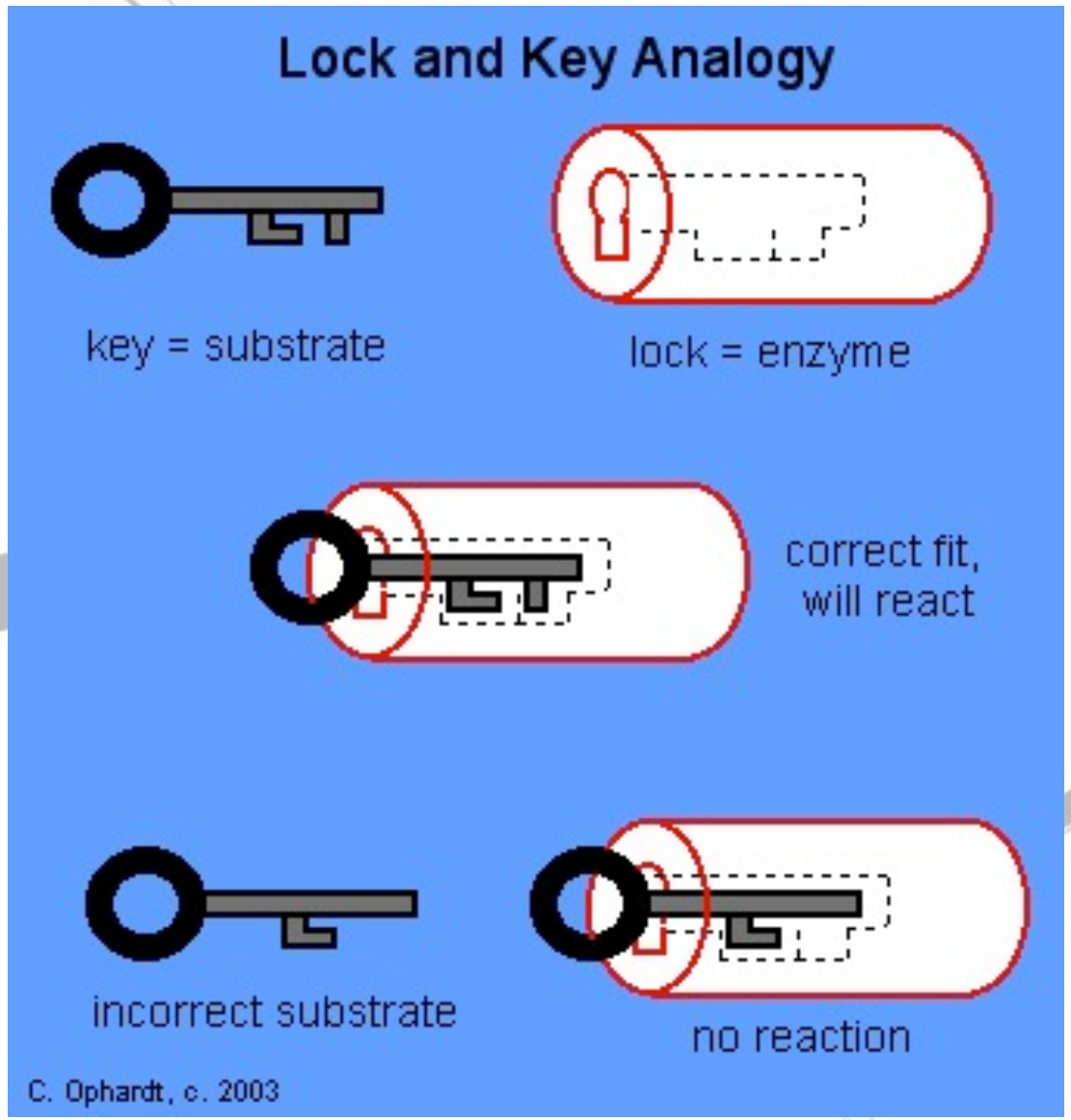
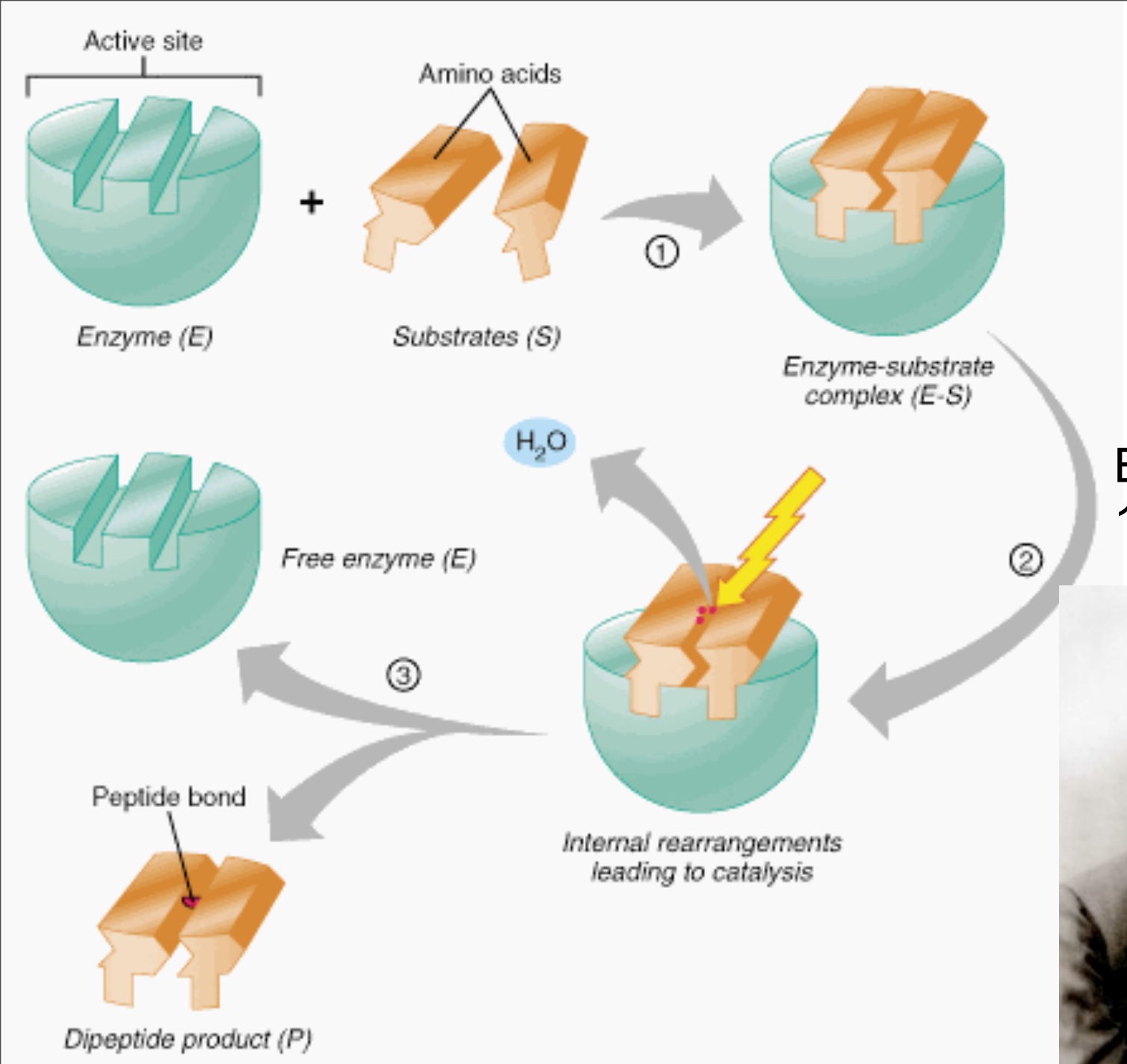
2. Lower <u>Energy of Activation</u>
3. Show Specificity

a. Lock and Key Model
b. Induced Fit Model

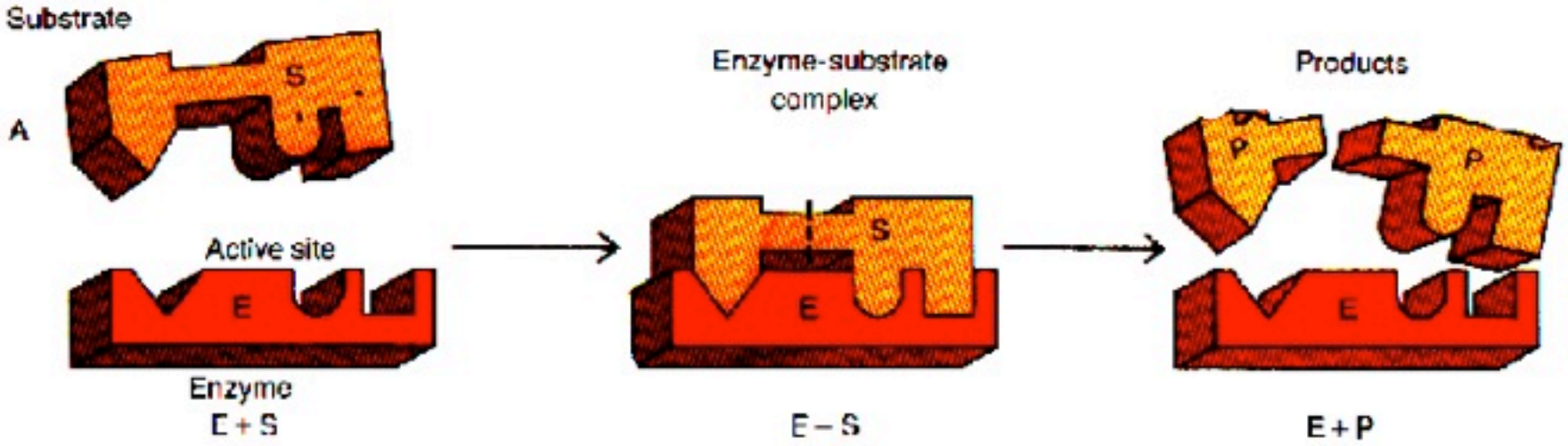



Lock and Key Analogy
key = substrate
lock = enzyme
correct fit,
will react
incorrect substrate
no reaction
C. Ophardt, c. 2003



Emil Fischer
1894

Lock and Key Model



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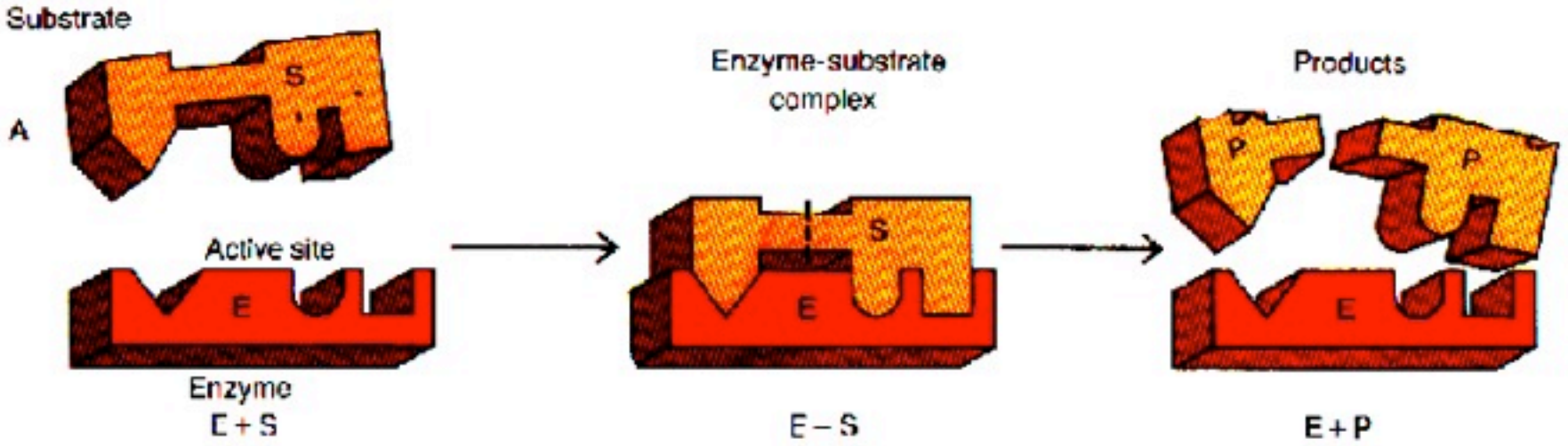
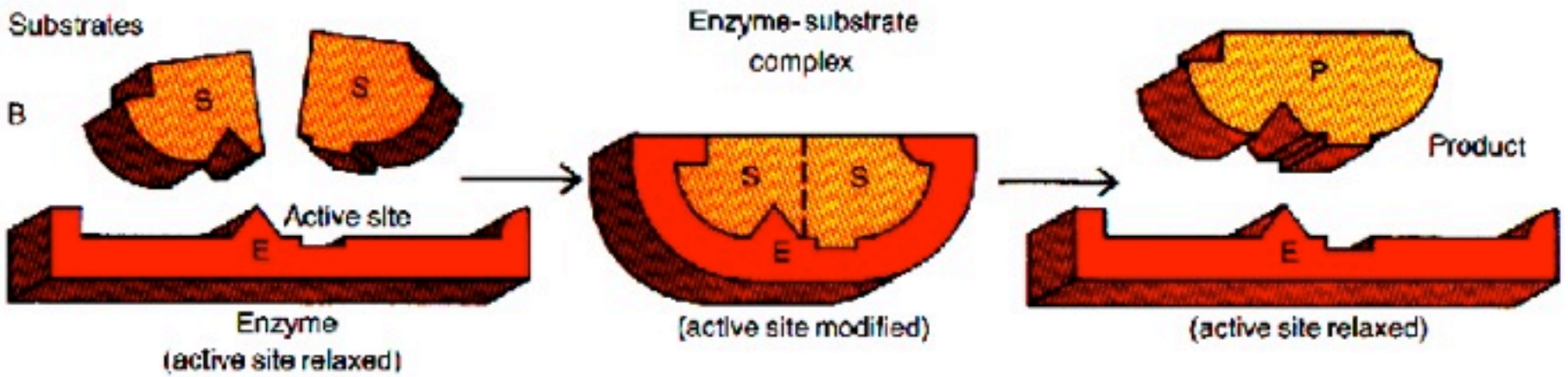
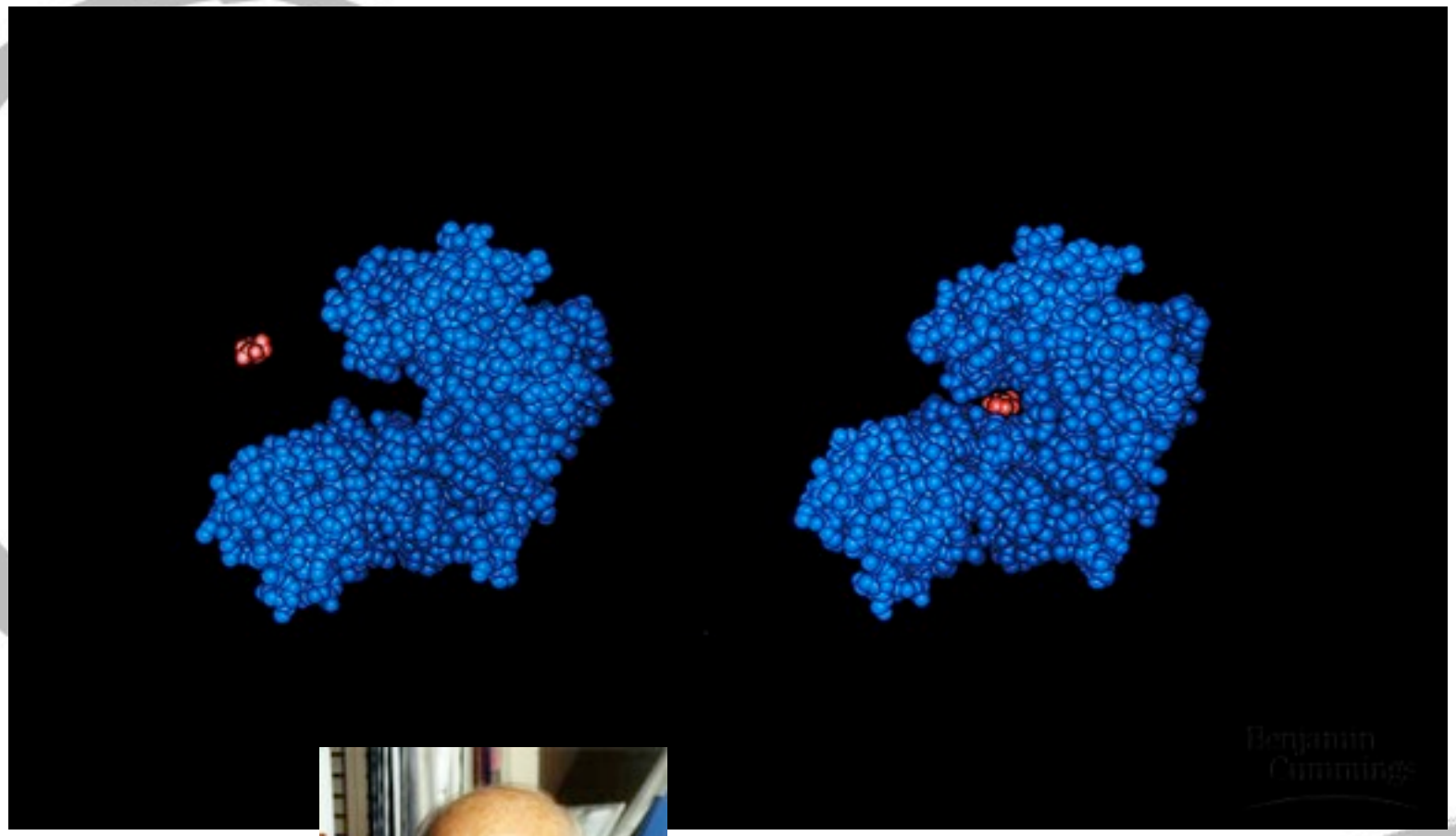
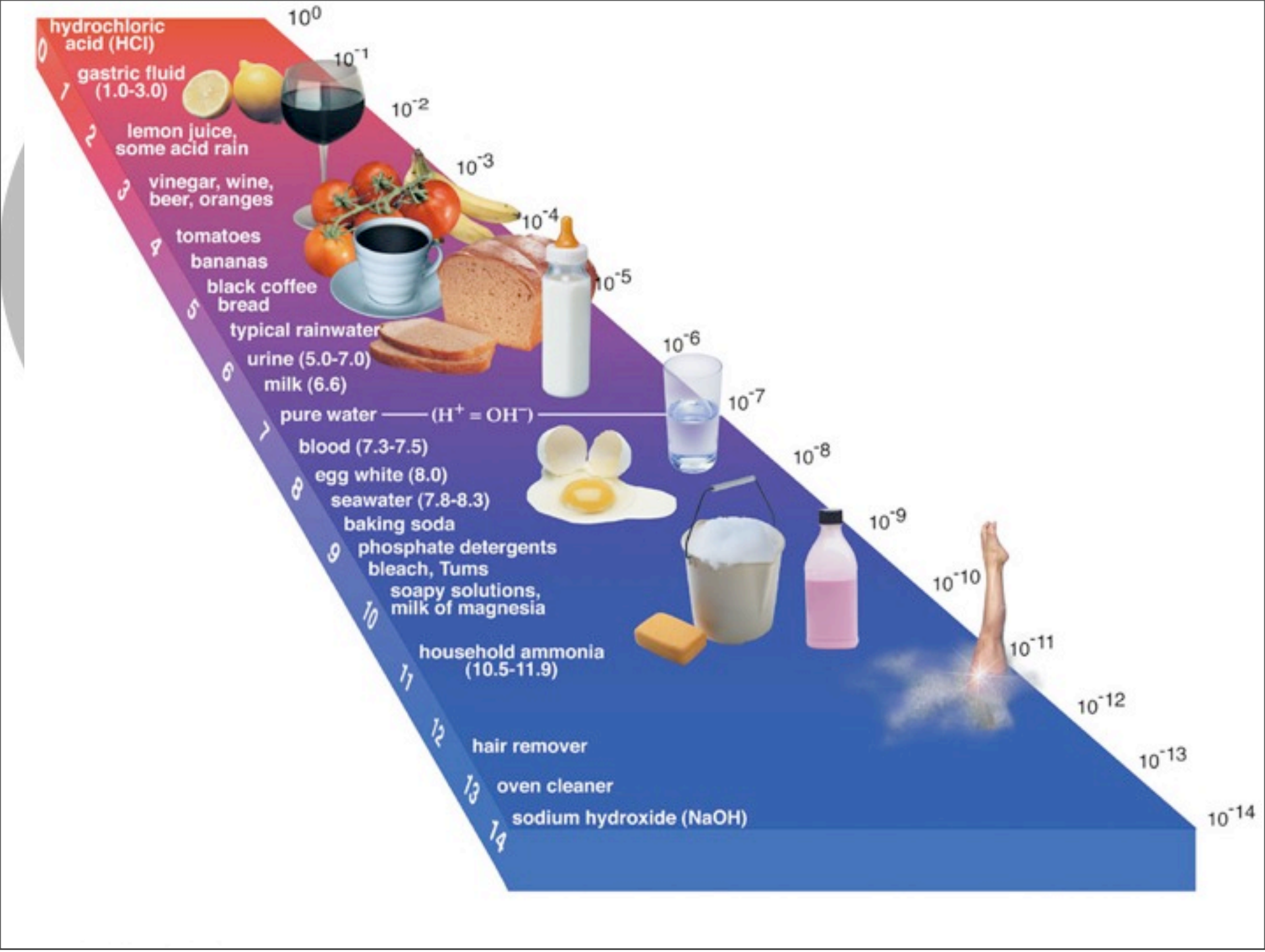


Induced Fit Model





Daniel Koshland
1958


hydrochloric acid (HCl)
0
gastric fluid (1.0-3.0)
1
lemon juice, some acid rain
2
vinegar, wine, beer, oranges
3
tomatoes
4
bananas
black coffee
bread
5
typical rainwater
urine (5.0-7.0)
6
milk (6.6)
pure water
(H+ = OH−)
7
blood (7.3-7.5)
egg white (8.0)
8
seawater (7.8-8.3)
baking soda
phosphate detergents
9
bleach, Tums
soapy solutions, milk of magnesia
10
household ammonia (10.5-11.9)
11
hair remover
12
oven cleaner
13
sodium hydroxide (NaOH)
14
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
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10^-11
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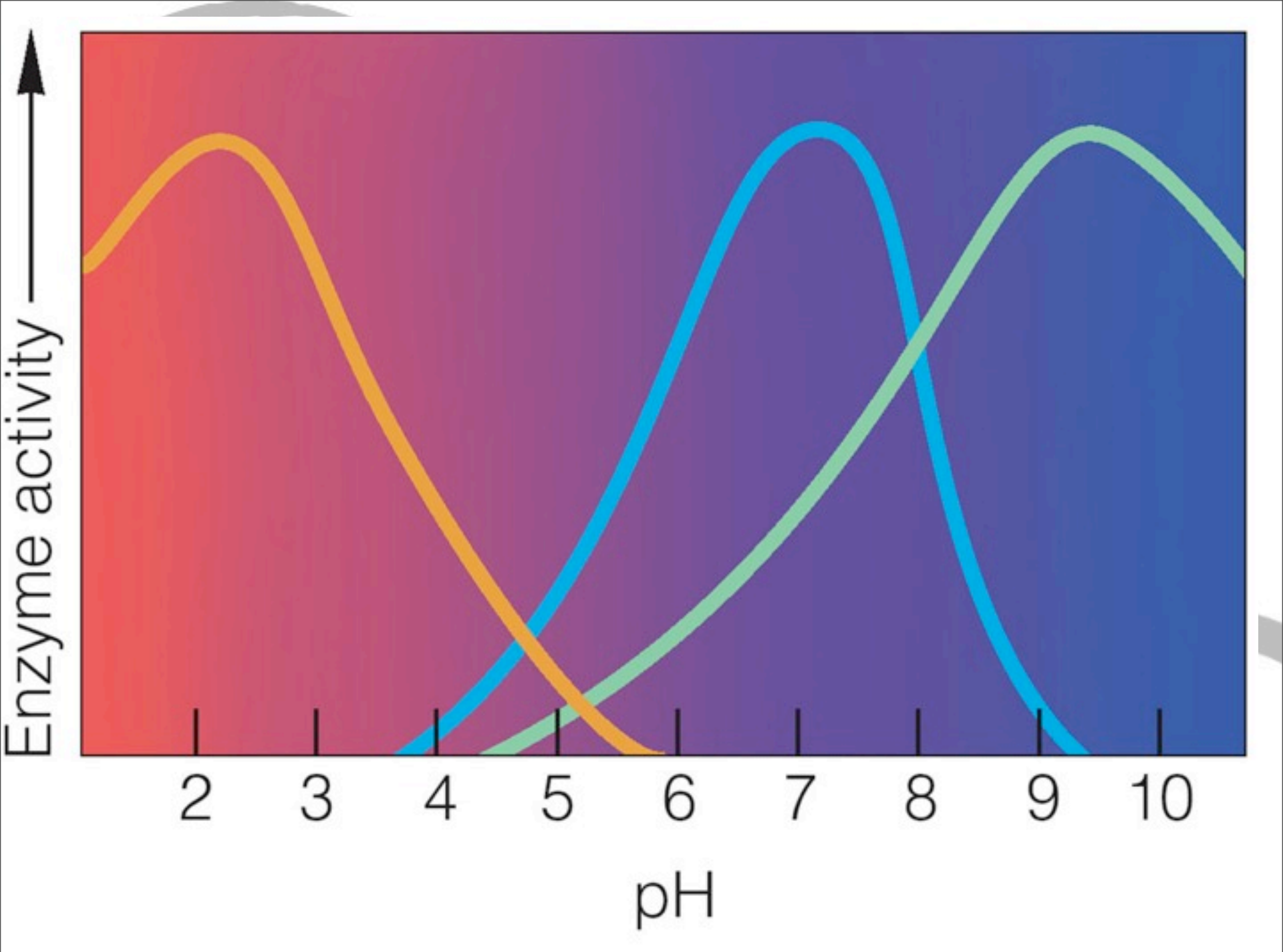
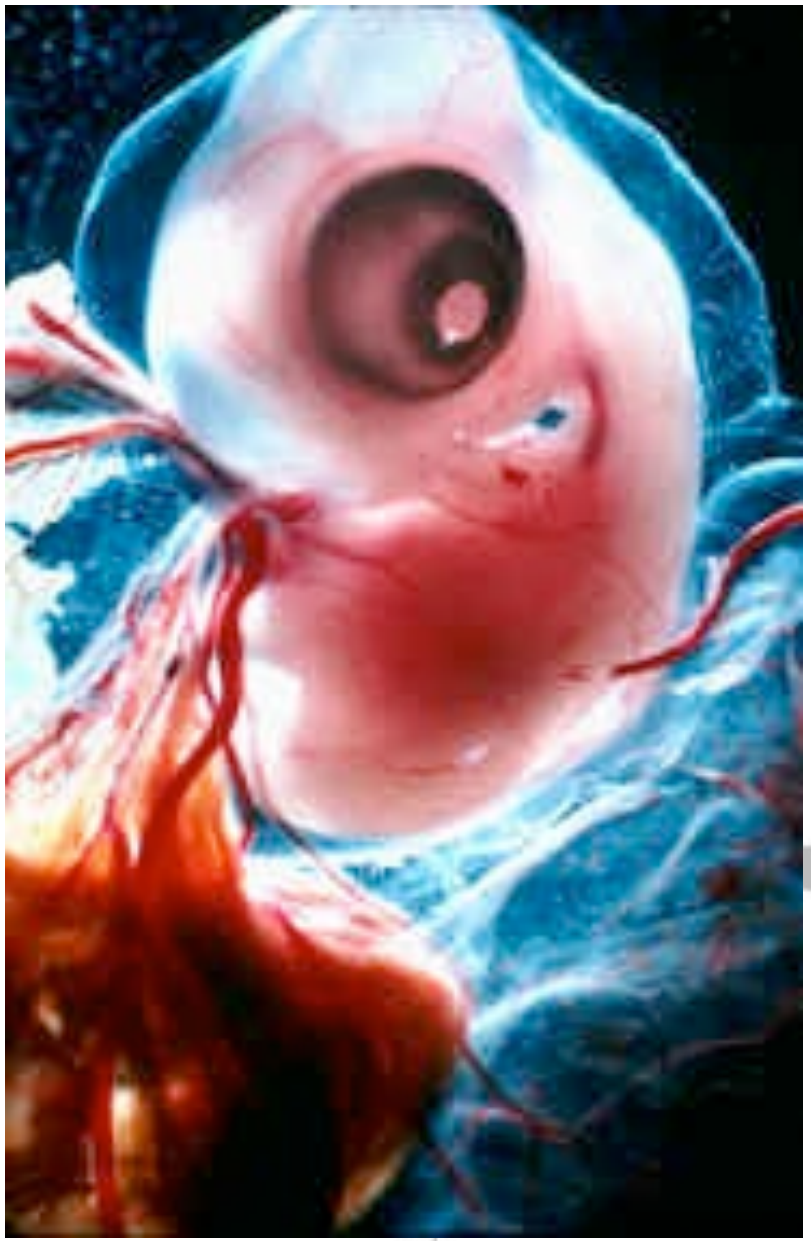
10^-13
10^-14


Enzyme activity
2
3
4
5
6
7
8
9
10
pH

V. Buffers- are substances that minimize changes in the concentrations of H^+ and OH^- in a solution.

Carbonic Acid (H_2CO_3) is a famous buffer in blood.
If the blood starts to become too basic
it breaks down and adds H^+ to the solution.



7 day old chicken embryo

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5. Only Needed in Small Amounts

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6. Activity Affected By
   Temperature, Substrate
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