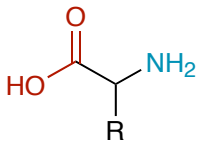
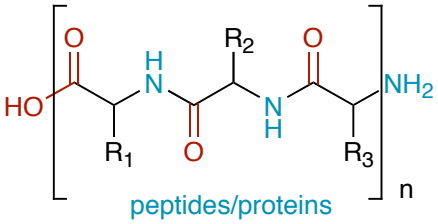
Chapter 24 - Amines

Amines are Biologically Important

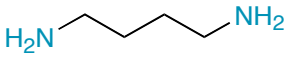
Amino acids for the basis of all peptides and proteins. These are the tissue building blocks and nature's catalysts (enzymes) in biological systems. Amine functional groups have marked biological activity, from being very foul smelling compounds from degrading flesh to impacting upon neural chemistry.



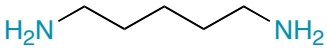
amino acids



peptides/proteins



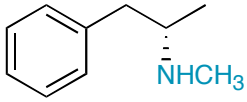
putrescine



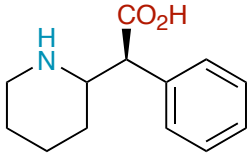
cadeverine

foul smelling constituents of rotting flesh

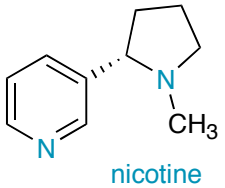
Some biologically active amine compounds



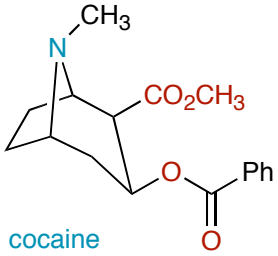
methamphetamine



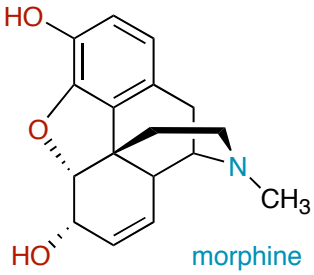
ritalin



nicotine



cocaine



morphine

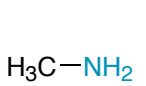
Amine Substitution

Primary, secondary and tertiary amines refer to the amount of alkyl subsitution on the Nitrogen atom (not the carbon as is the case with other functional groups).

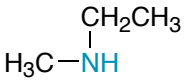
NH_3	$R-NH_2$	R_2NH	R_3N	R_4N^+
ammonia	1°	2°	3°	4° (quaternary ammonium salt)

Amine Naming

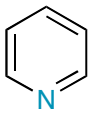
There are several ways to name amines, depending on what you call the substituent and what you call the parent. Also, when necessary, substituents on the nitrogen are indicated with a capital N.



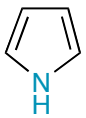
Methyl Amine
Aminomethane
Methanamine



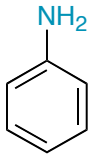
Ethyl Methyl Amine
N-Methylaminoethane
N-Methylethanamine



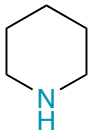
pyridine



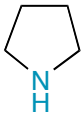
pyrrole



aniline



piperidine

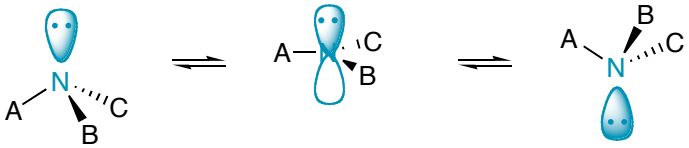


pyrrolidine

aziridine

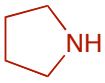
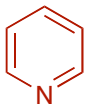
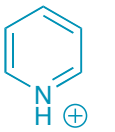
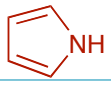
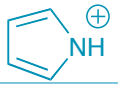
Amine Structure

Amines are sp^3-hybridized and tetrahedral with the lone pair taking up one of the four positions. Amines are inherently chiral, however, they undergo rapid inversion at room temperature. Thus, they are always racemic.



Amines Are Good Bases and Good Nucleophiles

Amines are very good bases - more basic than oxygen-containing compounds like alcohols or water. One way to measure the base strength is to look at the pK_a of the protonated amine (conjugate acid). The weaker this acid is, the stronger was the base that generated it.

amine	ammonium	pK_a (ammonium)
NH_3	$NH_4^{\oplus}$	9.26
CH_3NH_2	$CH_3NH_3^{\oplus}$	10.66
		11.27
Et_3N	$Et_3NH^{\oplus}$	11.01
$PhNH_2$	$PhNH_3^{\oplus}$	4.63
		5.24
		0.4