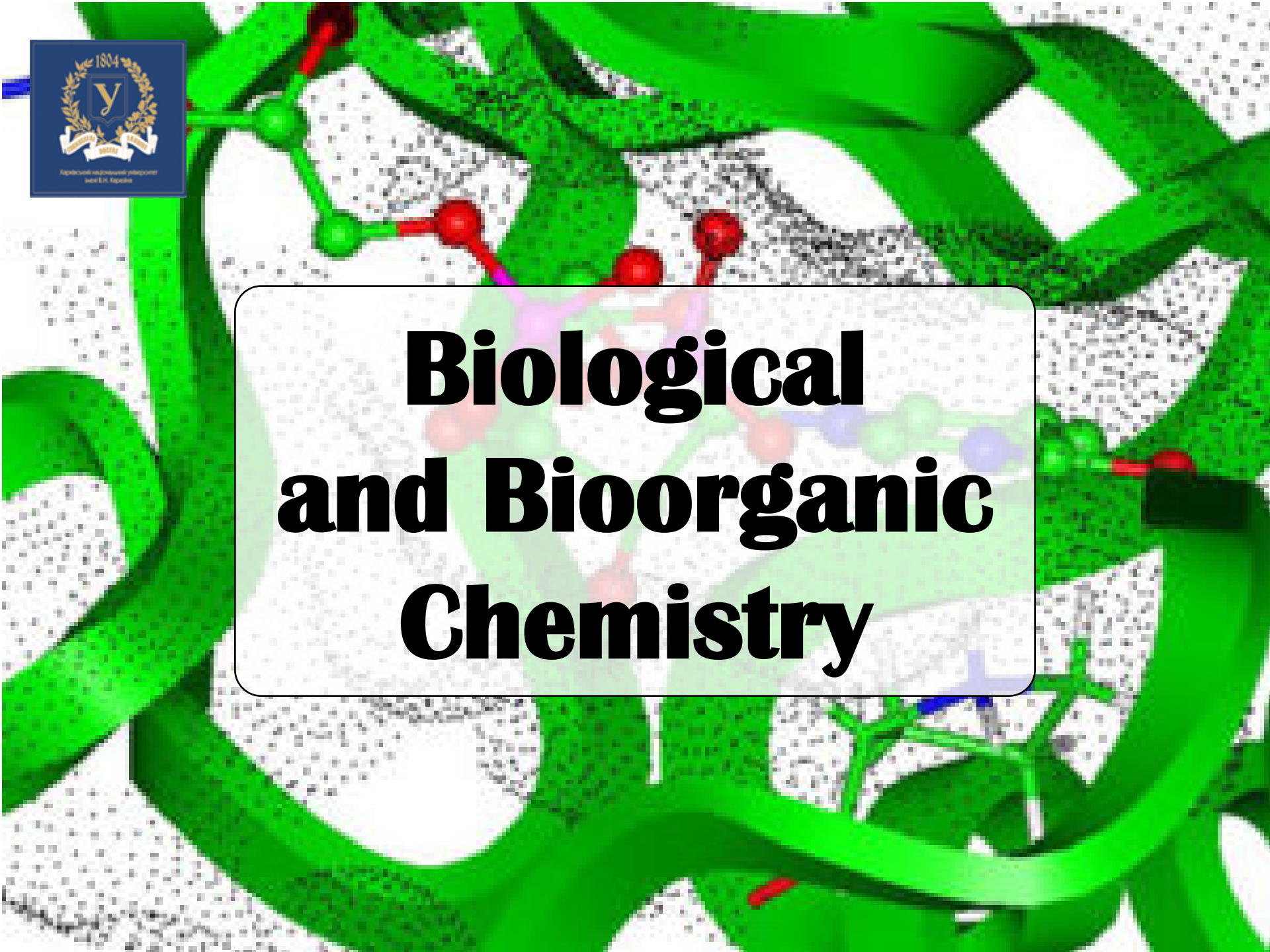
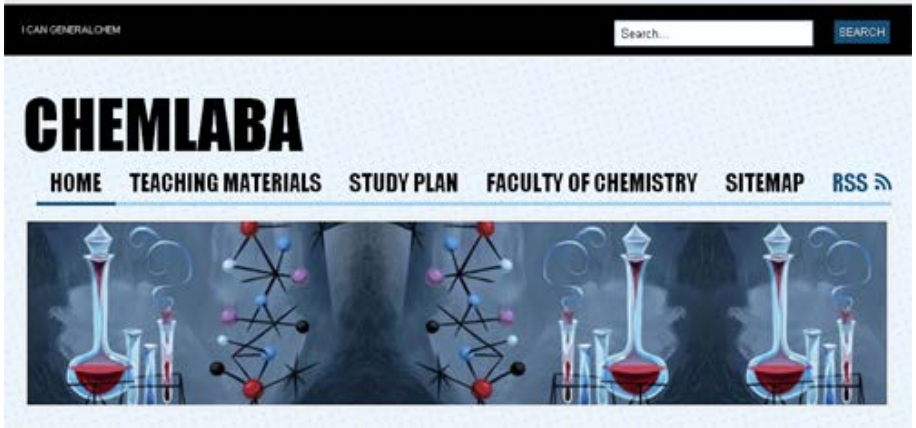
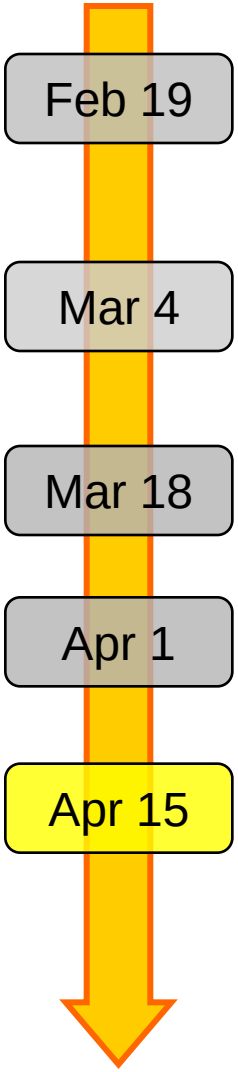

Biological
and Bioorganic
Chemistry

Some useful material

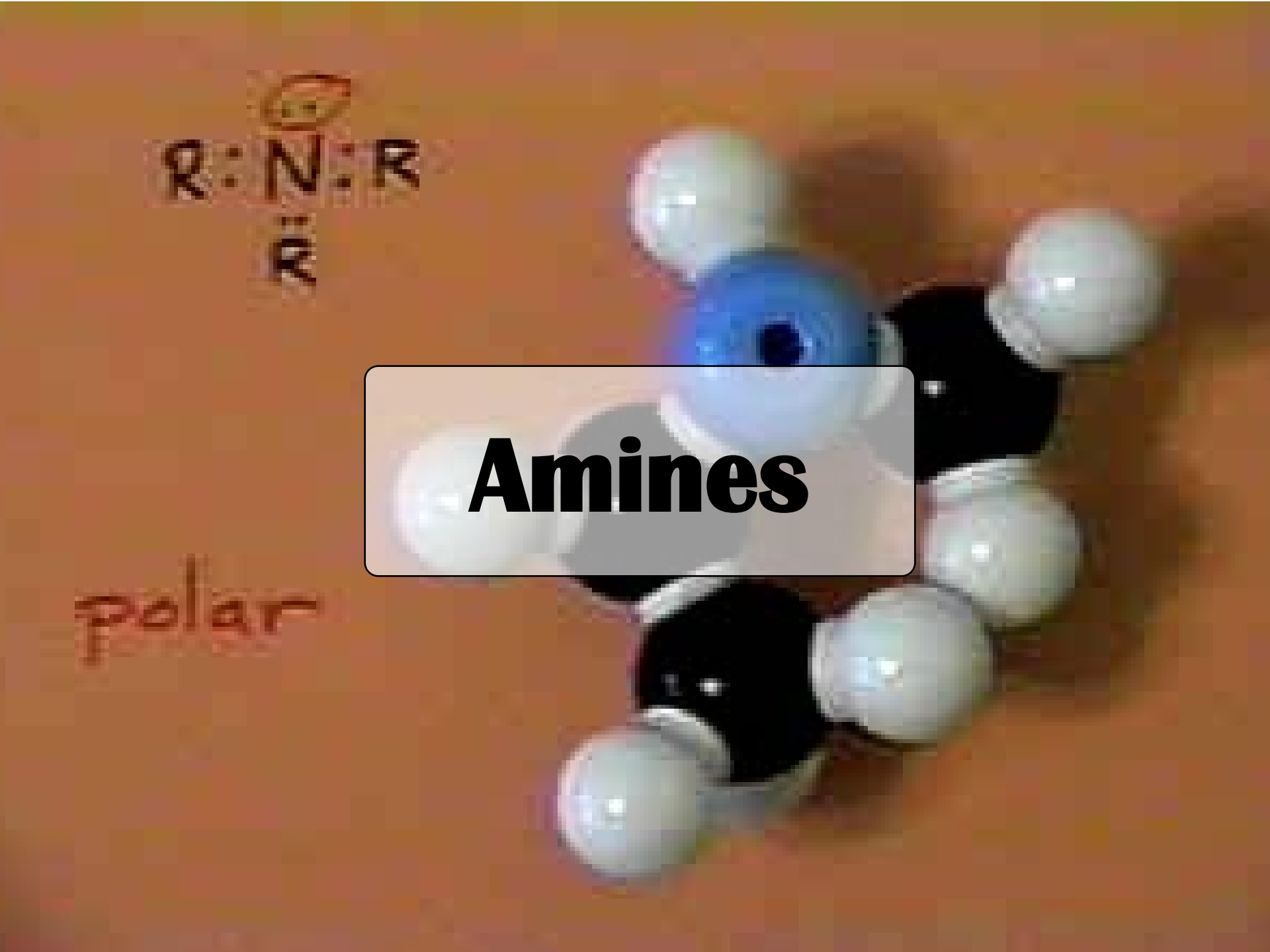


will be announced ...

What shall we do?

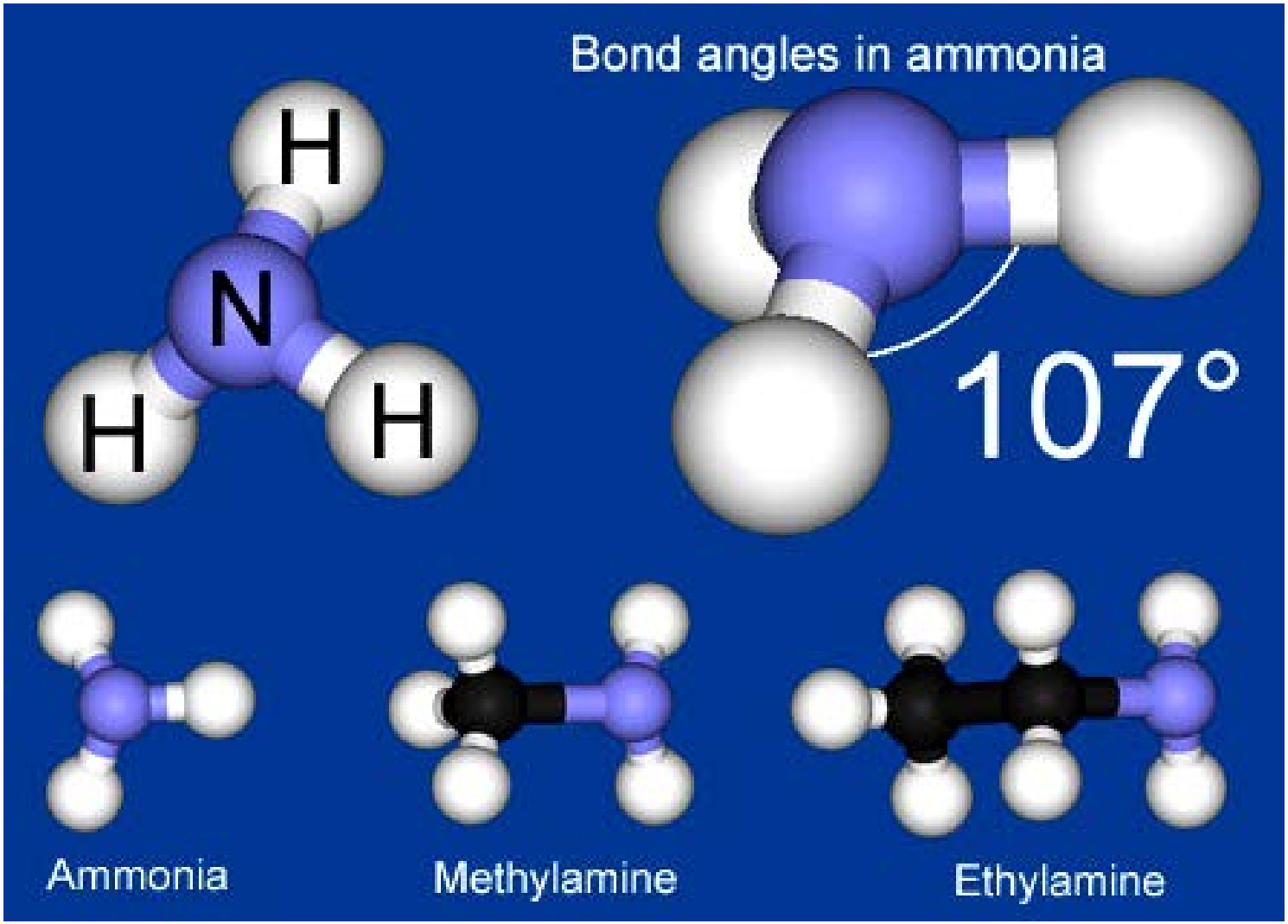


Feb 19	Introduction to organic and biological chemistry. Classes and nomenclature of organic compounds. Saturated and unsaturated hydrocarbons. S_R and Ad_E reactions.
Mar 4	Aromatic hydrocarbons. Orientation in the aromatic ring. Halogen derivatives of hydrocarbons. S_N reacions. Alcohols, ethers. Polyhydric alcohols.
Mar 18	Carbonyl compounds – aldehydes and ketones. Carbohydrates.
Apr 1	Carboxylic acids and their derivatives: amides, nitriles, anhydrides. Esters, fats, lipids.
Apr 15	Amines, aminoacids, peptides. Heterocyclic compounds and their biological activity.

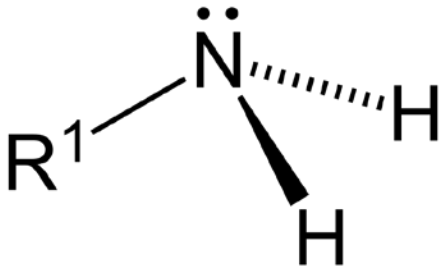


Amines

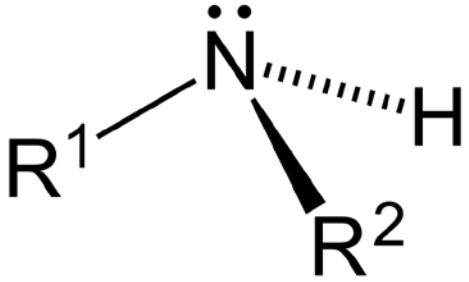
The amino group



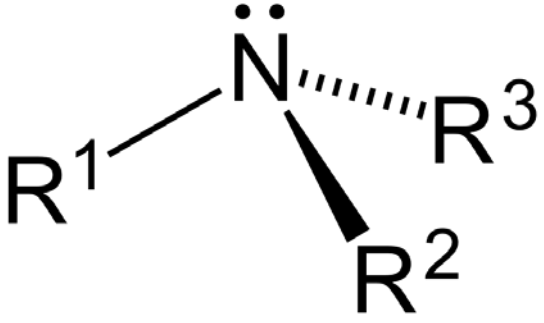
Amines classification



Primary amine



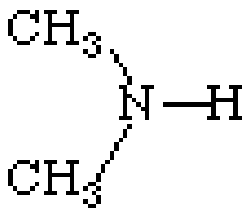
Secondary amine



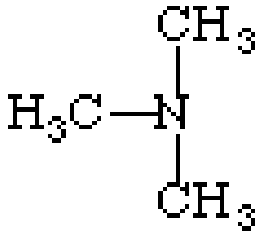
Tertiary amine

Amines are organic compounds and functional groups that contain a basic nitrogen atom with a lone electronic pair.

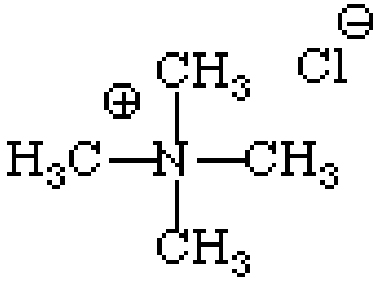
Amines classification



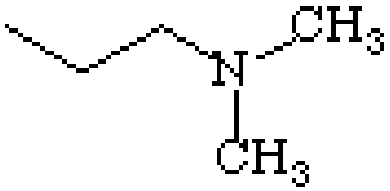
Secondary Amine



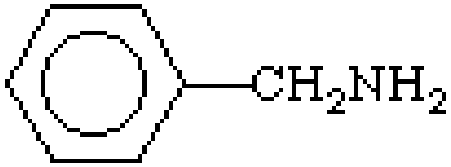
Tertiary Amine



Quaternary Ammonium Chloride

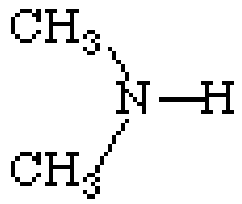


Secondary Amine

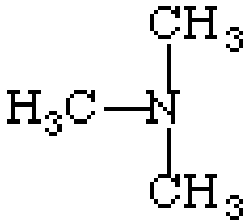


Primary Amine

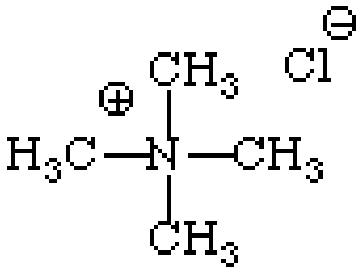
Naming aliphatic amines



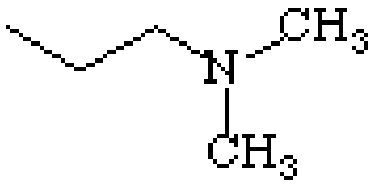
Dimethylamine



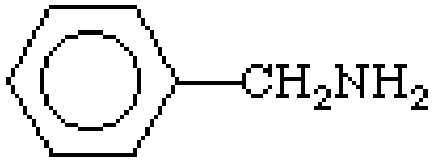
Trimethylamine



Tetramethylammonium Chloride

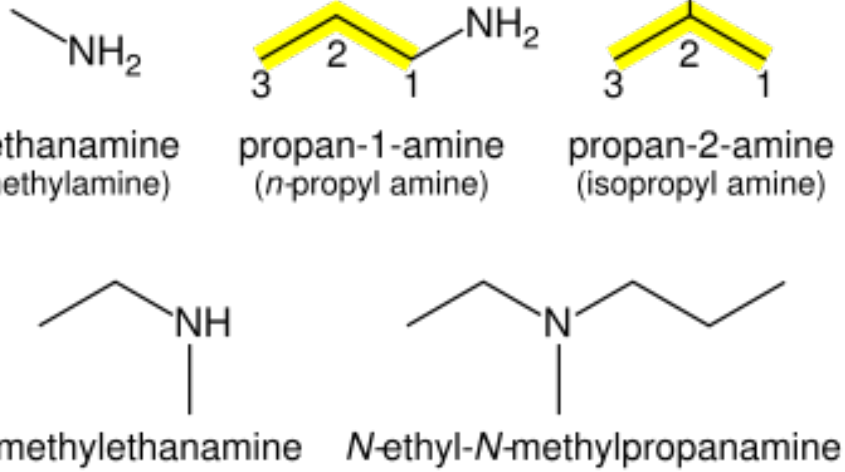


N,N-dimethylpropylamine



Benzyl amine (phenylmethyanamine)

Naming aliphatic amines



Primary

$R - NH_2$

Secondary

R
|
R - NH

Tertiary

R
|
R - N - R

Naming amines...

1° propylamine

$CH_3 - CH_2 - CH_2 - NH_2$

2° N - ethyl butylamine

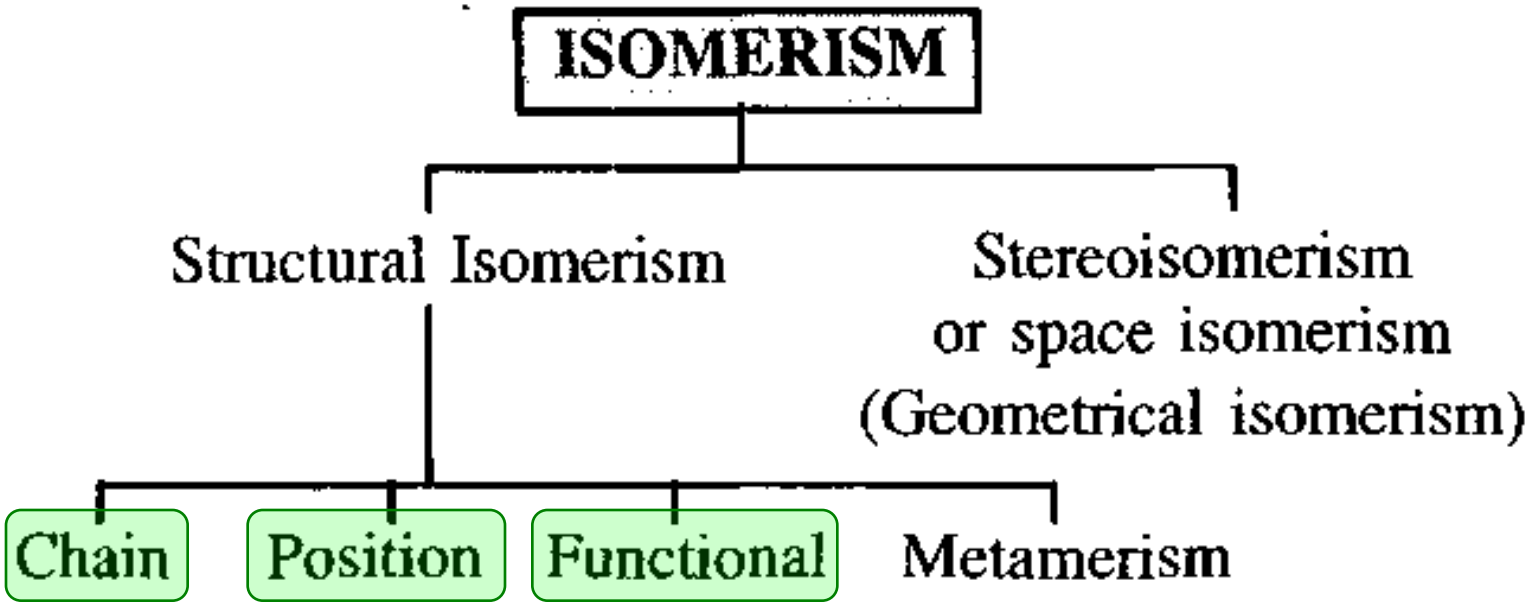
$CH_3 - CH_2 - NH$
|
$CH_2 - CH_2 - CH_2 - CH_3$

3° N - ethyl - N - methyl propylamine

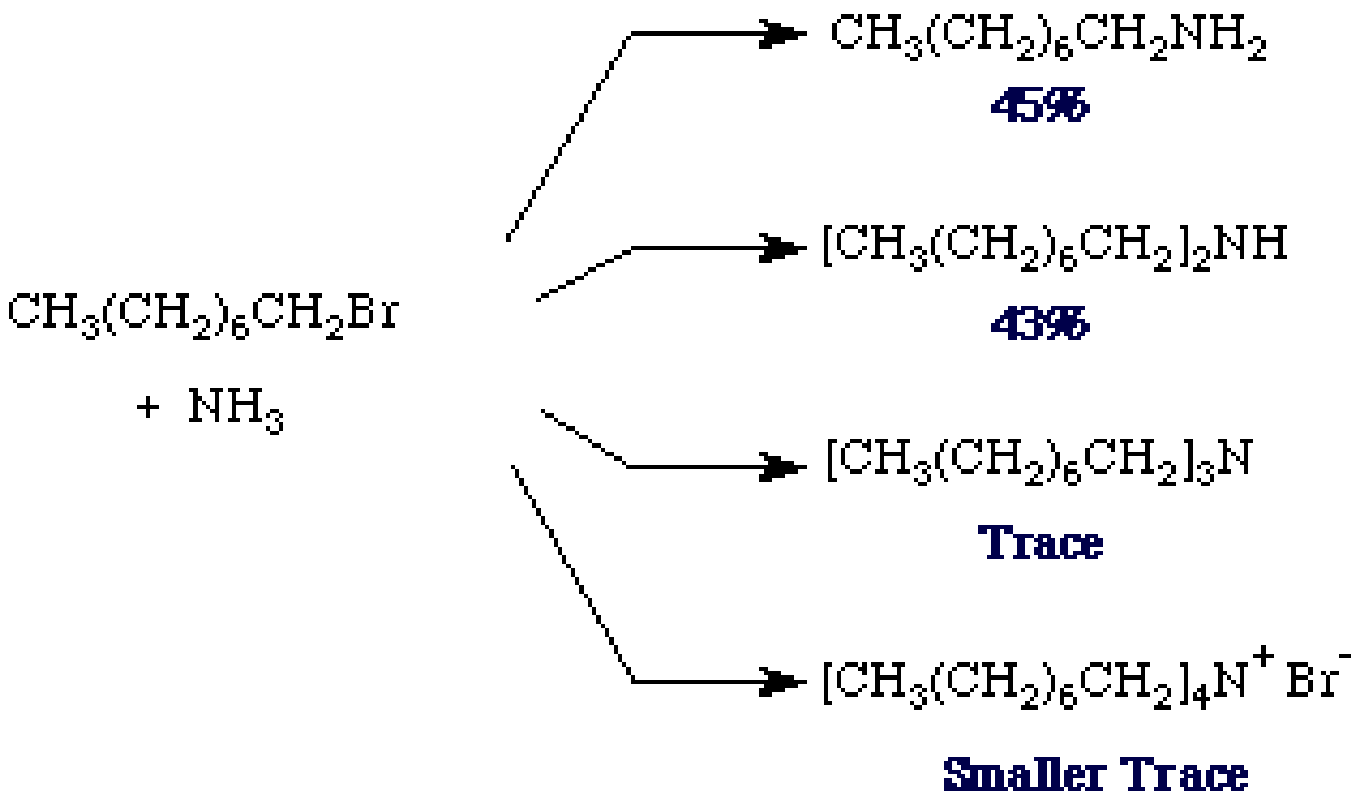
$CH_3 - CH_2 - N - CH_3$
|
$CH_2 - CH_2 - CH_3$

IUPAC nomenclature

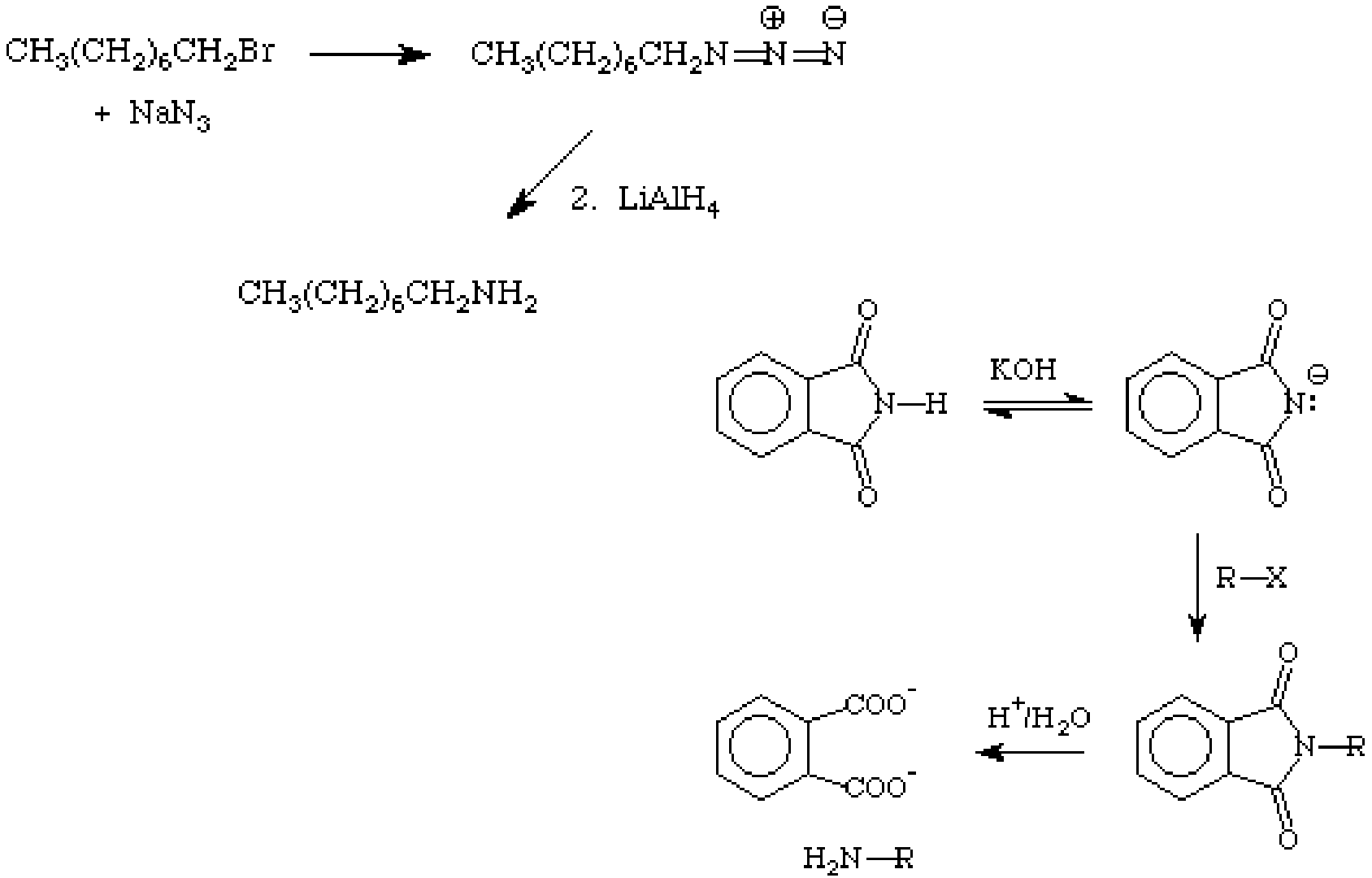
Isomerism of amines



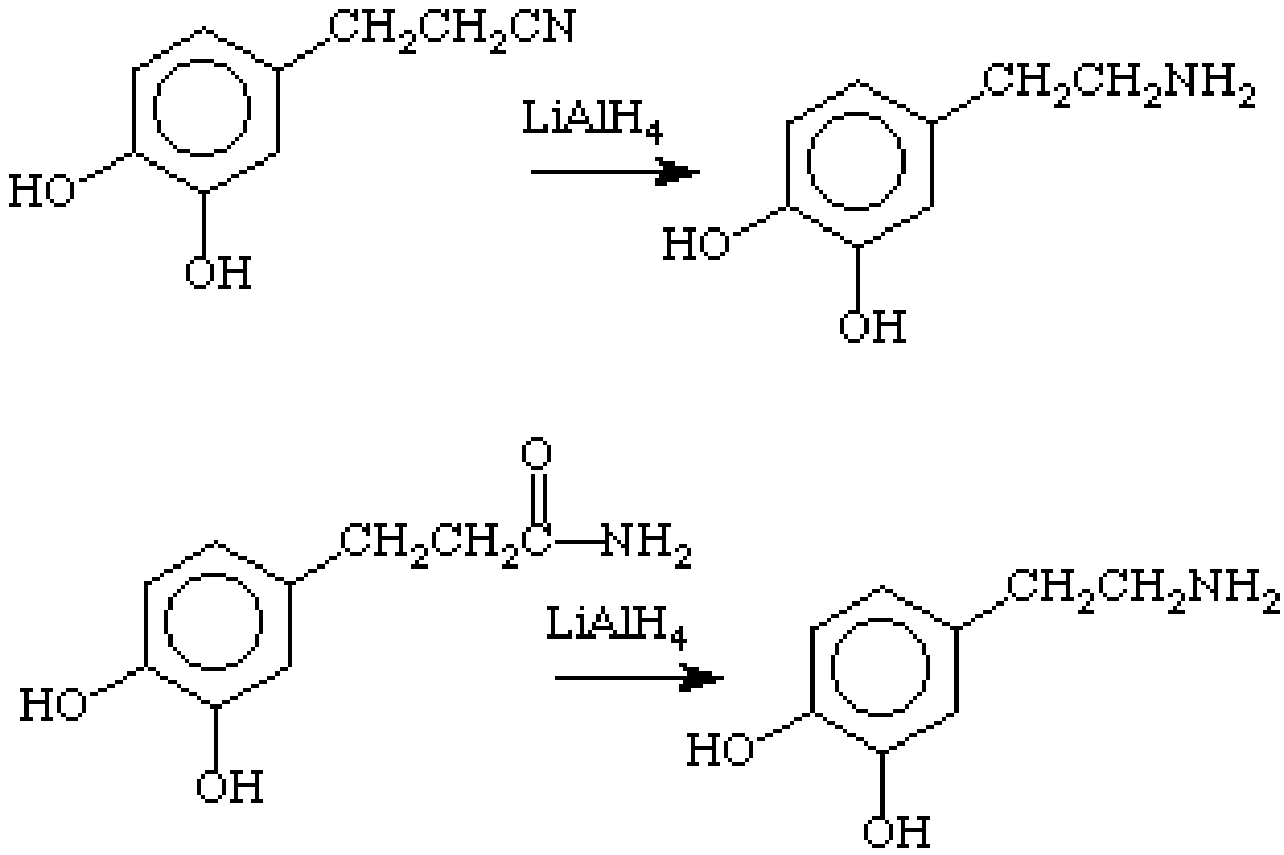
Synthesis of amines



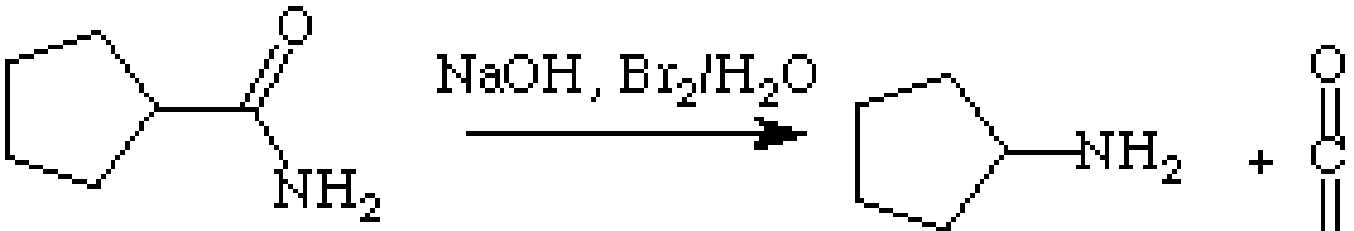
Synthesis of amines



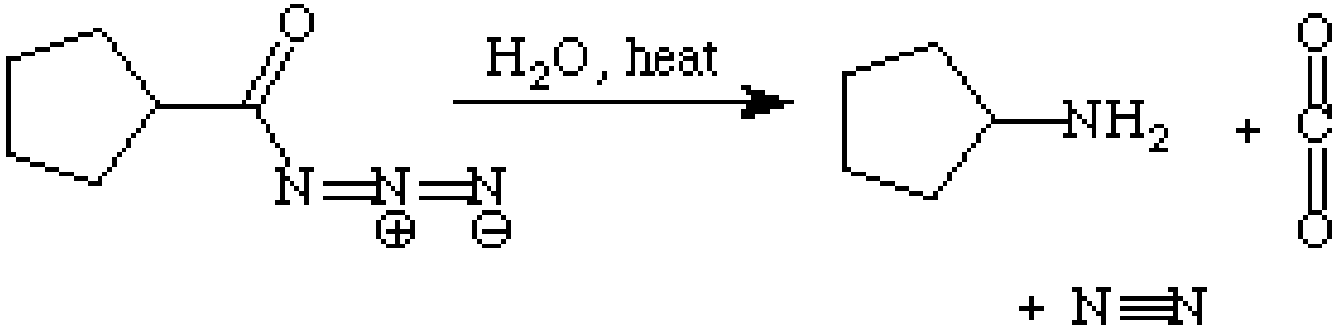
Synthesis of amines



Synthesis of amines

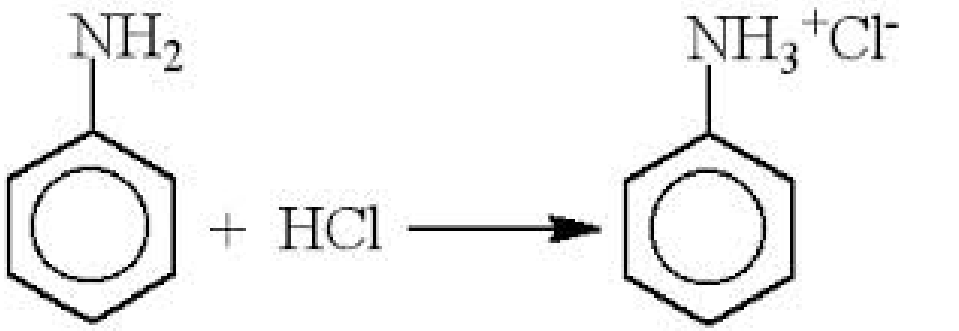


The Hofmann rearrangement...



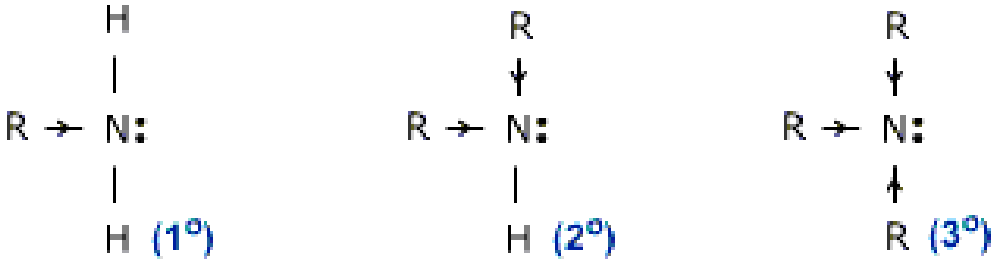
The Curtius rearrangement...

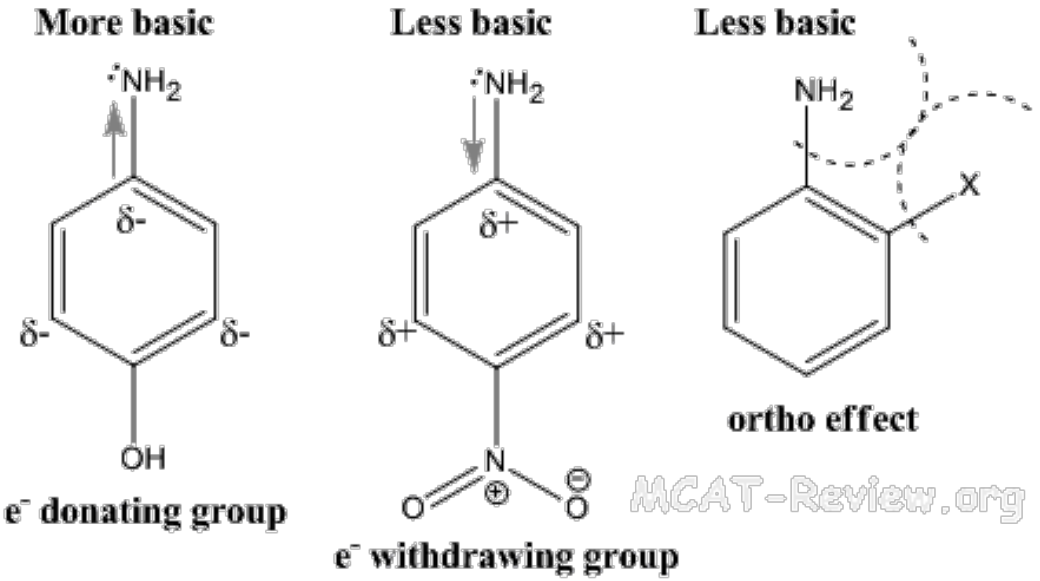
Basicity of amines



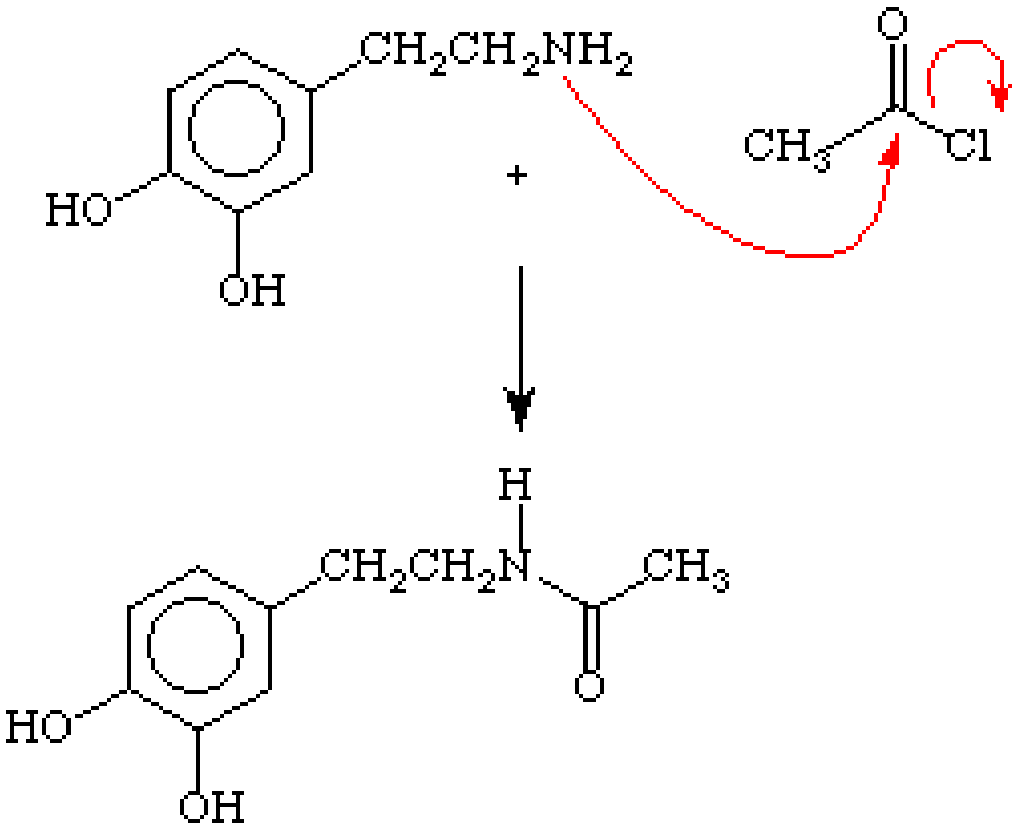
phenylammonium chloride

Basicity of amines

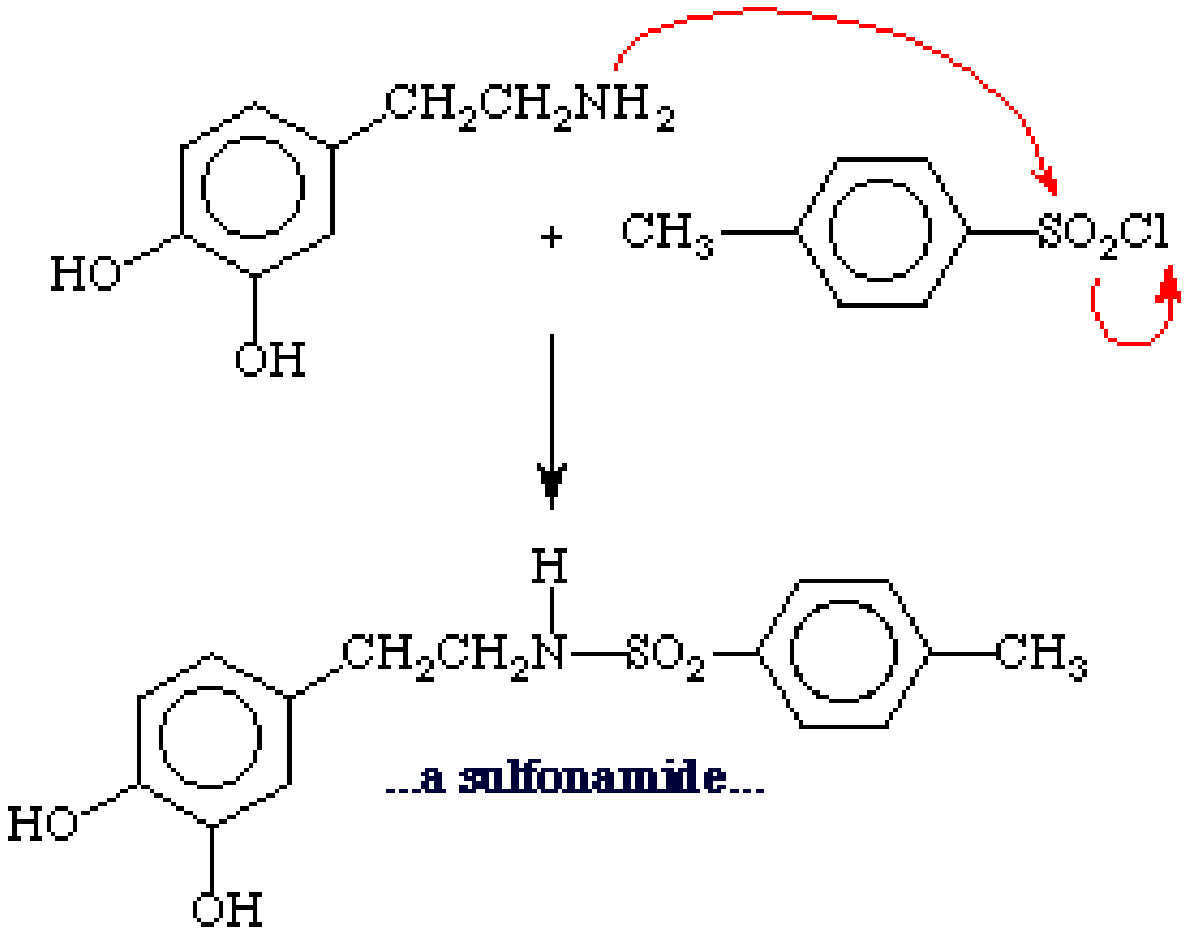




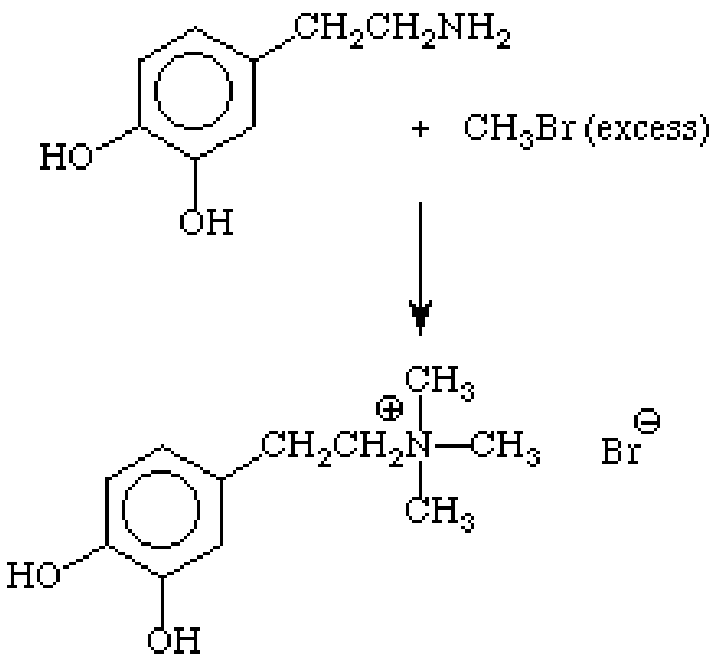
Reactions of amines

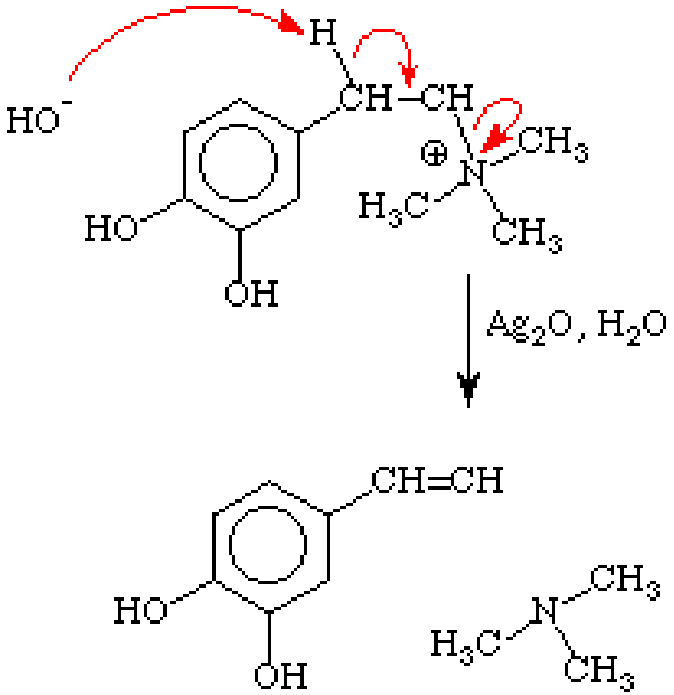


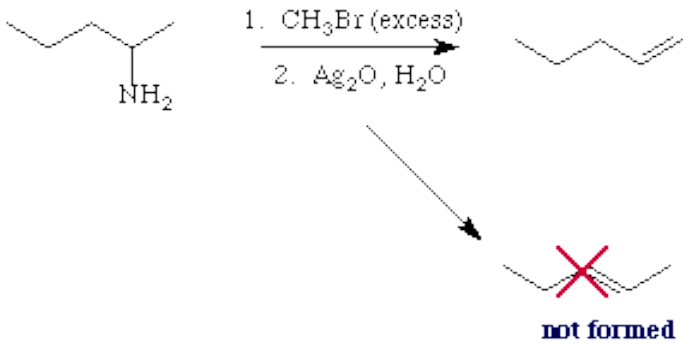
Reactions of amines



Reactions of amines



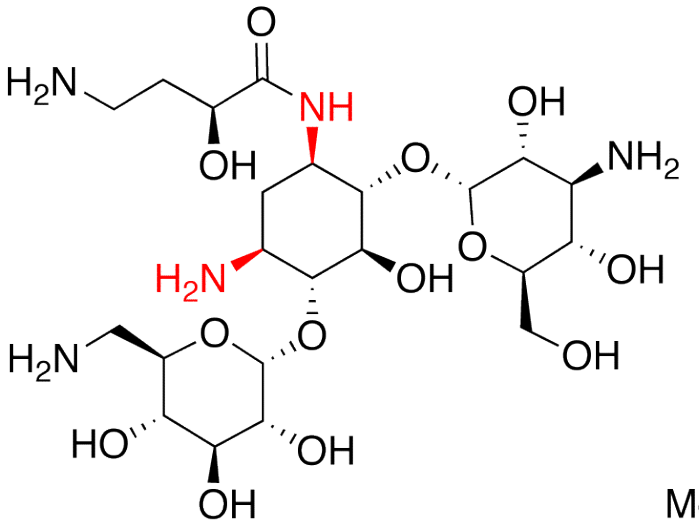




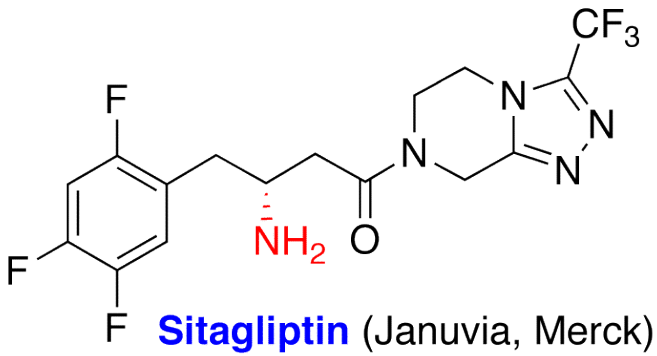
Hofmann elimination

Biologically active amines

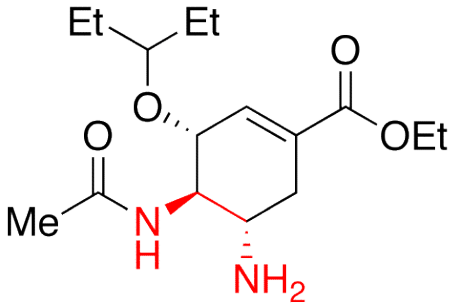
Examples of Pharmaceuticals Containing α-Chiral Amines



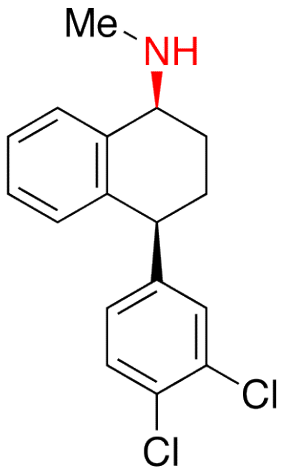
Amikacin (Amikin, BMS)
antibiotic



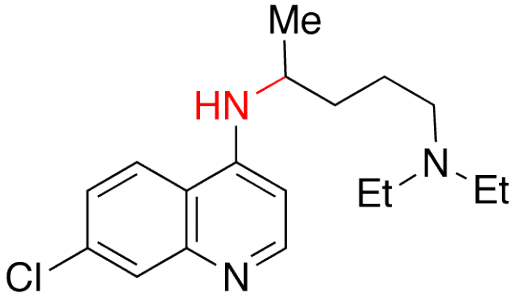
Sitagliptin (Januvia, Merck)
type 2 diabetes



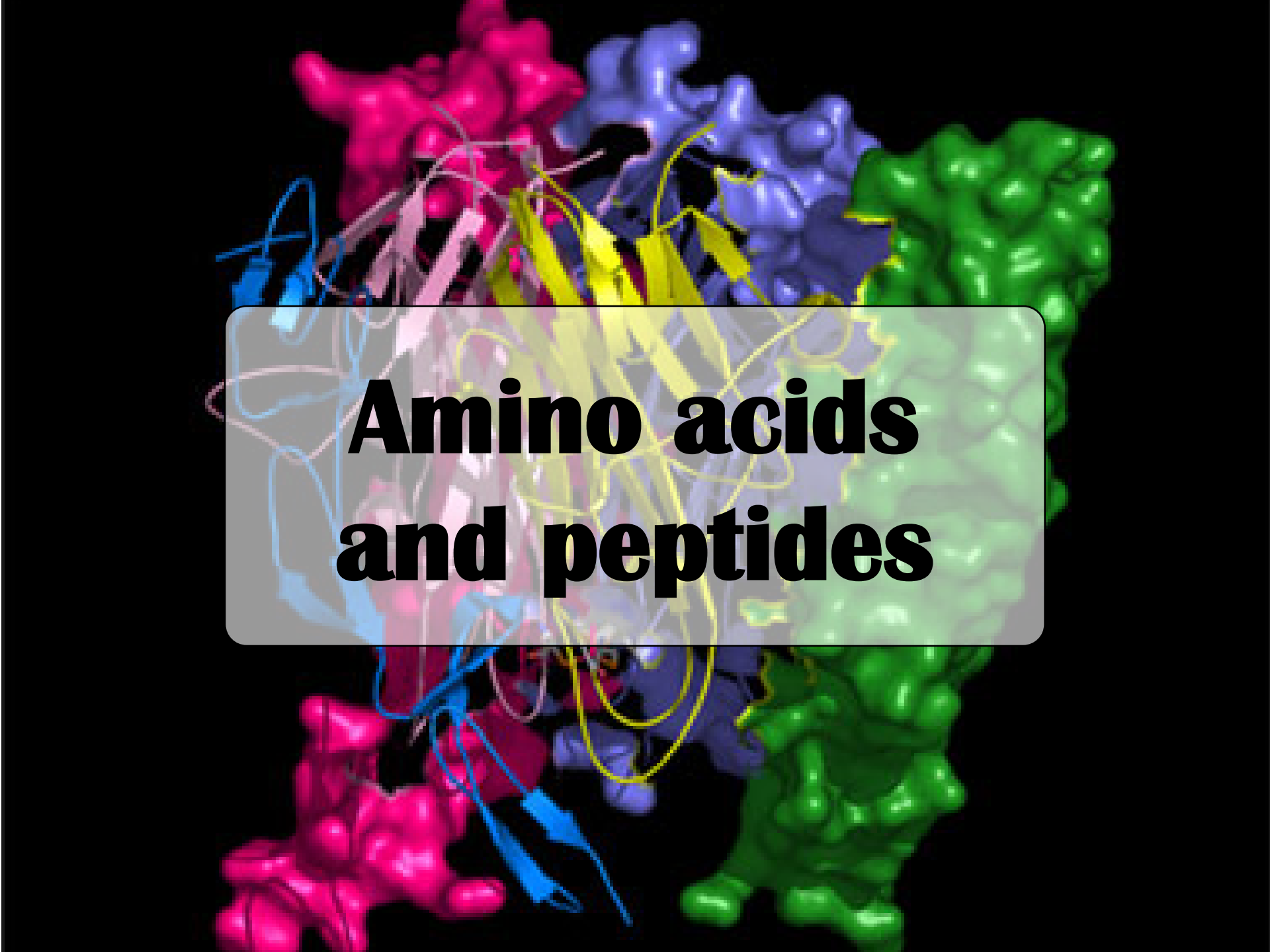
Oseltamivir (Tamiflu, Gilead)
anti-viral



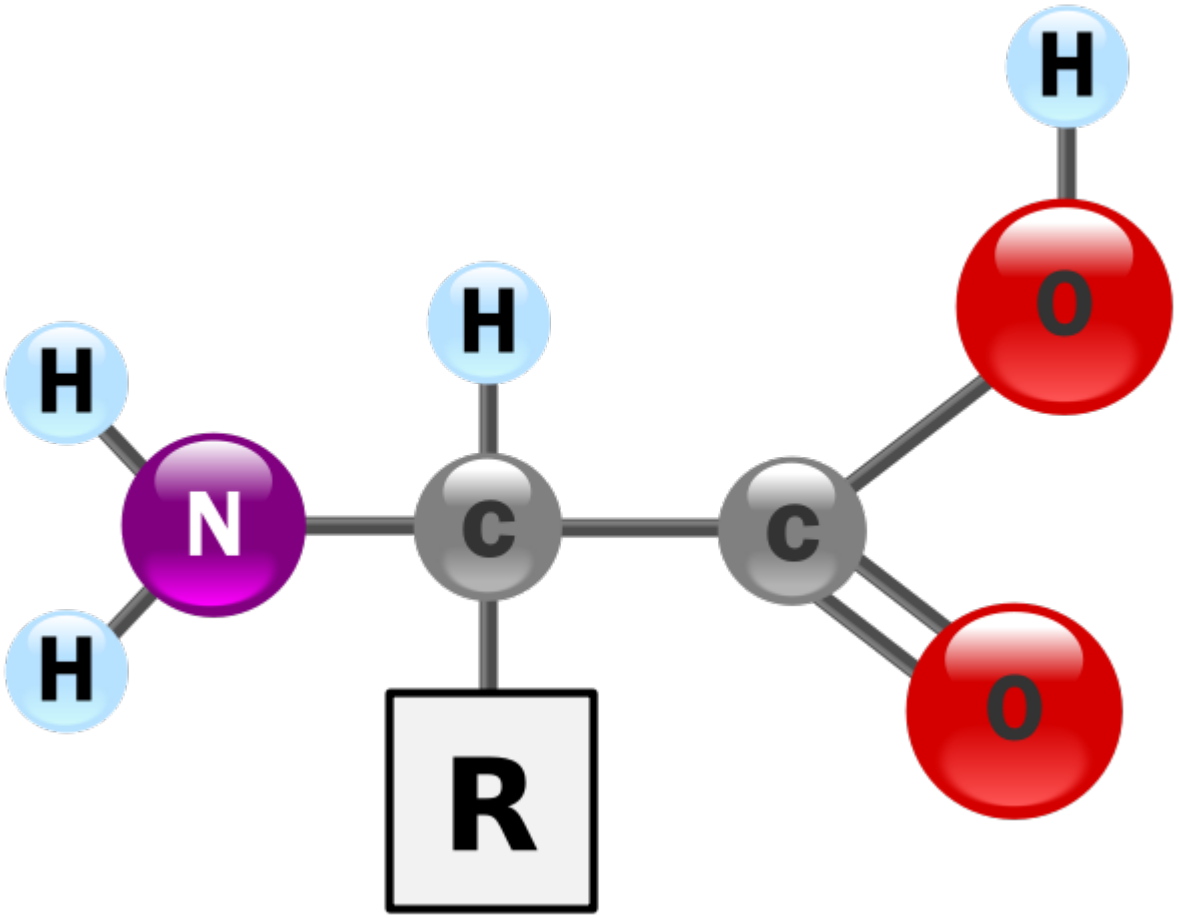
Sertraline (Zoloft, Pfizer)
Serotonin Reuptake Inhibitor



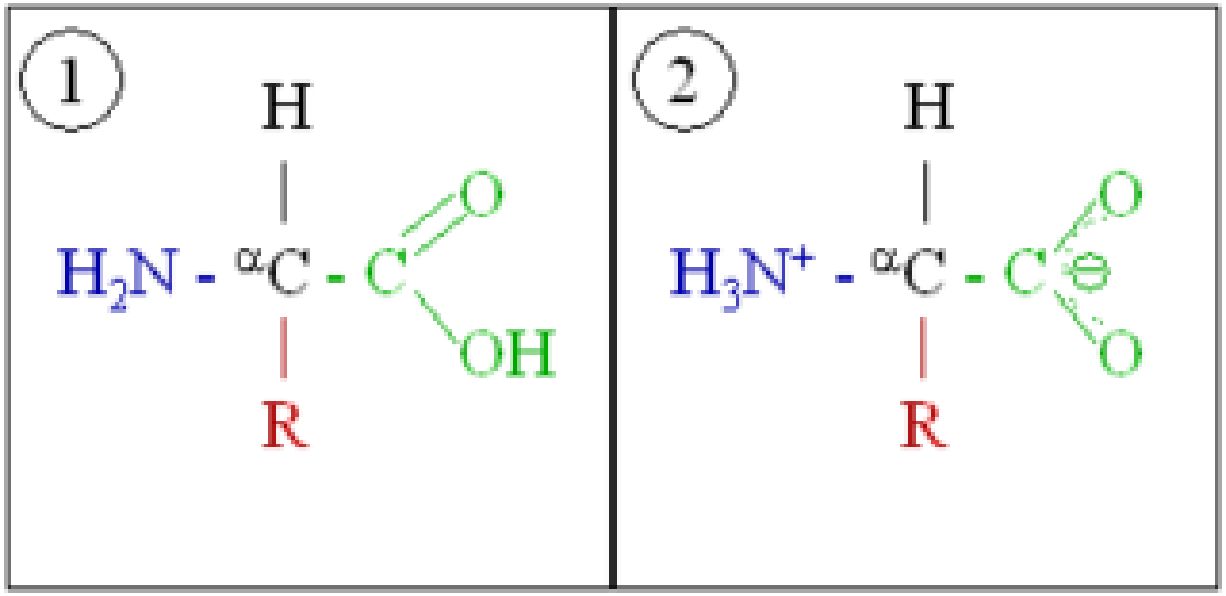
Chloroquine (Aralen)
anti-malarial


Amino acids
and peptides

Amino acids structure

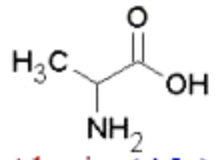


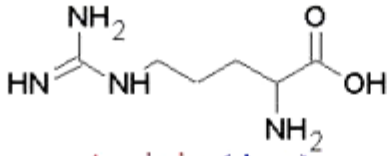
Amino acids structure

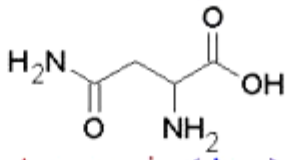


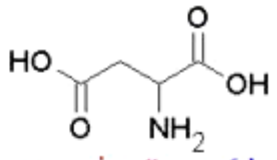
Unionized (1) and zwitterionic (2) structures of amino acids

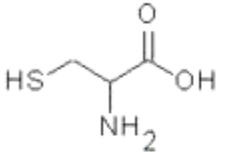
Standard amino acids

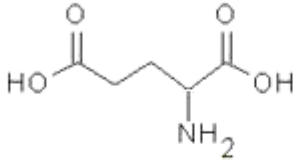

Alanin **(Ala)**

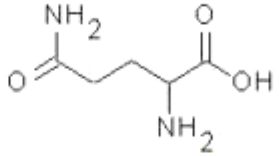

Arginin **(Arg)**

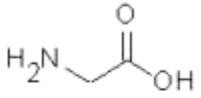

Asparagin **(Asn)**

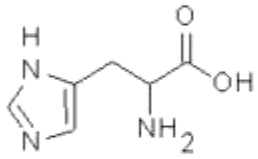

Asparaginsäure **(Asp)**

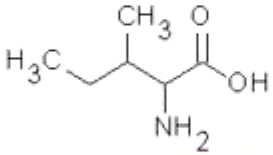

Cysteine **(Cys)**

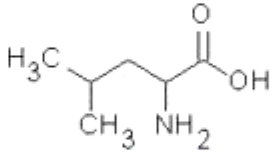

Glutaminsäure **(Glu)**

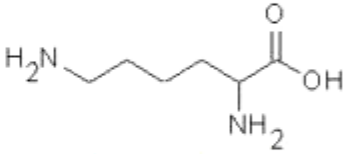

Glutamin **(Gln)**

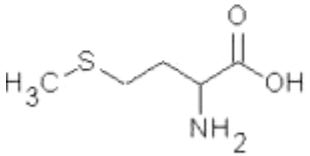

Glycin **(Gly)**

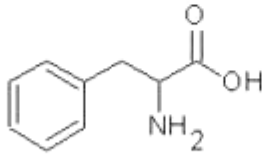

Histidin **(His)**

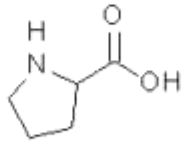

Isoleucin **(Ile)**

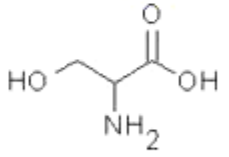

Leucin **(Leu)**

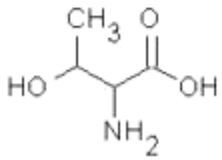

Lysin **(Lys)**

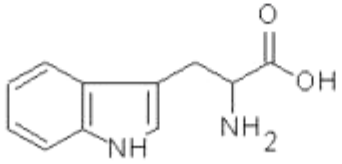

Methionin **(Met)**

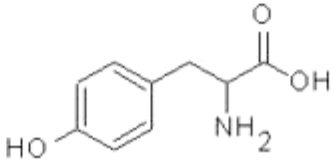

Phenylalanin **(Phe)**

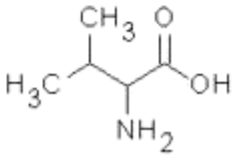

Prolin **(Pro)**


Serin **(Ser)**

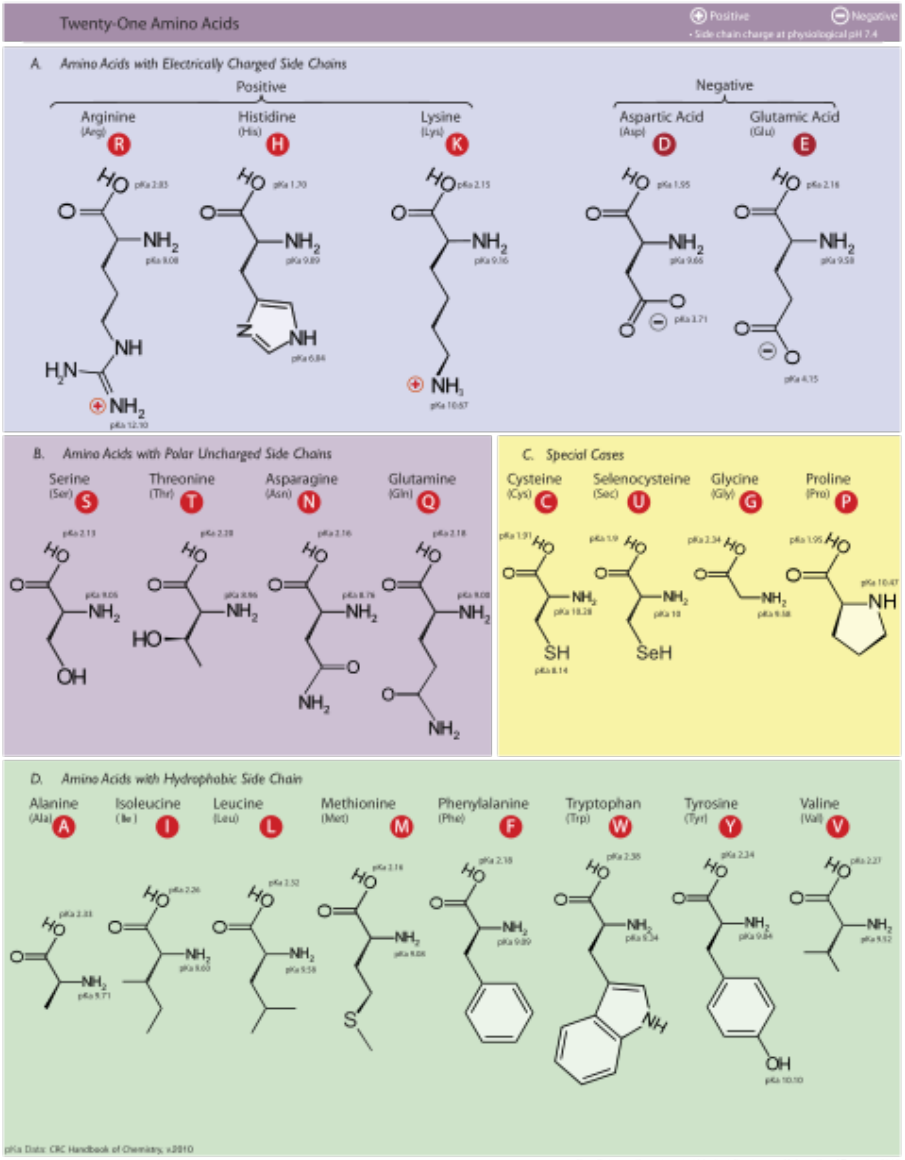

Threonin **(Thr)**


Tryptophan **(Trp)**

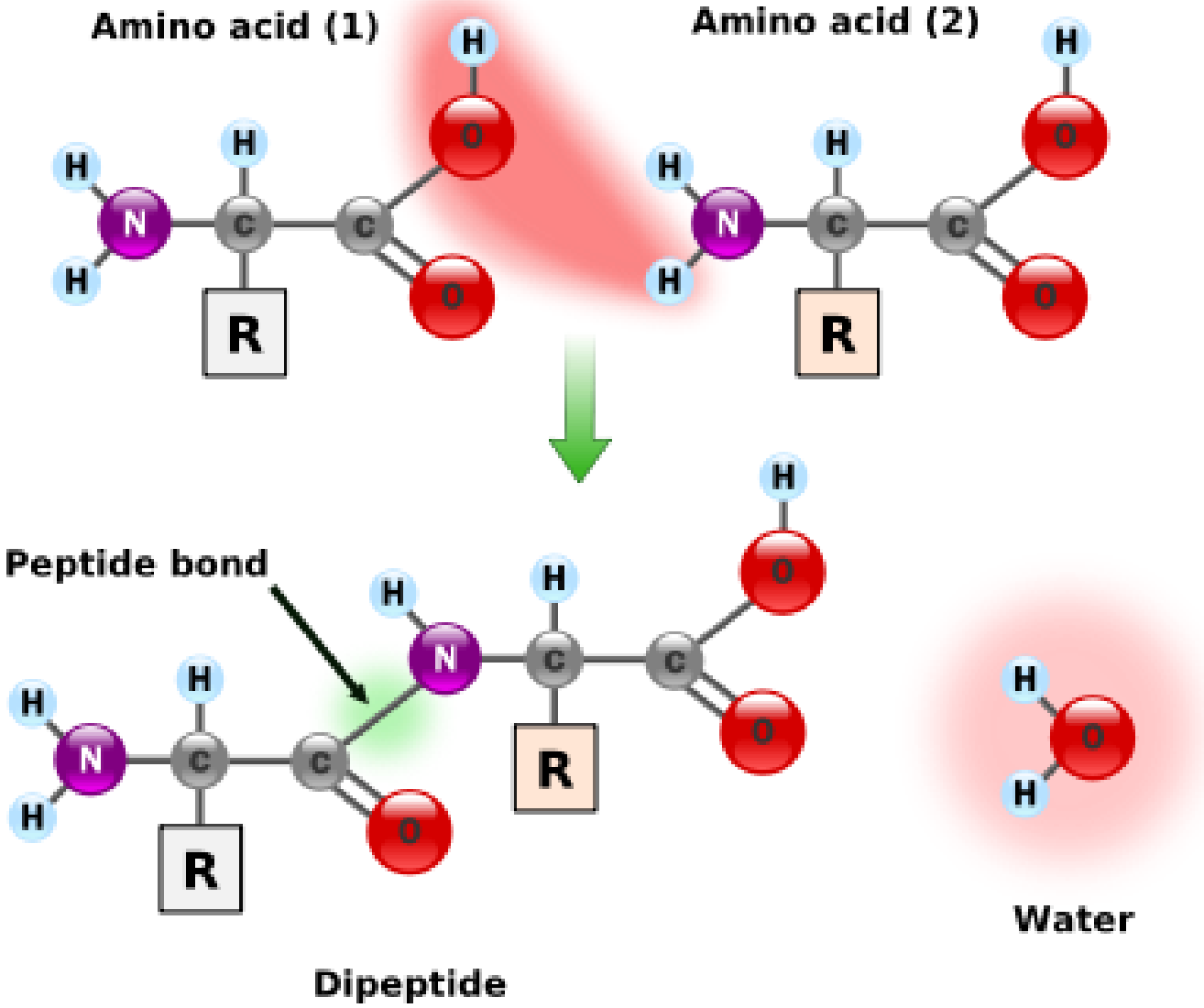

Tyrosin **(Tyr)**


Valin **(Val)**

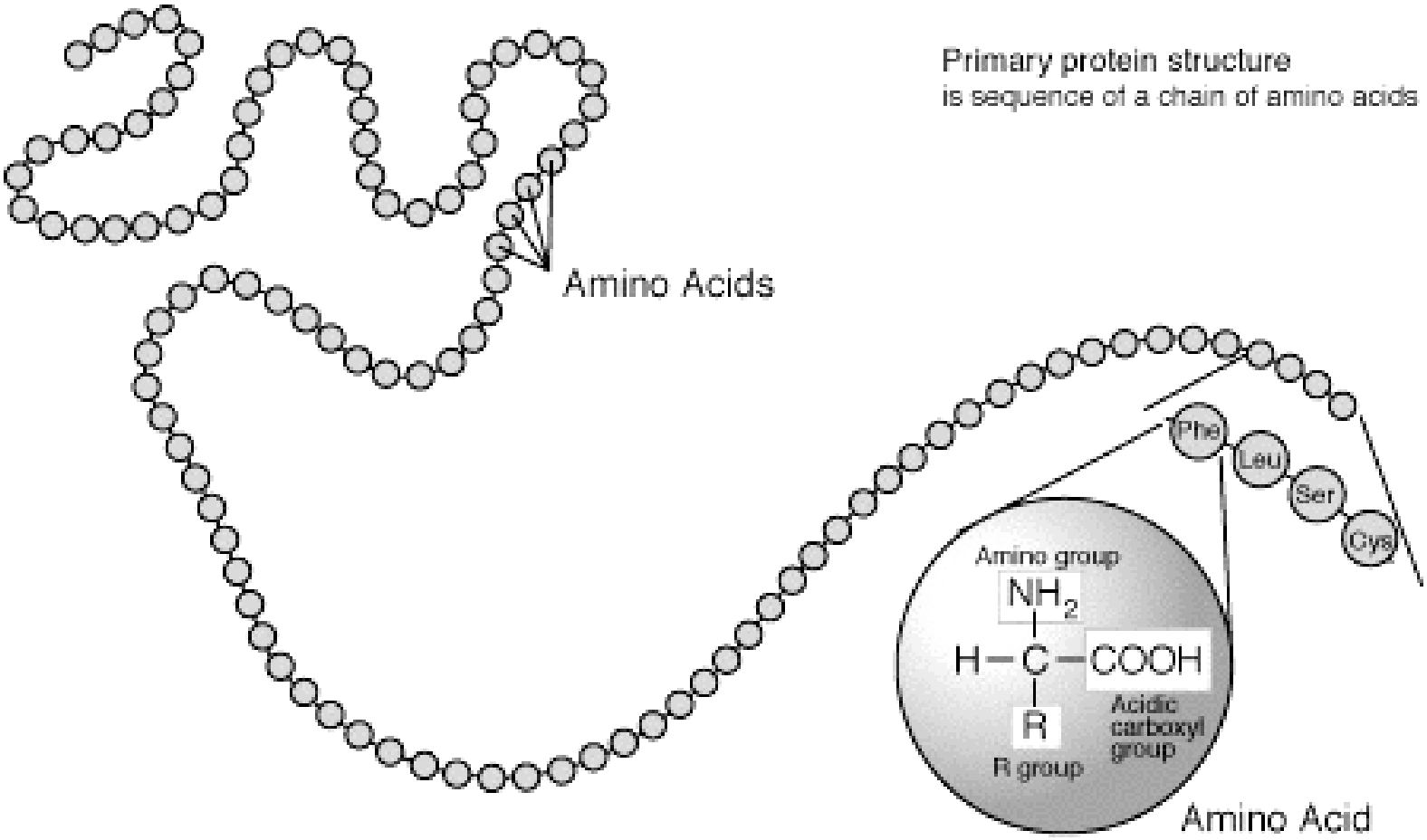
Standard amino acids



Peptide bond formation

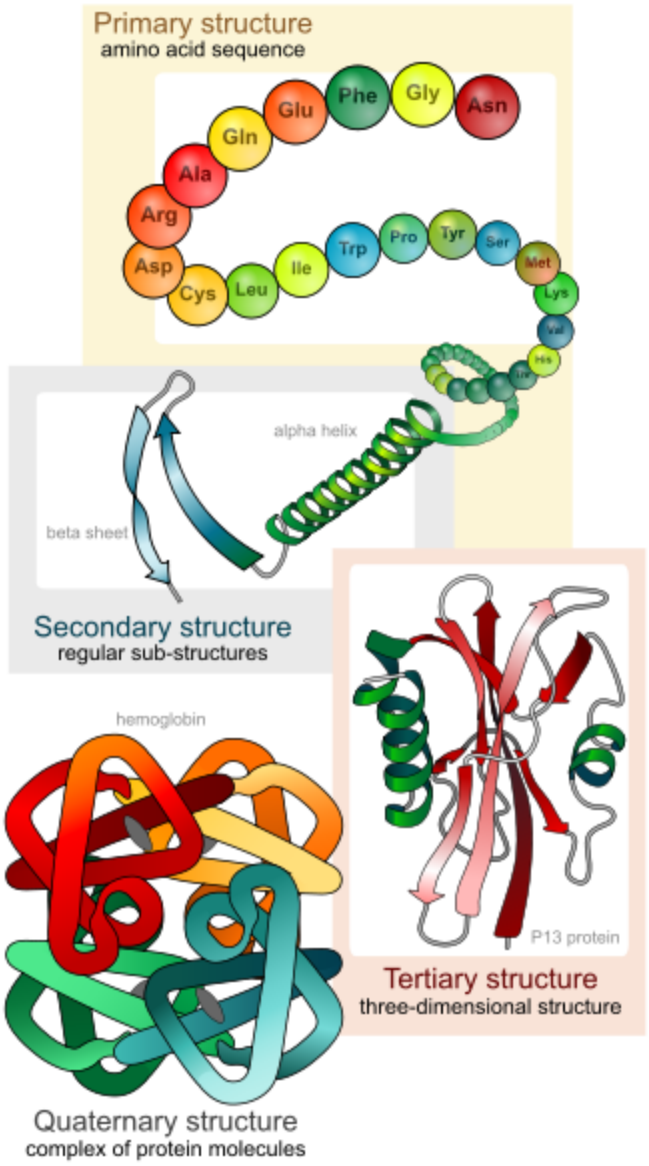


Polypeptides



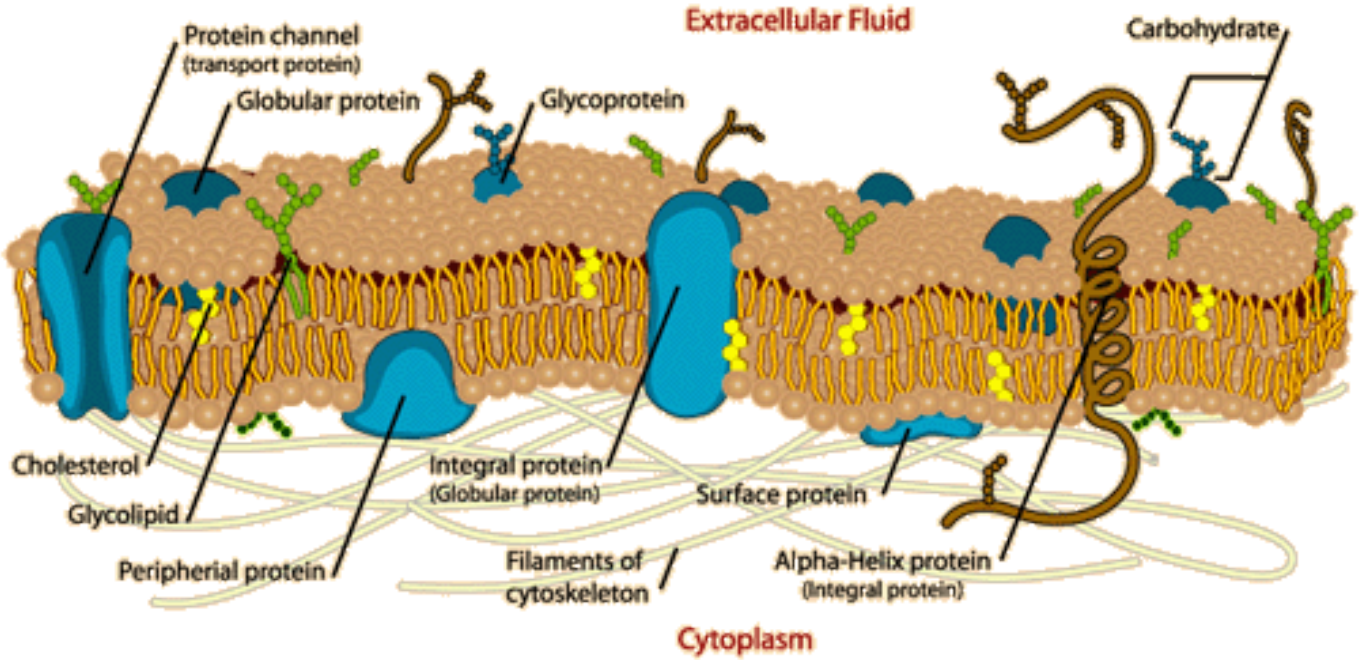
Peptides - are short chains of amino acid monomers (< 20) linked by peptide (amide) bonds

Polypeptides and proteins



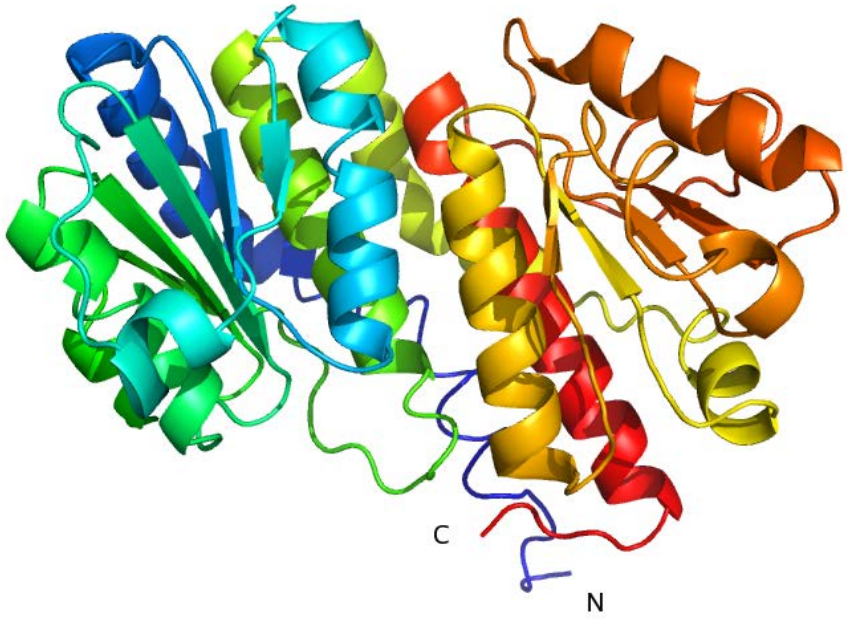
Like other biological macromolecules such as polysaccharides and nucleic acids, proteins are essential parts of organisms and participate in virtually every process within cells. Many proteins are enzymes that catalyze biochemical reactions and are vital to metabolism. Proteins also have structural or mechanical functions, such as actin and myosin in muscle and the proteins in the cytoskeleton, which form a system of scaffolding that maintains cell shape. Other proteins are important in cell signaling, immune responses, cell adhesion, and the cell cycle. Proteins are also necessary in animals' diets, since animals cannot synthesize all the amino acids they need and must obtain essential amino acids from food. Through the process of digestion, animals break down ingested protein into free amino acids that are then used in metabolism.

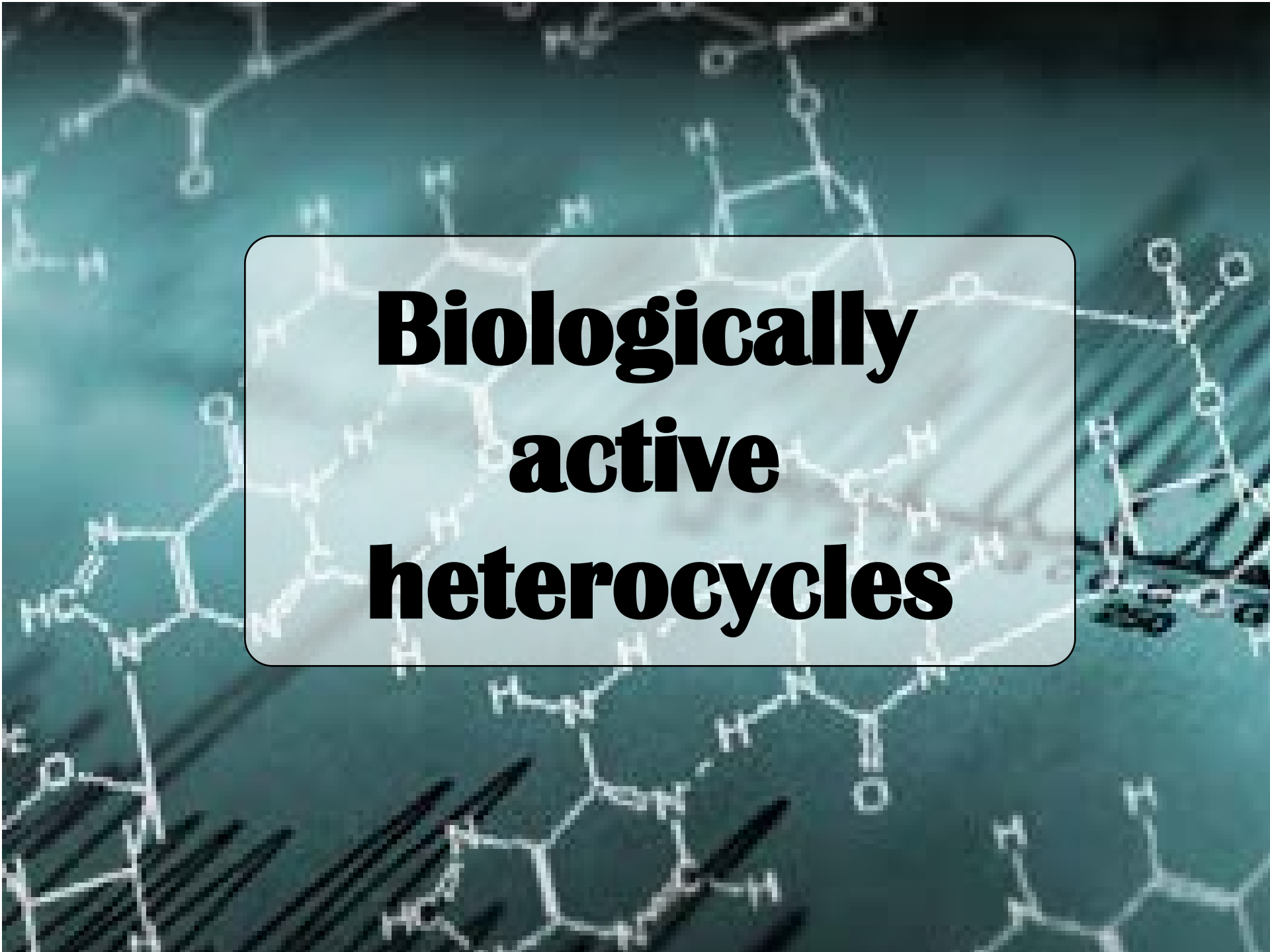
Cell Membrane



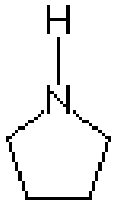
Proteins

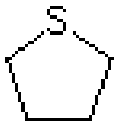
Proteins - are large biological molecules, or macromolecules, consisting of one or more chains of amino acid residues.

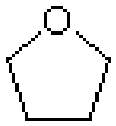


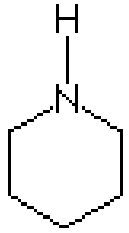

Biologically
active
heterocycles

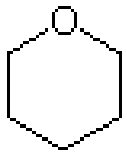
Carboxylic acids derivatives

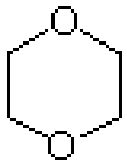

Pyrrolidine

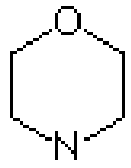

Tetrahydro thiophene

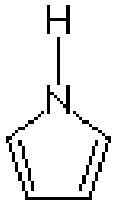

Tetrahydro furan

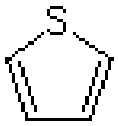

Piperdine

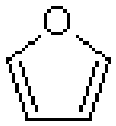

Pyran

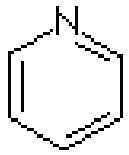

Dioxan

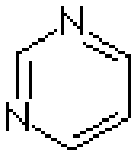

Morpholine

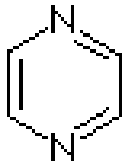

Pyrrole

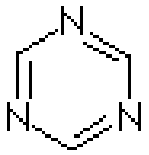

Thiophene

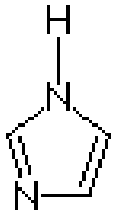

Furan


Pyridine

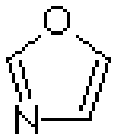

Pyrimidine

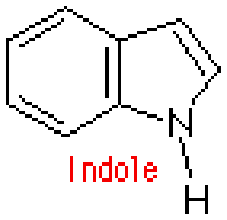

Pyrazine

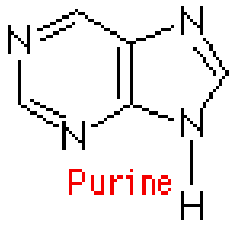

Triazine

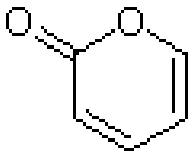

Imidazole

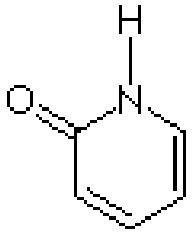

Thiazole

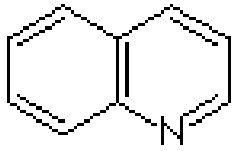

Oxazole

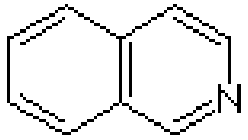

Indole


Purine

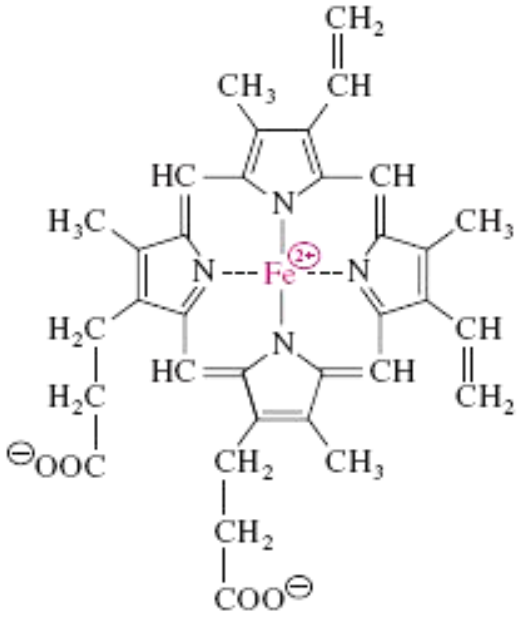

Pyrone


Pyridone

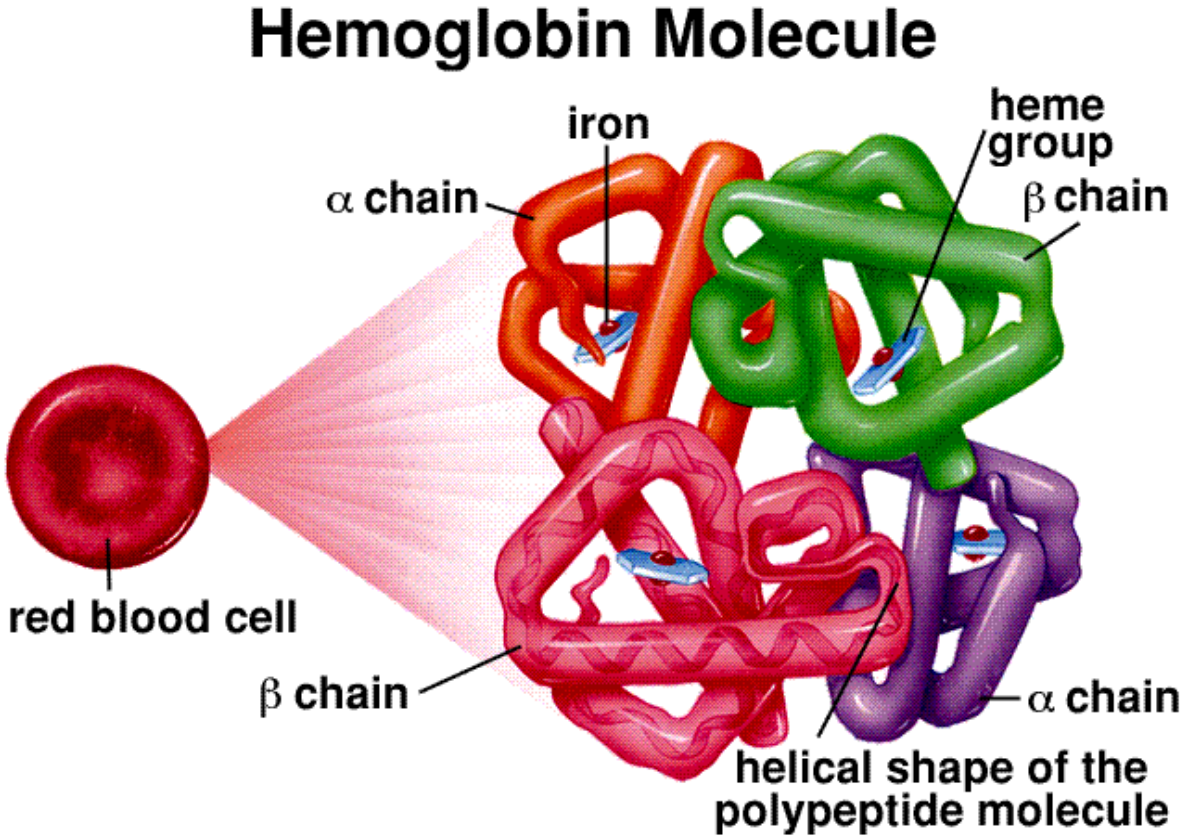

Quinoline


Isoquinoline

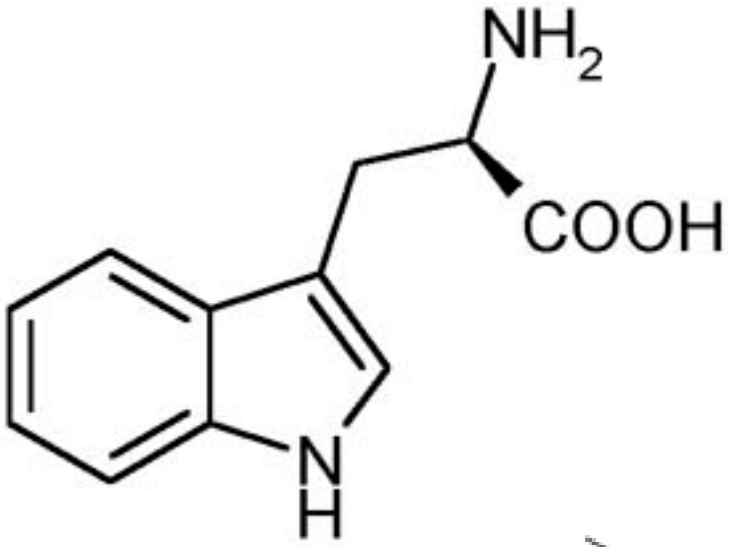
Pyrrole derivatives - porphyrins

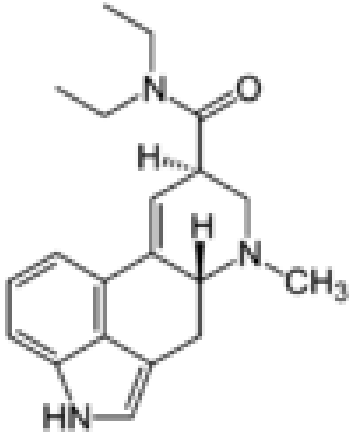


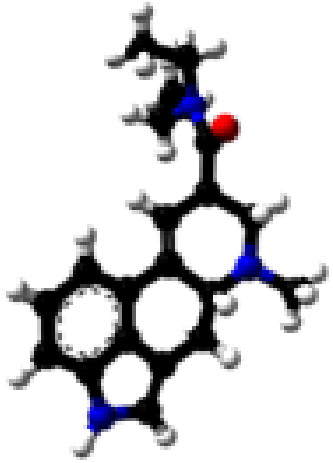
Chemical structure of the Fe(II)-protoporphyrin IX heme group in myoglobin and hemoglobin.

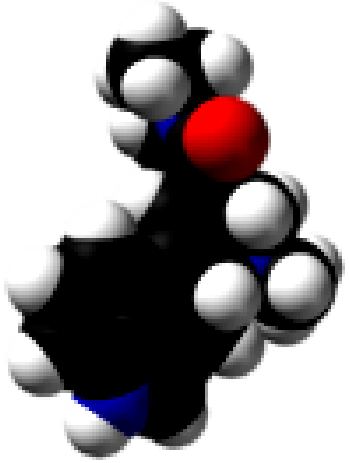


Indole derivatives – tryptophan and LSD

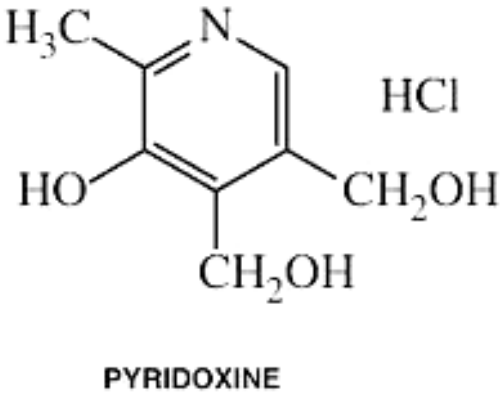




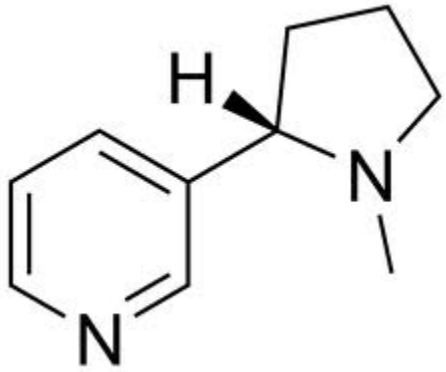


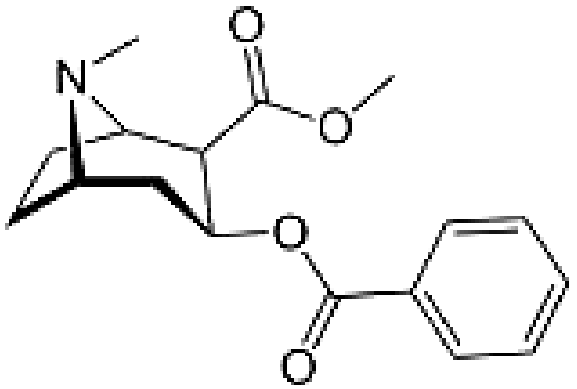


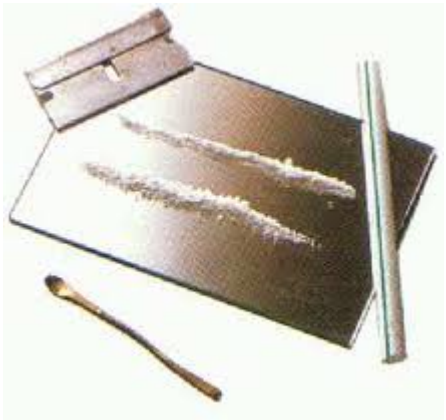
Pyridine derivatives – vitamin B6, nicotine, cocaine



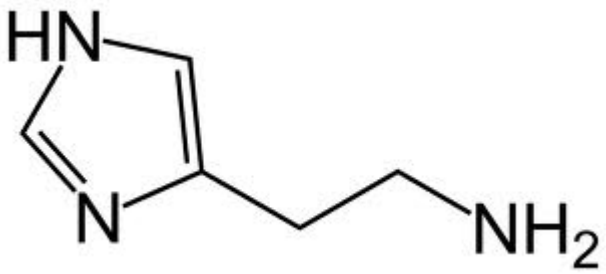
PYRIDOXINE

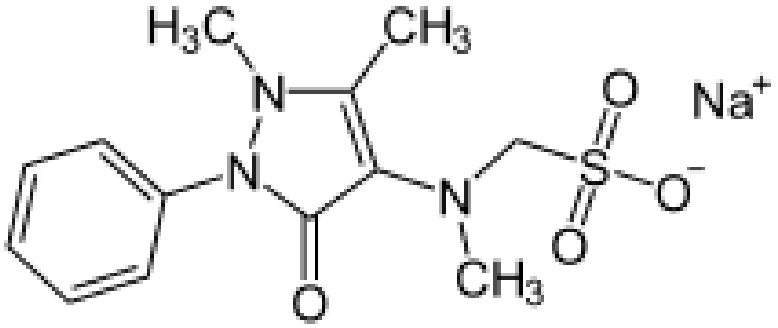




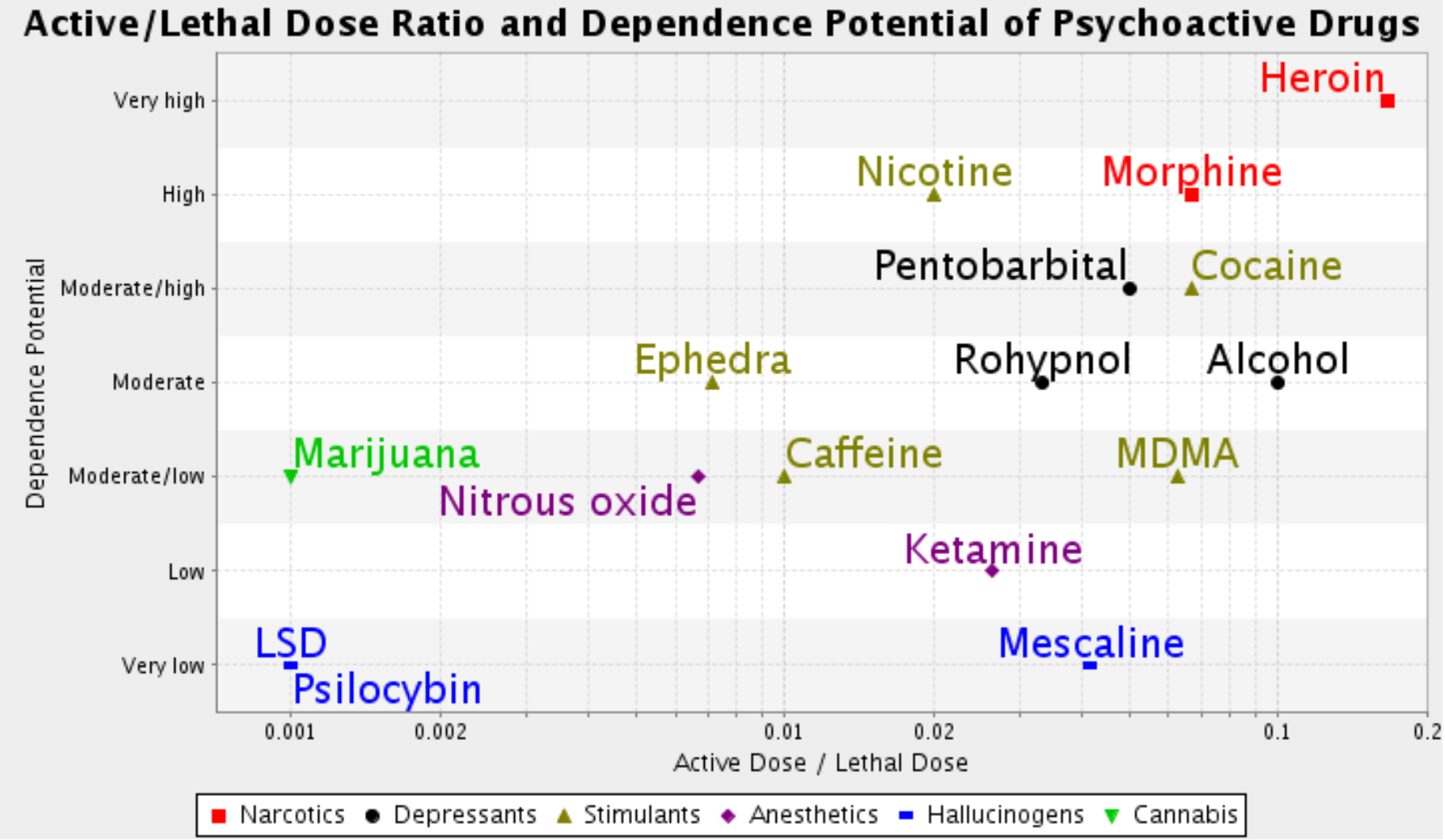


Imidazole and pyrazole derivatives – histamine, analgin

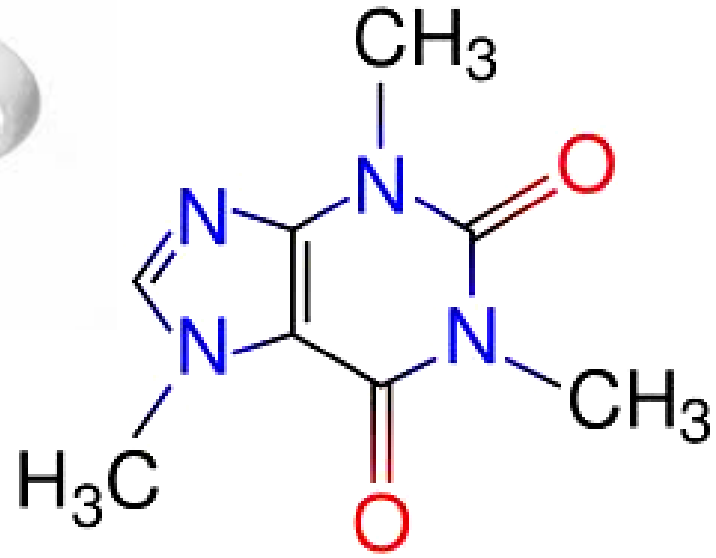




Drugs activity and danger

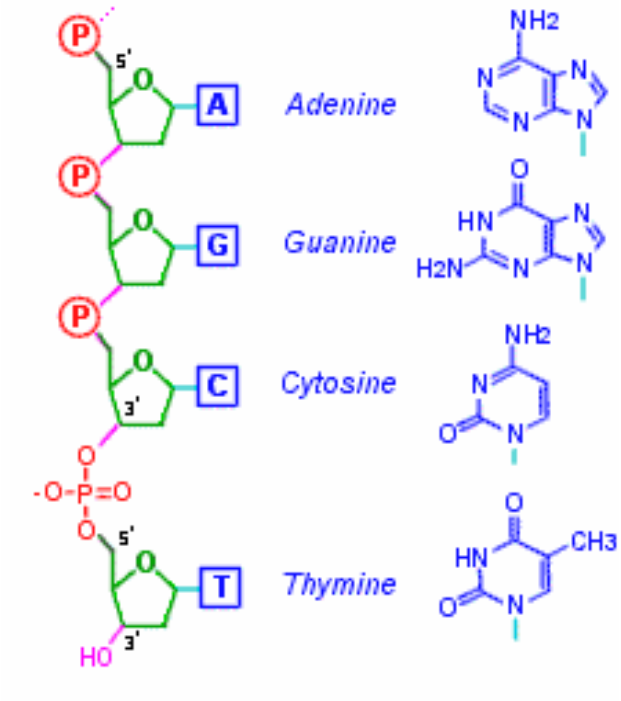


Caffeine – an everyday narcotic



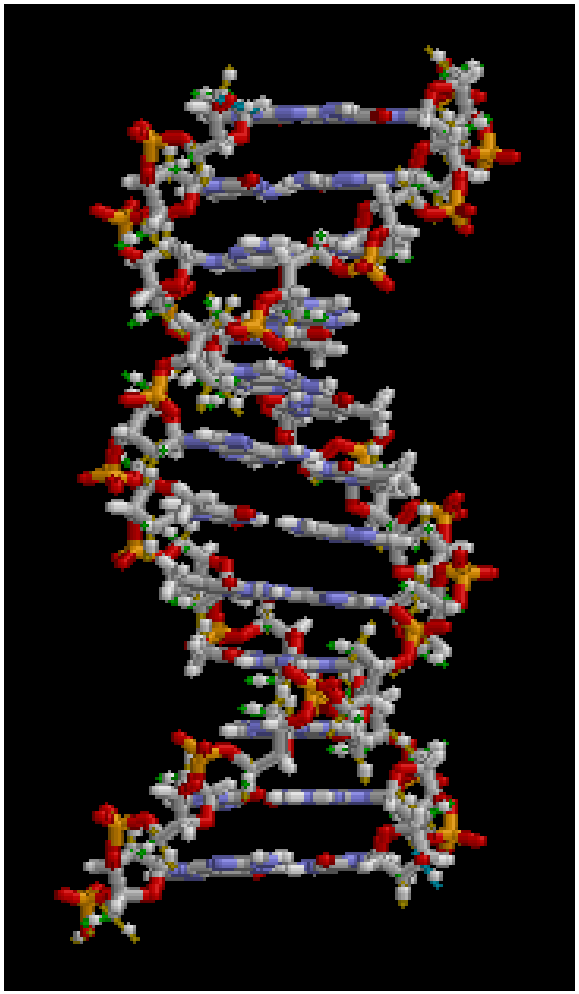
Nucleic Acids

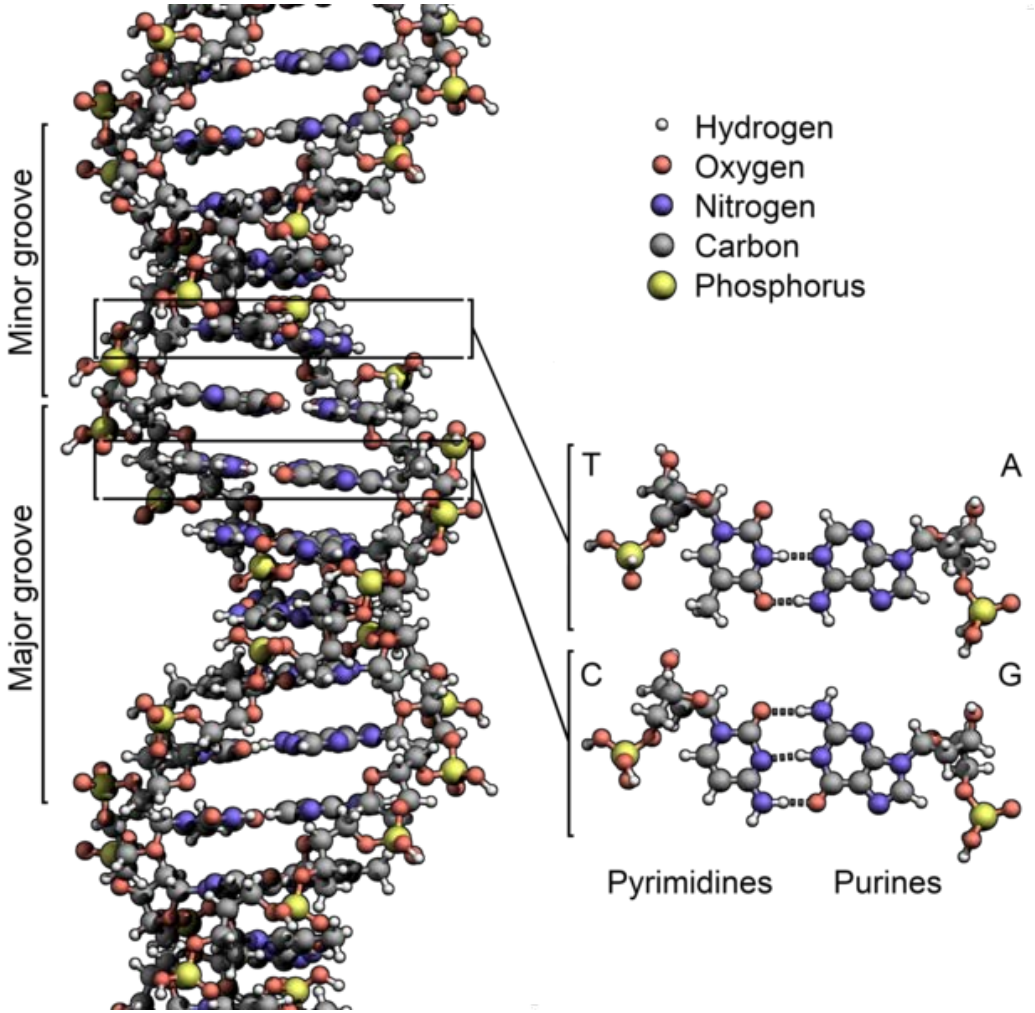
Nucleic acids are polymeric macromolecules, or large biological molecules, essential for all known forms of life



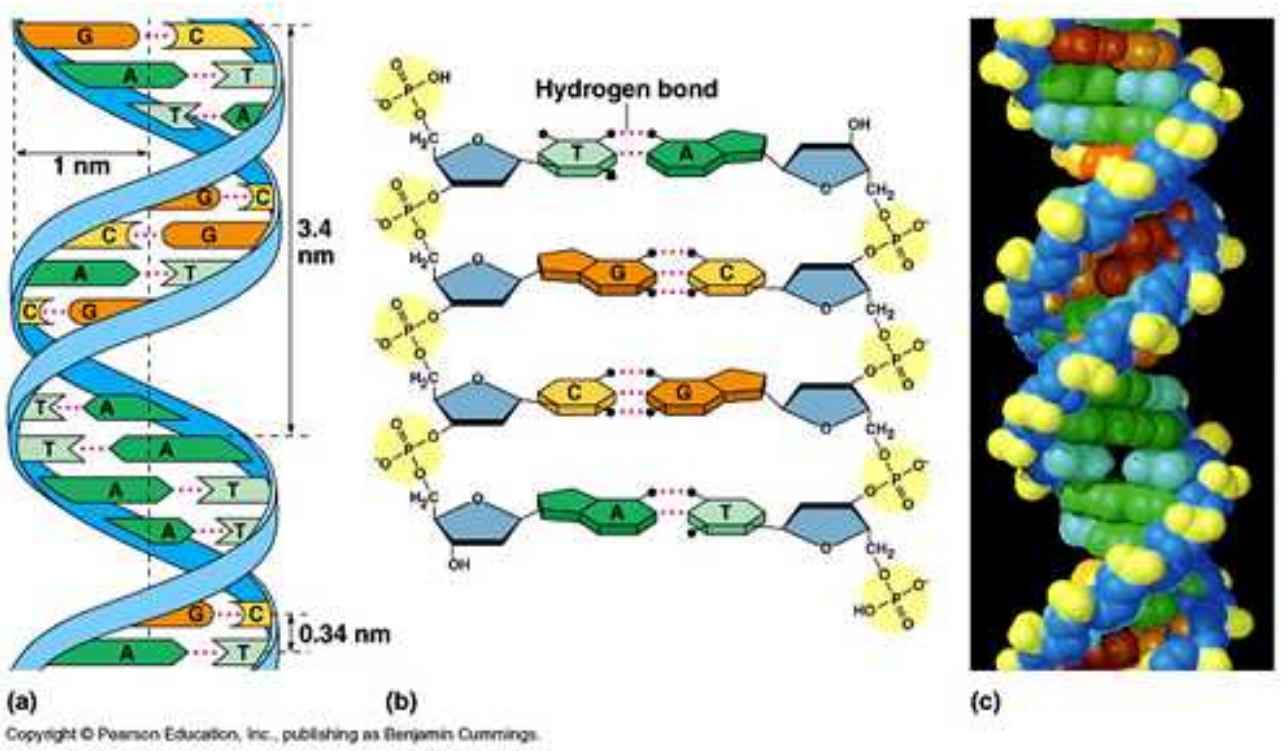
The Swiss scientist Friedrich Miescher discovered nucleic acids (DNA) in 1869. Later, he raises the idea that they could be involved in heredity.

Deoxyribonucleic acid (DNA)



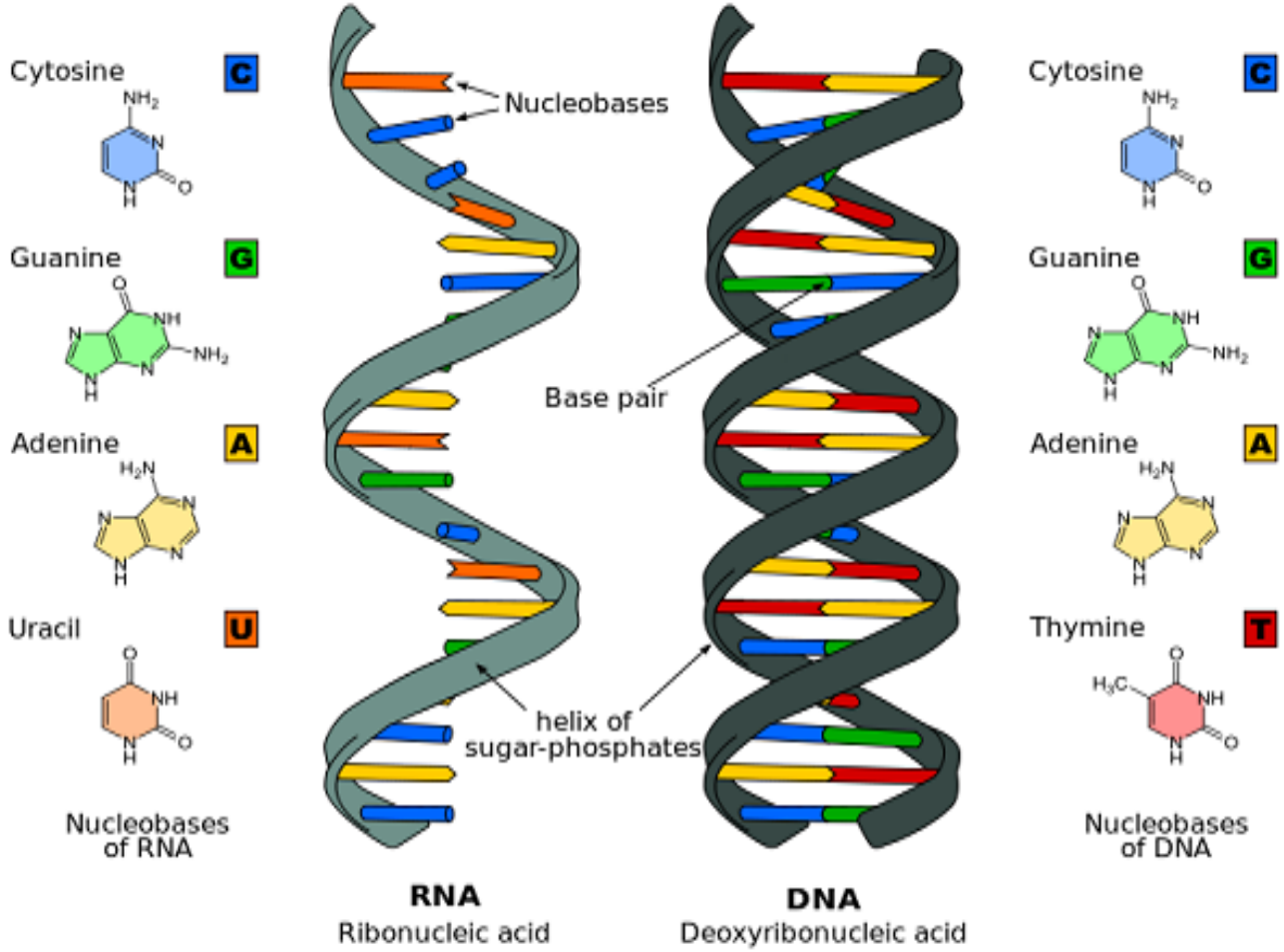


DNA



Deoxyribonucleic acid (**DNA**) is a molecule that encodes the genetic instructions used in the development and functioning of all known living organisms and many viruses. DNA is a nucleic acid

DNA


Cytosine
C
Guanine
G
Adenine
A
Uracil
U
Nucleobases of RNA
Nucleobases
Base pair
helix of sugar-phosphates
RNA
Ribonucleic acid
DNA
Deoxyribonucleic acid
Cytosine
C
Guanine
G
Adenine
A
Thymine
T
Nucleobases of DNA

Thank you for your attention !