Reductions of carboxylic acid derivatives might be expected to lead either to aldehydes or alcohols, functional groups having a lower oxidation state of the carboxyl carbon. Indeed, carboxylic acids themselves are reduced to alcohols by lithium aluminum hydr...
This is further demonstrated by the last reaction, in which a nitrile is preferentially reduced in the presence of a carbonyl group and two benzene rings. The resulting 1º-amine immediately reacts with the carbonyl function to give a cyclic enamine product (colored light blue).

In most nitrile reductions ammonia is added to inhibit the formation of a 2º-amine by-product. This may occur by way of an intermediate aldehyde imine created by addition of the first equivalent of hydrogen. The following equations show how such an imine species might react with the 1º-amine product to give a substituted imine (2nd equation), which would then add hydrogen to generate a 2º-amine. Excess ammonia shifts the imine equilibrium to the left, as written below.

(1) \[ R-\text{C≡N} + \text{H}_2 \xrightarrow{\text{catalyst}} \text{RCH=NH} \xrightarrow{\text{H}_2} \text{RCH}_2\text{NH}_2 \]

(2) \[ \text{RCH=NH} + \text{RCH}_2\text{NH}_2 \xrightarrow{\text{imine 1º-amine}} \text{RCH=NHCH}_2\text{R} + \text{NH}_3 \xrightarrow{\text{H}_2 \& \text{catalyst}} \text{RCH}_2\text{NHCH}_2\text{R} \]

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