

## Chemistry 506: Allied Health Chemistry 2

### Chapter 15: Amines and Amides

#### Functional Groups with Single Bonds to Nitrogen

Introduction to General, Organic & Biochemistry, 5<sup>th</sup> Edition by  
Bettelheim and March: Chapter 15, Pages 483-514

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**15A Section(s) 15.1/2/3 Amines**

## ❖ Amine Classification

## ❖ Ammonia

## ❖ 1°, Primary Amine

## ❖ 2°, Secondary Amine

❖ 3°, Tertiary Amine

❖ 4°, Quaternary Ammonium Salts

- ❖ IUPAC Nomenclature
  - ❖ Named as Alkyl Amines (multiple words)
  - ❖ Dimethyl Amine
  - ❖ Methyl Ethyl Amine
  - ❖ Tetramethyl Ammonium Chloride

❖ Aromatic Amines

❖ Aniline (coal tar)

❖ N-methyl-N-ethyl aniline

- ❖ Heterocyclic Amines
  - ❖ Pyridine ( $C_5H_5N$ , coal tar)
  
  
  
  
  
  
  
  
  
  
  - ❖ Piperidine ( $C_5H_{11}N$ )
  
  
  
  
  
  
  
  
  
  
  - ❖ Pyrimidine ( $1,3-C_4H_4N_2$ )
  
  
  
  
  
  
  
  
  
  
  - ❖ Pyrole ( $C_4H_5N$ )
  
  
  
  
  
  
  
  
  
  
  - ❖ Pyrrolidine ( $C_4H_9N$ )

❖ Properties

❖ Relatively high **Mp** and **Bp**

❖ Polar

❖ Hydrogen Bonding Donor

❖ Hydrogen Bonding Acceptor

❖ Solubility

❖ Stench!

❖ Putrescine



❖ Cadaverine



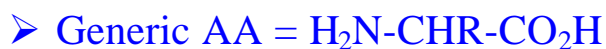
❖ Hydrogen Bonding

❖ H-bonding donors and H-Bonding acceptors

## 15B Section(s) 18.2 Amino Acids having Amine/Heterocyclic

## Containing Side Chains

## ➤ Amino Acids (Building Blocks of Proteins)

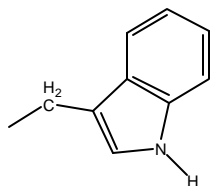


## ➤ Lysine (basic)

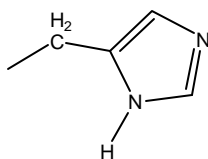


## ➤ Tryptophan (neutral polar)

➤ Nitrogen is in "aromatic" bond



## ➤ Histidine (basic)



## ➤ Arginine (basic)





**15C Section(s) 15.4 Amine Basicity**

## ❖ Simple Acid/Base Chemistry

❖ All Amines plus acids such as  $\text{H}^+$  (ammonium salts)

❖ Neutralization of ammonium salts by bases such as  $\text{OH}^-$

- ❖ Amines plus Alkyl Halides
  - ❖ Generic (Nucleophilic Attack and Deprotonation)
  
- ❖  $\text{NH}_3$  plus Alkyl Halides
  
  
  
  
  
  
  
  
  
  
- ❖  $\text{NH}_2\text{R}$  plus Alkyl Halides
  
  
  
  
  
  
  
  
  
  
- ❖  $\text{NHR}_2$  plus Alkyl Halides

❖  $\text{NR}_3$  plus Alkyl Halides

❖ no deprotonation possible

**15D Section(s) 15.5/6 Amides**

- ◆ Generic Structures
  
  
  
  
  
  
  
  
  
  
- ◆ Properties
  - ◆ Mp and Bp
    - ◆ Polarization of Bonds
    - ◆ Hydrogen Bonding
  - ◆ Lone Pairs
  - ◆ Neither Acidic or Basic



**15E Section(s) 15.7/8 Amide Reactions**◆ **Direct Synthesis from Carboxylic Acids and Amines**

## ◆ Acid/Base reaction

## ◆ Thermolysis

◆ **Synthesis from Acid Chlorides**◆ **Synthesis from Anhydrides**

- ◆ Nylon 66

- ◆ Synthesis by Direct Reaction of Carboxylic Acids and Amines

- ◆ Synthesis from Acid Chlorides and Amines

- ◆ Related to Protein Backbones

- ◆ Polyamides with Side Chains

- ◆ Hydrolysis of Amides
  - ◆ Acidic Hydrolysis ( $\text{H}_3\text{O}^+$  or  $\text{H}^+/\text{H}_2\text{O}$ )

- ◆ Basic Hydrolysis ( $\text{OH}^-/\text{H}_2\text{O}$ )

Problems 15.1 to 15.41

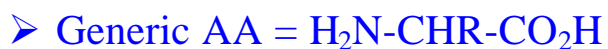


## 15F Section(s) 18.2

## Amino Acids having Amide Containing

## Side Chains

## ➤ Amino Acids (Building Blocks of Proteins)



## ➤ Asparagine (neutral polar)



## ➤ Glutamine (neutral polar)



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