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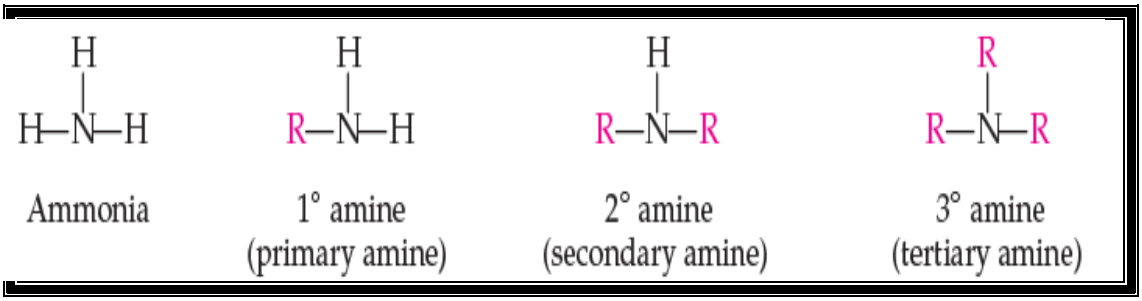
Lecture 6: Nitro compounds

Although amines play many different roles in our day-to-day lives, one important use is in medicine. A host of drugs derived from amines is responsible for improving the quality of life, whereas others, such as cocaine and heroin, are highly addictive.

Amines

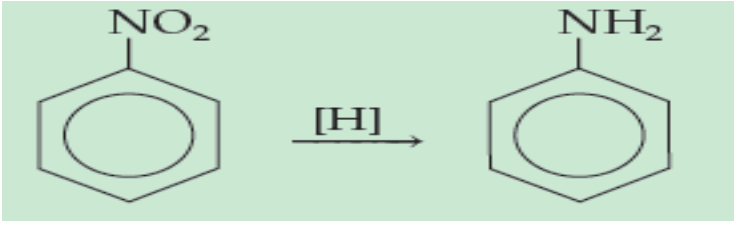
- Amines are organic derivatives of ammonia and, like ammonia, they are basic. In fact, amines are the most important type of organic base found in nature.
- Primary amines are liquids at room temperature containing three to four carbon atoms, whereas higher amines are solids.
- Amines are classified according to the number of alkyl or aryl groups attached to the nitrogen.



- The nitrogen atom is more electronegative than the hydrogen atoms in amines. As a result, the N-H bond is polar. In addition, the nitrogen atom contains an unshared pair of electrons. As a result, hydrogen bonding between amine molecules or between amine molecules and water can occur.

Preparation of Amines

In the laboratory, amines are prepared by the reduction of amides and nitro compounds.



The Biogenic Amines:

- Biogenic Amines are chemical compounds have at least one amine functional group in its molecular structure. Produced by living organisms or biological processes essential for maintaining the fundamental life processes. They play an important role as source of nitrogen and precursor for the synthesis of hormones, nucleic acids, proteins.
- Many neurotransmitters are amines, including epinephrine, norepinephrine, dopamine, serotonin, and histamine.

Serotonin: is an important amine, that functions as one of the primary neurotransmitters, for the brain. It controls the feelings, of happiness, hunger, and helps in regulating the sleeping, and waking-up Cycle, of the brain.

Transamination & Deamination Process:

Transamination is the *transfer* of an amine group from an amino acid to a keto acid, thus creating a new amino acid and keto acid. The first step transamination in catabolizing, or breaking down, an amino acid is the removal of its amine group (-NH2).

Deamination: Deamination is the removal of the amine group as ammonia (NH3)

Keto acids and carbon skeletons that remains after removed nitrogen group by deamination or transamination are used to synthesize nonessential amino acids.

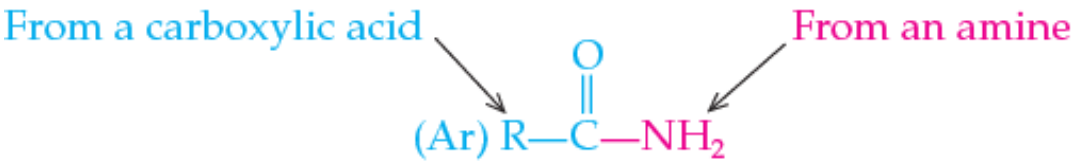
This transamination & deamination process are done in response to biological activity for cell need for a specific type of amino acid

Medically Important Amines

- Amphetamines, such as benzedrine and methedrine, stimulate the central nervous system. They elevate blood pressure and pulse rate and are often used to decrease fatigue. Medically, they have been used to treat depression and epilepsy.
- Ephedrine, its stereoisomer pseudoephedrine, and phenylephrine are used as decongestants in cough syrups and nasal sprays. These compounds are very closely related to dopamine, which is a key compound in the function of the central nervous system.

Amide

- **Amides** are the products formed in a reaction between a carboxylic acid derivative and ammonia or an amine.



- Most amides are solids at room temperature. They have very high boiling points, and the simpler ones are quite soluble in water. Both of these properties are a result of strong intermolecular hydrogen bonding between the N-H bond of one amide and the C=O group of a second amide.

Medically Important Amides

- Barbiturates, often called "downers," are derived from amides and are used as sedatives. They are also used as anticonvulsants for epileptics and for people suffering from a variety of brain disorders that manifest themselves in neurosis, anxiety, and tension.
- Phenacetin and acetaminophen are also amides. Acetaminophen is an aromatic amide that is commonly used in place of aspirin, to relieve pain and reduce fever.

Note:

1. The main difference between amine and amide is the presence of a carbonyl group in their structure; amines have no carbonyl groups attached to the nitrogen atom whereas amides have a carbonyl group attached to a nitrogen atom.
2. Amines are derivatives of ammonia with at least one alkyl or aryl group, while amides are derivatives of a carboxylic acid with a carbonyl group attached to a nitrogen atom