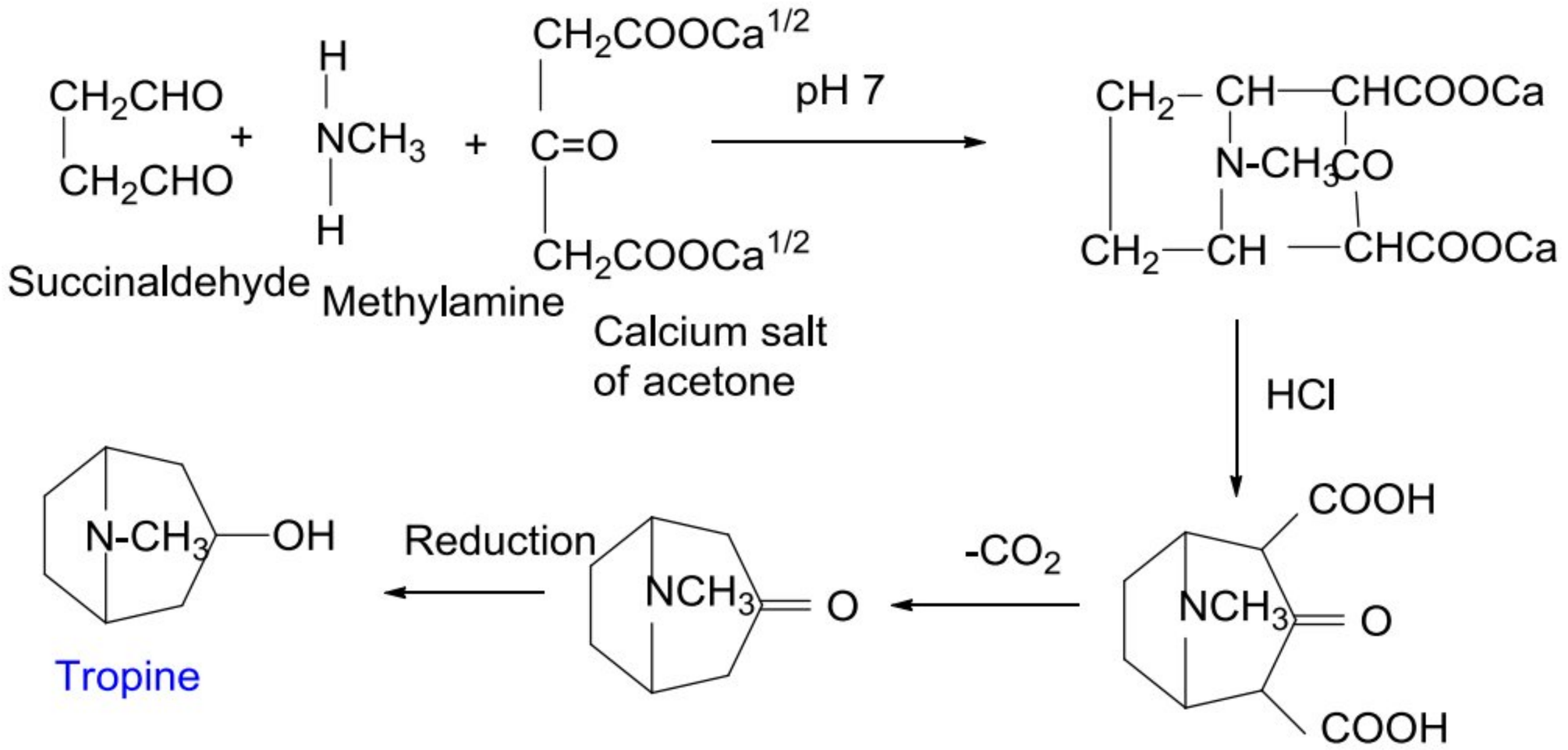
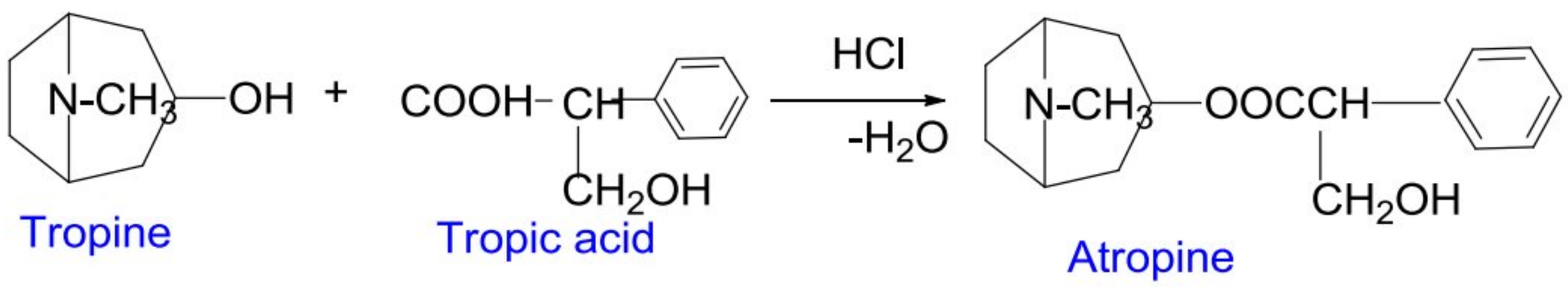
Synthesis of Tropine:



Structure of Atropine:



1.12 COCAINE:

1.12 .1 Introduction: Isolated from the leaves of *Erythroxylon cocaL.*Leaves are powderd and digested with carbonate and water. It is extracted with light petroleum. The alkaloids are removed by adding dil.sulphuric acid. The acid solution is evaporated to yield a crystalline solid of cocaine.

1.12.2 Physical Properties:Colourless crystals, sparingly soluble in water, strong tertiary base.

1.12.3 Constitution of Cocaine:

Molecular formula of cocaine from elemental analysis was found to be $C_{17}H_{21}NO_4$.

Nature of nitrogen atom: It is a strong tertiary base (pK 8.7) and adds one molecule of methyl iodide to form methiodide. It also reacts with cyanogen bromide to give methyl bromide indicating the presence of N-CH_3 group.

$$C_{17}H_{21}NO_4 + CH_3I \longrightarrow C_{17}H_{21}NO_4.CH_3I$$

$$C_{17}H_{21}NO_4 + CNBr \longrightarrow C_{16}H_{18}NO_4.CN + CH_3Br$$

Hydrolysis: When cocaine is heated with water, it is hydrolysed to methanol and benzoyl ecgonine.

$$C_{17}H_{21}NO_4 + H_2O \longrightarrow \underset{\text{Benzoyl Ecgonine}}{C_{16}H_{19}NO_4} + CH_3OH$$

Benzoyl ecgonine mustc ontain a –COOH group. Thus cocaine is the methyl ester of benzoyl ecgonine. It is further proved that when benzoyl ecgonine is heated with methanol it forms cocaine.

When benzoyl ecgonine is boiled with $Ba(OH)_2$ it undergoes hydrolysis yields benzoic acid and ecgonine. But Ecgonine shows reactions of alcohol. Hence, benzoyl ecgonine is the benzoyl derivative of ecgonine.

$$C_{16}H_{19}NO_4 + H_2O \xrightarrow{Ba(OH)_2} \underset{\text{Ecgonine}}{C_9H_{15}NO_3} + \underset{\text{Benzoic acid}}{C_6H_5COOH}$$

a) Constitution of Ecgonine:

Molecular formula of the compound is $C_9H_{15}NO_3$.

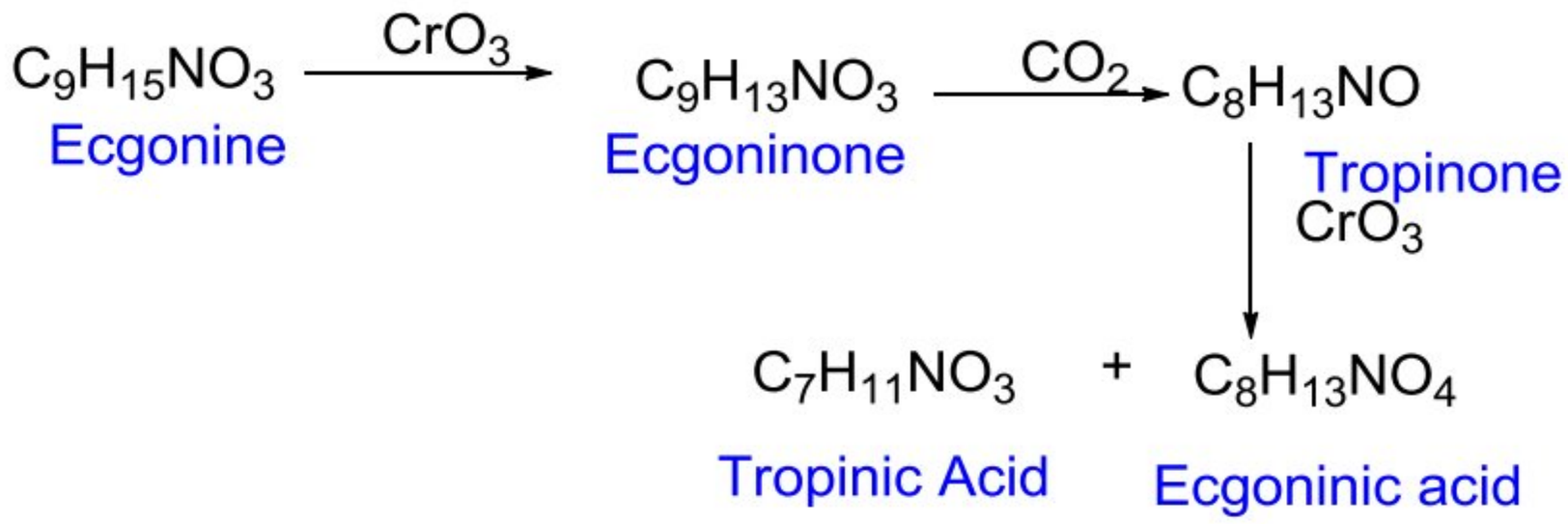
It is a tertiary base as it forms a crystalline solid $C_9H_{15}NO_3.CH_3I$ with methyl iodide.

Ecognine forms an ester and salt with alcohol and alkali it means it contains a carboxyl group.

Presence of –OH group is indicated by its reaction with acid chlorides and anhydrides to form acyl derivative. The acyl derivative can be esterified indicating that ecgonine as both alcohol and an acid.

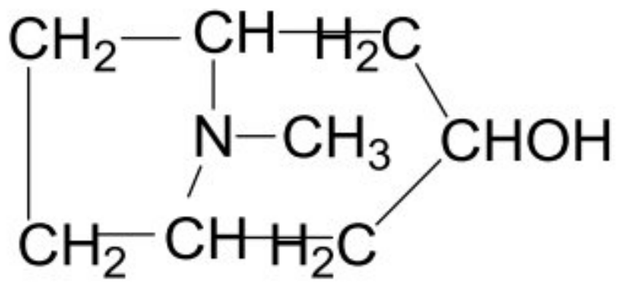
Ecgonine on oxidation yields a ketone, ecgoninone, means ecgonine contains a secondary alcoholic group i.e., –CHOH group.

Ecgonine on oxidation with CrO_3 forms a ketone ecgoninone which soon loses a molecule of CO_2 to form tropinone, further oxidation yields tropinic acid.



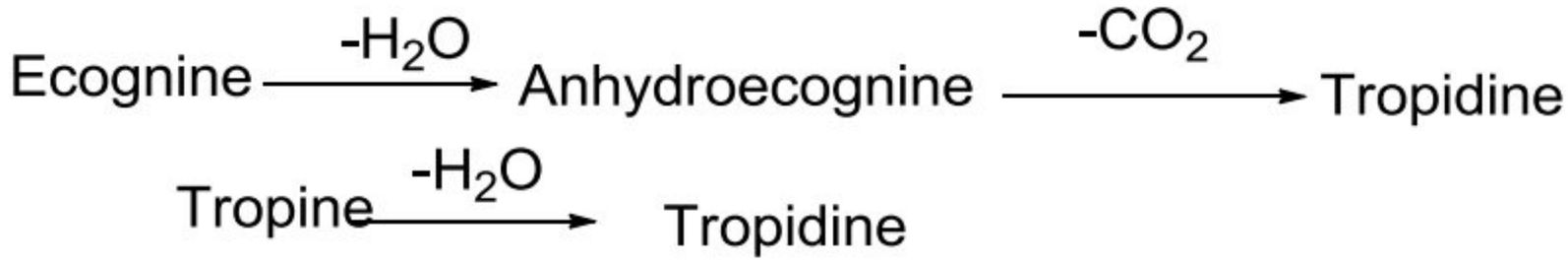
Based on the above reactions,

Ecgonine contains the tropane skeleton.

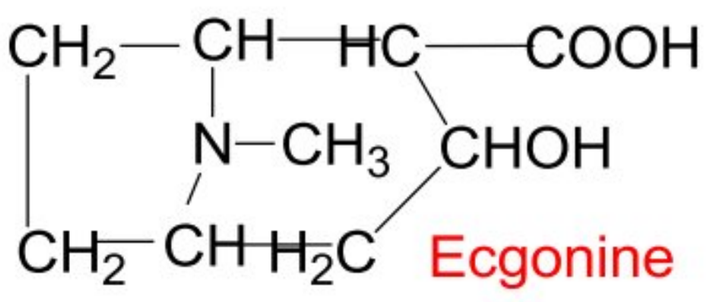


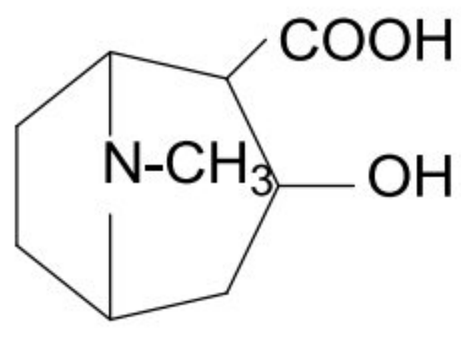
Tropine

Ecgonine undergoes dehydration to form anhydroecgonine which on decarboxylation forms tropidine.

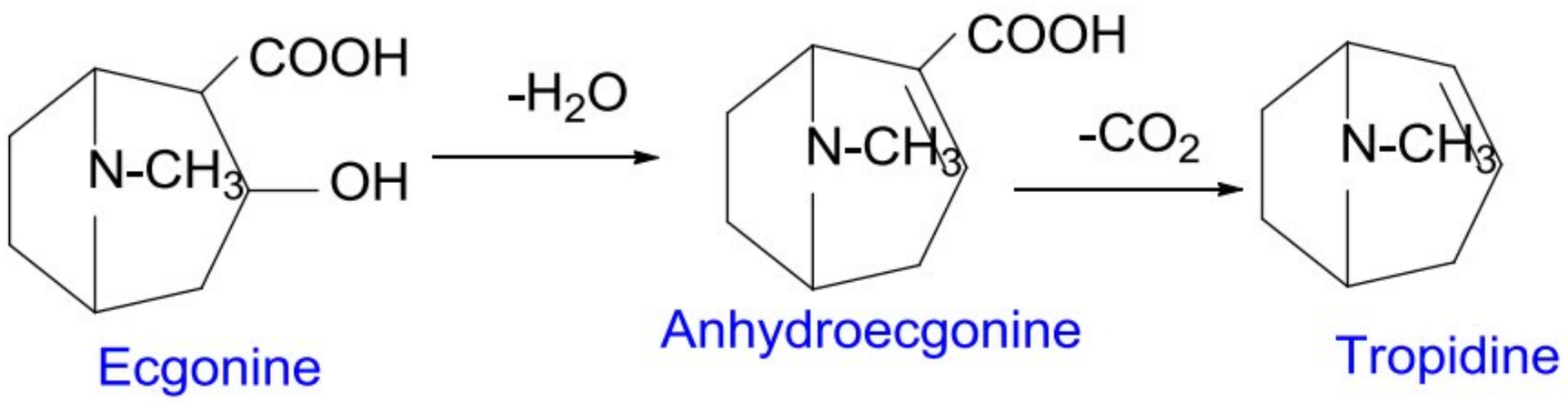


Ecgonine undergoes easy decarboxylation which reveals it is a β-keto acid.

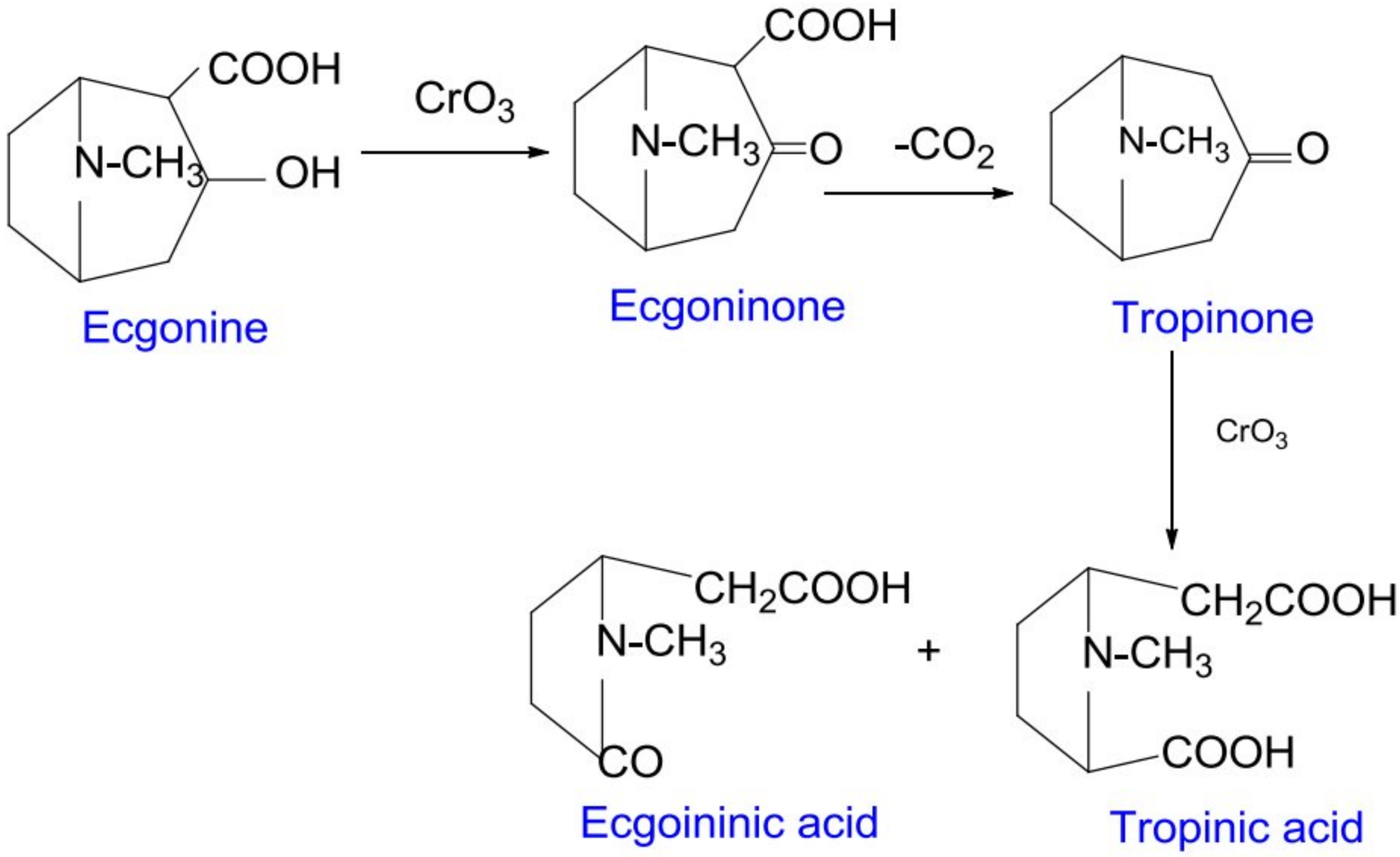




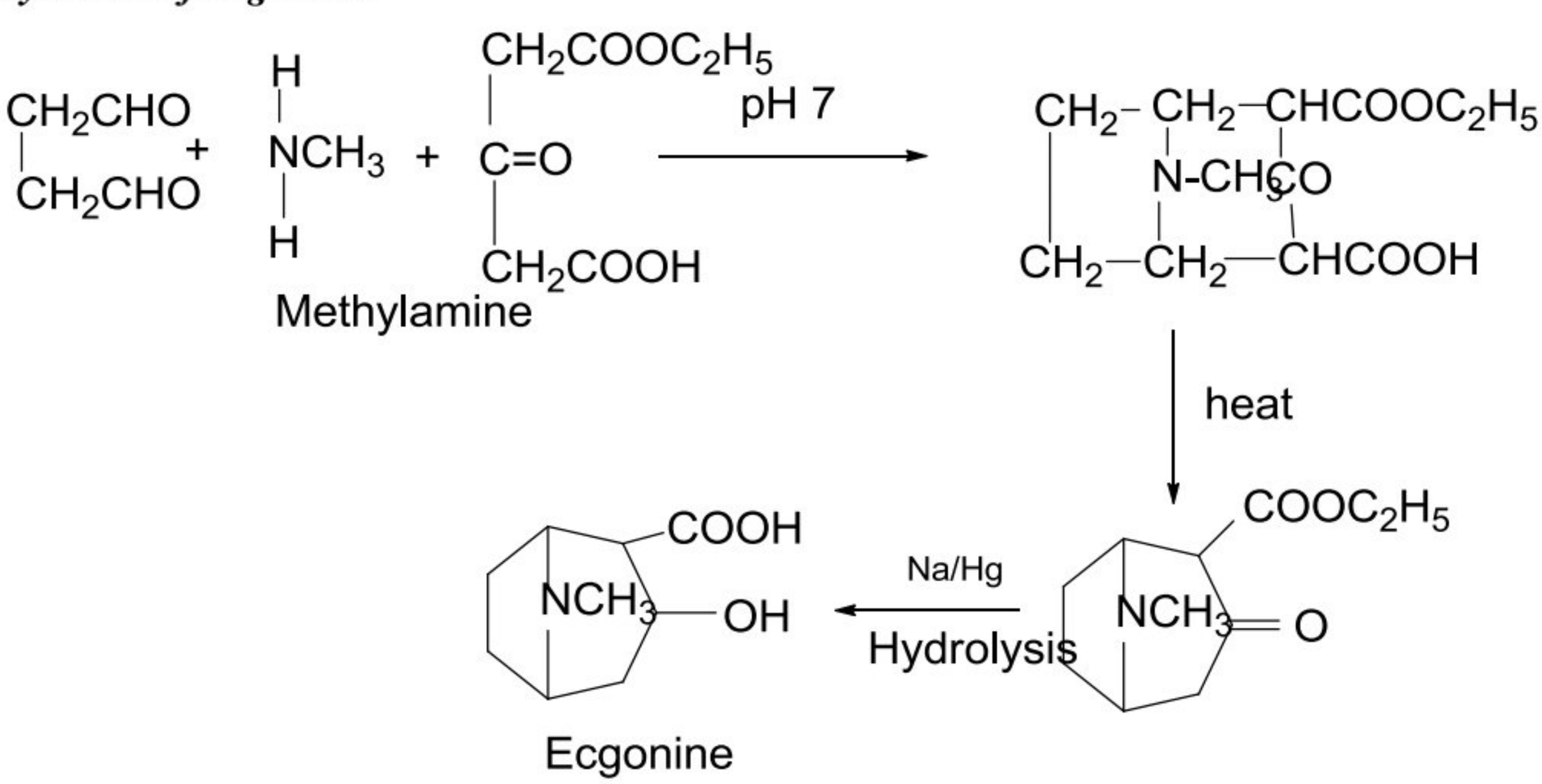
a) Reactions:



b) Reaction 2:



Synthesis of Ecgonine:



Constitution of Cocaine: