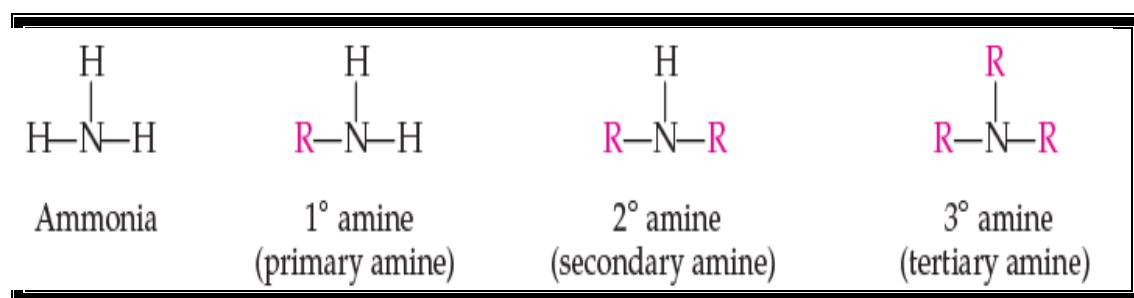


## Lecture 8: Amines

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.

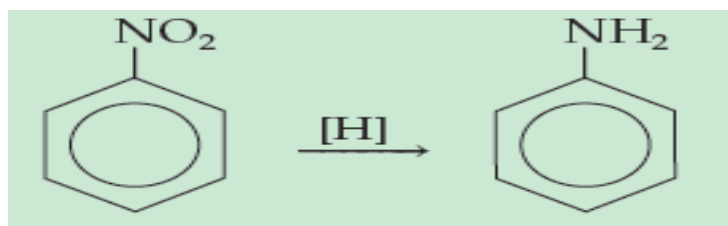
- Amines are organic derivatives of ammonia and, like ammonia, they are basic. In fact, amines are the most important type of organic base found in nature.
- Amines are classified according to the number of alkyl or aryl groups attached to the nitrogen.
- Primary amines are liquids at room temperature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



- 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

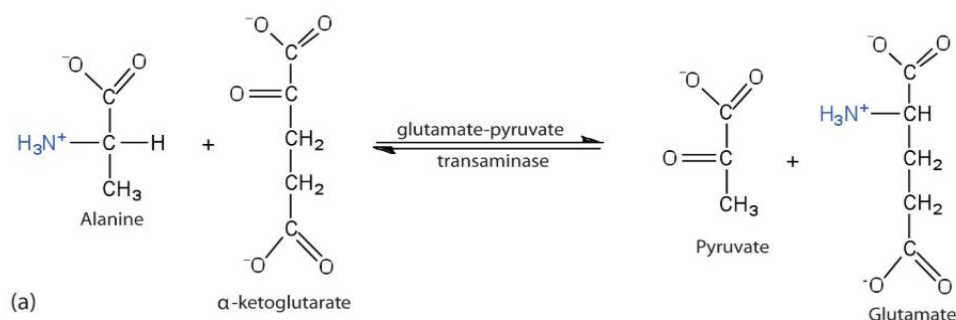
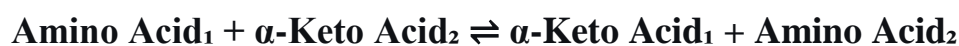
Biogenic Amines are chemical compounds that have at least one amine functional group in its molecular structure. Produced by living organisms or biological processes essential for maintaining the fundamental life processes. They play an important role as source of nitrogen and precursor for the synthesis 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  $\alpha$ -amino group ( $\text{NH}_2$ ) from an amino acid to an  $\alpha$ -keto acid. This reaction converts the original amino acid into an  $\alpha$ -keto acid and the original  $\alpha$ -keto acid into a new amino acid.

### The General Reaction

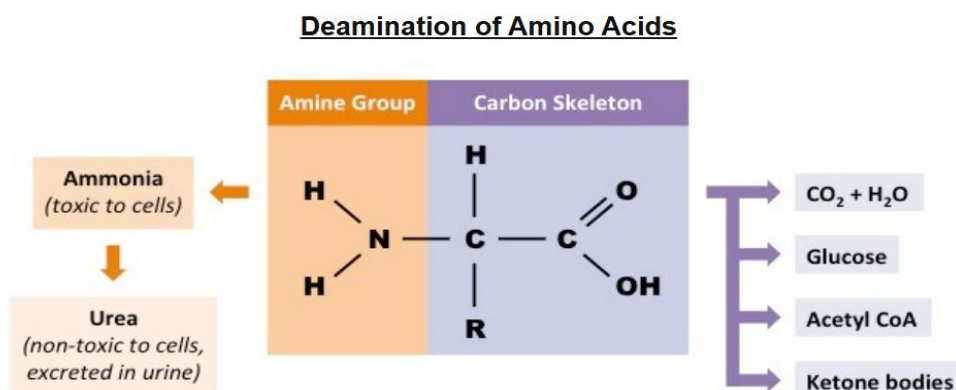


- **Donor:** The amino acid that gives up its amino group.
- **Acceptor:** The  $\alpha$ -keto acid that accepts the amino group.
- The reaction is **reversible** and **mediated by enzymes called transaminases (or aminotransferases)**.

- The most common  **$\alpha$ -keto acid acceptor** is  **$\alpha$ -ketoglutarate**. When it accepts an amino group, it becomes the amino acid **glutamate**.

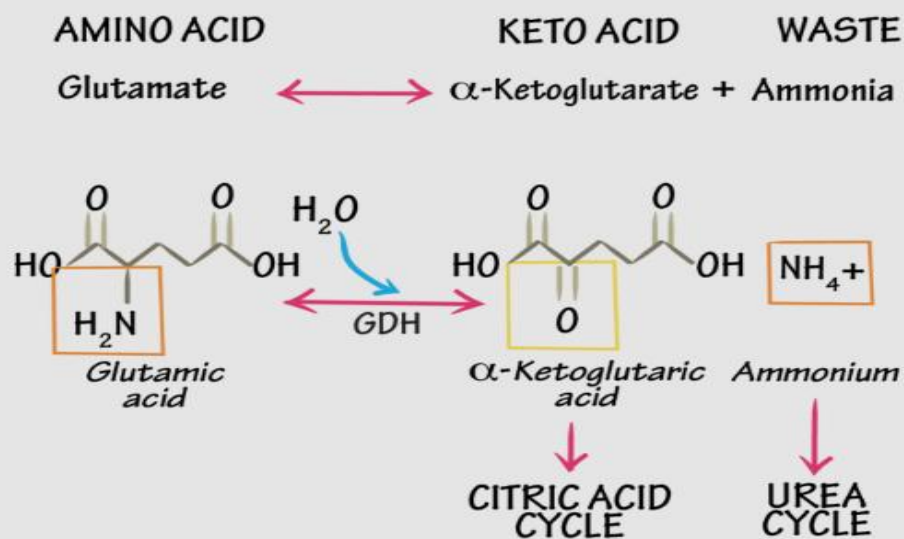
### Deamination Process

**Deamination** is the **removal of an amino group ( $-\text{NH}_2$ ) from an amino acid or other organic compound**, resulting in the release of **ammonia ( $\text{NH}_3$ )** and the formation of a carbon skeleton, typically an  **$\alpha$ -keto acid**.



### Oxidative Deamination Components

#### *Glutamate Dehydrogenase*

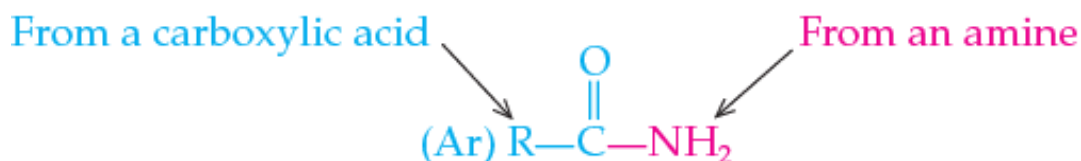


### Medically Important Amines

- 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.

Mustansiriyah University

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**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