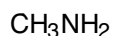
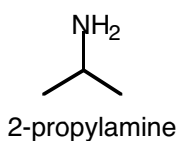


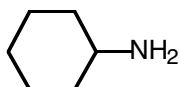
### Amines:

Another very important class of compounds is the amines. These all contain at least one carbon nitrogen single bond. Alcohols and ethers are to water what amines are to ammonia! Like ammonia, all amines are Brønsted-Lowery bases, and their relative strength depends on how many C–N bonds there are. The more substituted the nitrogen is, the stronger is its basic character. Amines are notoriously smelly. They are responsible for the stench of rotting flesh! They also tend to be bitter tasting.

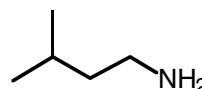
When naming amines, the longest chain is given as the parent name, and the suffix "amine" is placed after the alkyl name. Of course, the position of the amino group must be indicated. The simplest amines to name are primary amines.



methanamine

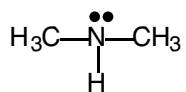


cyclohexylamine

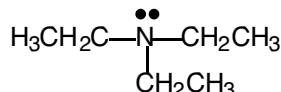


3-methyl-1-butylamine

Symmetric secondary and tertiary amines can be named simply with the Greek numeral designation (di, tri etc) placed before the name of the alkyl chain followed by "amine".

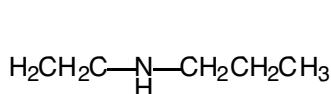


dimethylamine

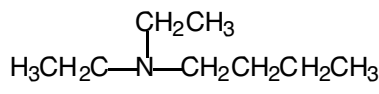


triethylamine

Unsymmetrical secondary and tertiary amines have a parent name that is the same as name of primary amine for the longest alkyl chain. Other alkyl chains on the nitrogen atom are treated as substituents and an *N* (underlined when written) is placed before the alkyl chain name.

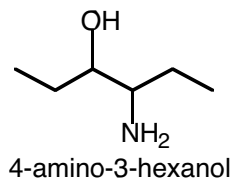
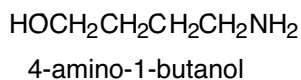


*N*-ethylpropylamine



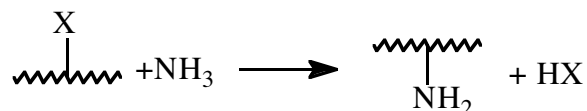
*N,N*-diethylbutylamine

Amines have the lowest priority of any functional group, so when another functional group with priority is present on the parent chain the amine must be named as a substituent. The prefix for amines is "amino".



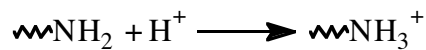
**Synthesis of Amines:** There are several ways of producing amines. Some of them are beyond our scope, or involve compounds we have not discussed yet. Here are a few starting from compound that we have touched on in the past.

Mixing halo alkanes with concentrated ammonia will produce an amine. Before we talk about the reaction, it should be pointed out that the industrial source of methylamine is actually from methanol and ammonia (in the presence of a catalyst and at super-high temperatures). However, the method we will focus on for now is the **ammonolysis of haloalkanes**. This is very similar to the hydrolysis of halo alkanes when done in basic (i.e. OH<sup>-</sup>) solution. The reaction can either cause a substitution (in 1° and 2° halides) or an elimination (in 3° halides). Essentially, the reaction takes place as follows:



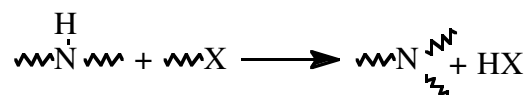
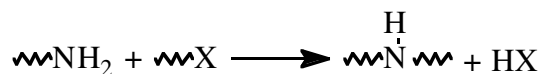
The placement of the amino group on the opposite side of the side chains is relevant. We will see a bit later on that there is a special kind of isomerism (called **stereo** isomerism, or **enantiomeric** isomerism) that comes into play in this type of reaction.

**Reactions of Amines** - Now that we have established how to make amines, the obvious question is what can we do with them. Since they are Brønsted-Lowry bases, they react with acids to produce ammonium ions:

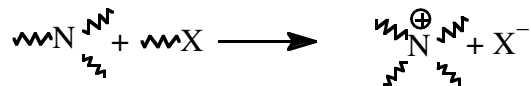


These reactions, though simple are very important biologically, since amines are not very soluble in water, but ammonium is. One could of course produce the amine from an ammonium ion by exposing it to base.

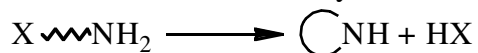
A slight variation is the formation of a quaternary (4°) ammonium ion. To form this, you need a tertiary amine. These are formed by reacting amines with halo alkanes:



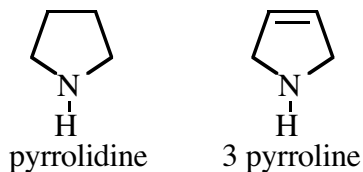
If a third haloalkane is reacted with the 3° amine, a 4° ammonium ion is formed:



**Heterocyclic Amines:** 2° amines do not necessarily have to be made from 2 separate haloalkanes. If the carbon chain is long enough, and there is a halogen at one end, and an amino group on the other, the molecule can form a cyclic amine:



The names of these molecules are usually "common", and do not obey any systematic rules. For example, the following two 5 membered ringed amines:



In addition to the saturated and slightly unsaturated cyclic amines, there are also aromatic ones. In fact, DNA is composed of many of these heterocyclic aromatic compounds. A few of the more common ones are:

