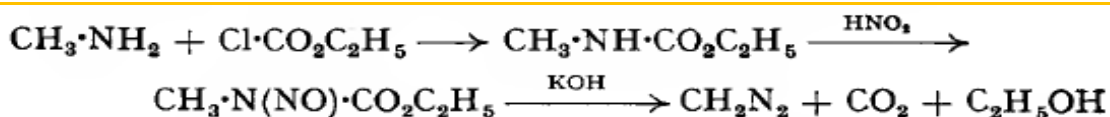


Diazomethane and Diazoacetic Ester

❖ **Preparation of diazomethane:** It may be prepared in various ways;

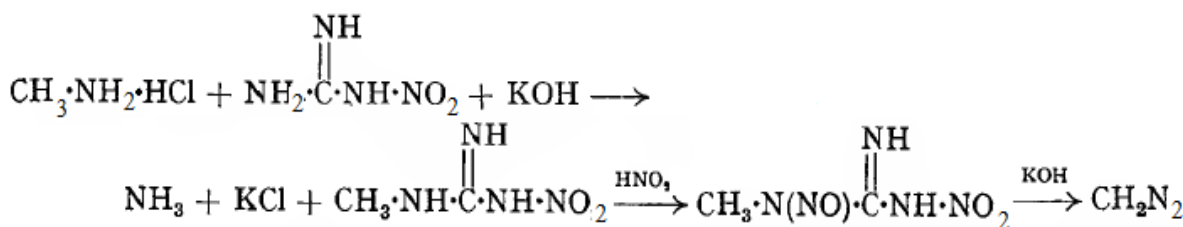
- Method of Von Pechmann:** Methylamine is treated with ethylchloroformate to give N-methylurethan, which on treatment with HNO_2 in ethereal solution, forms N-methyl-N-nitroso-urethan. It decomposes to diazomethane on warming with methanolic KOH.



An improved method starts with methylurea

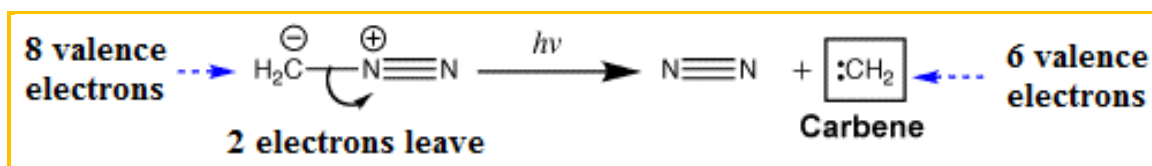


- Method of McKay:** Methylamine hydrochloride and nitroguanidine are allowed to react in KOH solution, the product N-methyl-N-nitroguanidine is treated with nitrous acid to produce the N-methyl-N-nitroso-N-nitroguanidine, which is then warmed with KOH to obtain diazomethane.

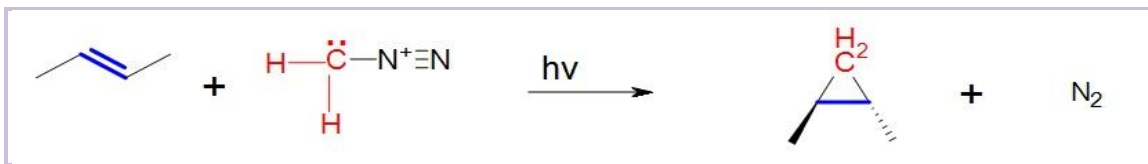
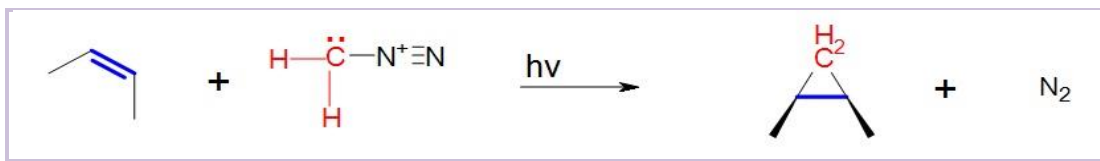


❖ **Reaction:**

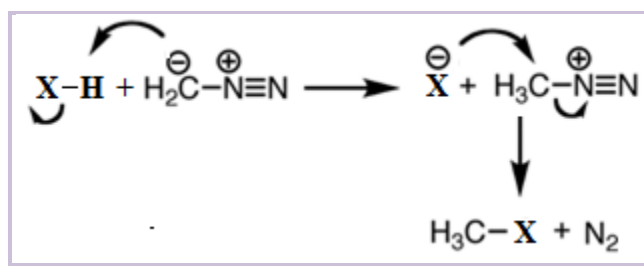
- Photolysis diazomethane leads to formation of carbene



Diazomethane reacts with alkene through the formation of carbene and produces cyclopropane. Cis-2-butene gives *cis*-1, 2-dimethylcyclopropane and trans-2-butene gives trans product.

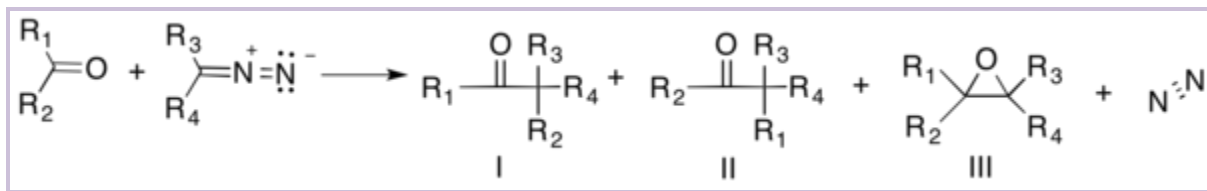


B. When it is treated with halogen acids, methyl halide is formed.



C. The Buchner–Curtius–Schlotterbeck:

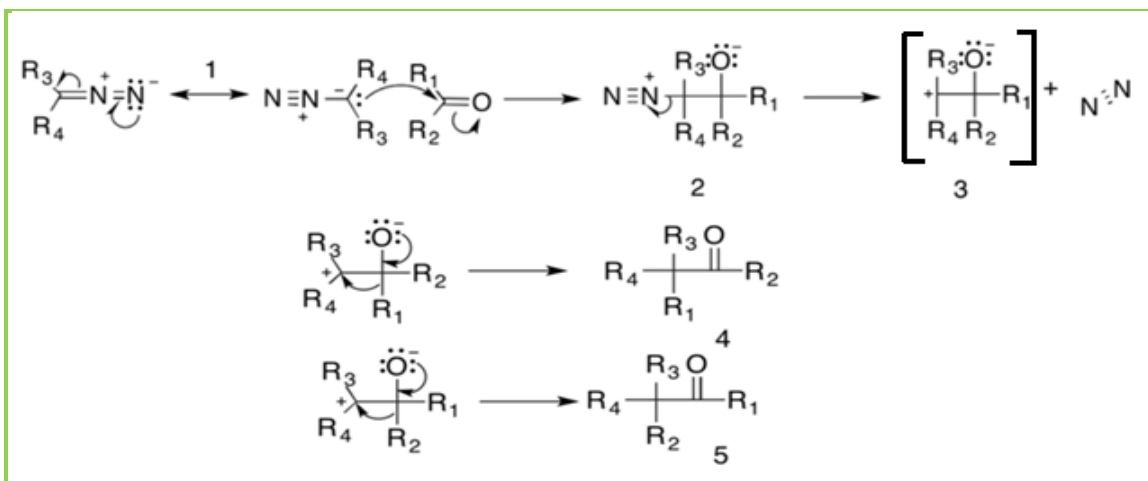
Aldehydes or ketones react with aliphatic diazoalkanes and produce homologated ketones. It was first described by Eduard Buchner and Theodor Curtius in 1885 and later by Fritz Schlotterbeck in 1907. The general reaction scheme is given below;



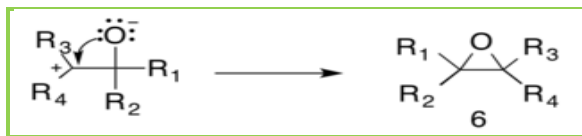
The reaction yields two possible carbonyl compounds (I and II) along with an epoxide (III). The ratio of the products is determined by the reactant used and the reaction conditions.

Mechanism:

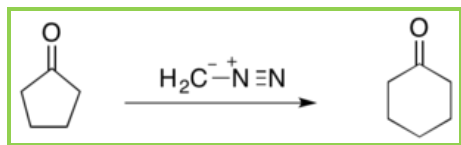
The general mechanism is shown below. The diazo compound attacks on the carbonyl-compound (nucleophilic addition) to produce a tetrahedral intermediate (2) which decomposes by the evolution of nitrogen gas forming the tertiary carbocation. This intermediate (3) then undergoes either an 1,2-rearrangement to form carbonyl compound or epoxidation to produce epoxide. There are two possible carbonyl products: one formed by migration of R_1 (4) and the other by migration of R_2 (5). The relative yield of each possible carbonyl is determined by the migratory preferences of the R-groups.



The epoxide is formed by an intramolecular addition reaction in which a lone pair from the oxygen attacks the carbocation (6).

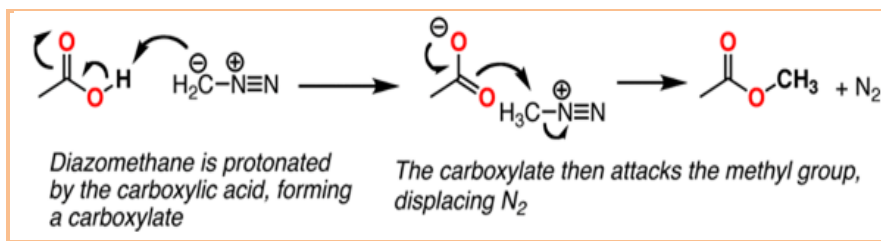


The Büchner-Curtius-Schlotterbeck reaction can be used for one carbon ring expansions when the ketone is cyclic. For example, cyclopentanone reacts with diazomethane to form cyclohexanone (shown below). The Büchner ring expansion reactions utilizing diazoalkanes have proven to be synthetically useful as they can not only be used to form 5- and 6-membered rings, but also more unstable 7- and 8-membered rings.



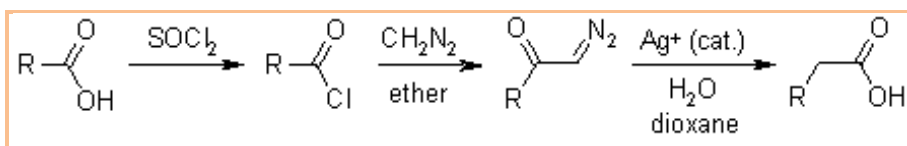
D. Reaction with carboxylic acid:

Diazomethane reacts with carboxylic acid to form carboxylate anion which further attacks CH_3N_2 through $\text{S}_{\text{N}}2$ pathway and produce ester with the evolution of N_2 .



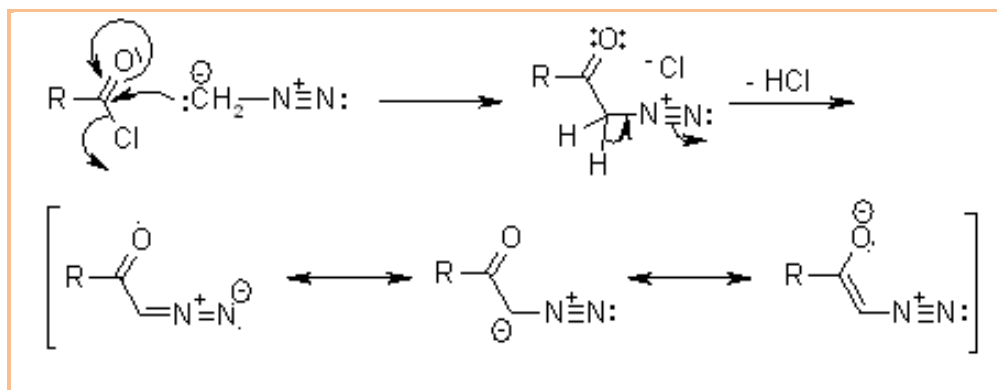
E. Arndt-Eistert Synthesis:

The Arndt-Eistert Synthesis involves the formation of homologated carboxylic acids or their derivatives by the reaction of the activated carboxylic acids with diazomethane and subsequent Wolff-Rearrangement of the intermediate diazoketones in the presence of nucleophiles e.g., water, alcohols, or amine.

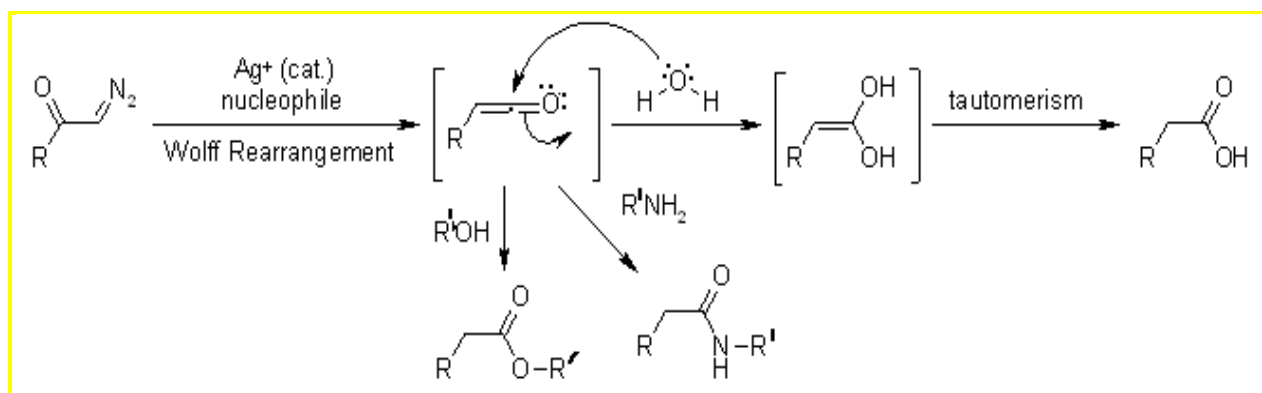


Mechanism:

In the first step, the diazomethane carbon is acylated by an acid chloride or mixed anhydride, to give α -diazoketone. The excess diazomethane can be destroyed by addition of small amounts of acetic acid or vigorous stirring.

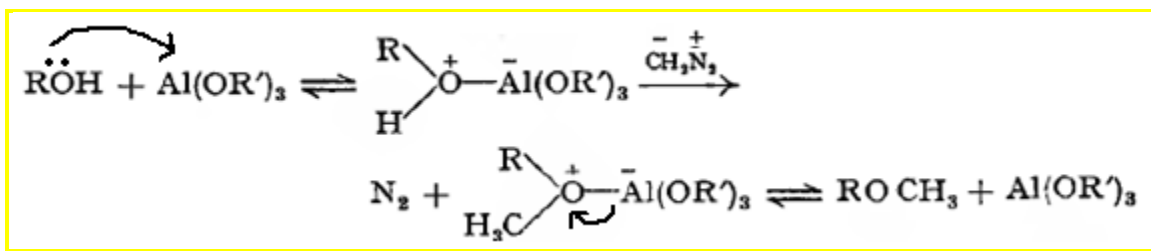


The key step of the Arndt-Eistert Homologation is the Wolff-Rearrangement of the diazoketone to ketenes, which can be accomplished thermally, photochemically or by silver (I) catalysis. The reaction is conducted in the presence of nucleophiles such as water (to yield carboxylic acids), alcohols (to give esters) or amines (to give amides), to capture the ketene intermediate and avoid the competing formation of diketenes.



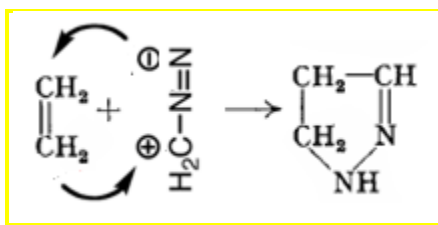
F. Reaction with alcohol:

Alcohols can also be methylated by diazomethane in the presence of a suitable catalyst, *e.g.*, an aluminium alkoxide.

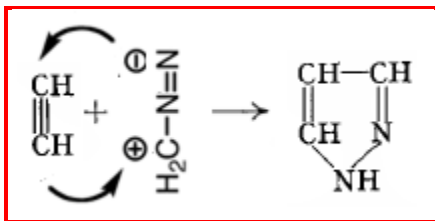


G. Reaction with alkyne and alkyne:

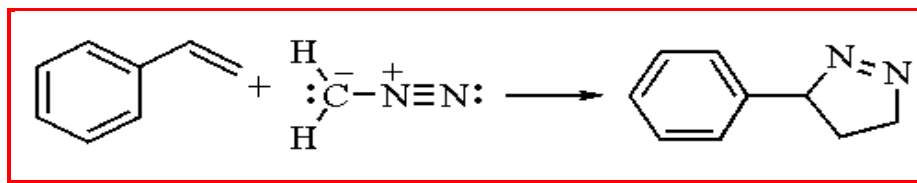
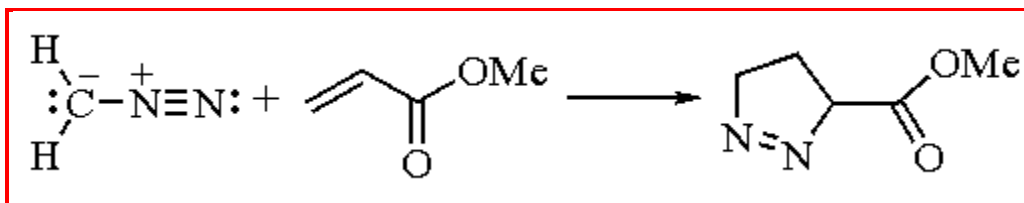
Diazomethane adds to ethylenic compounds to form pyrazoline derivatives; pyrazoline is formed with ethylene.



Diazomethane also adds to acetylenic compounds to form pyrazole derivatives; with acetylene pyrazole is formed.

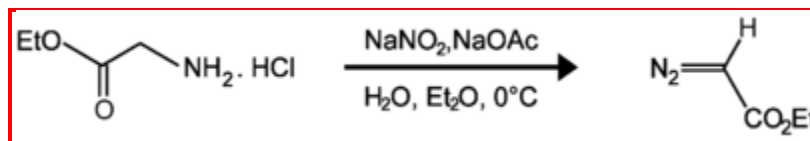


Example:



❖ Preparation of diazoacetic ester:

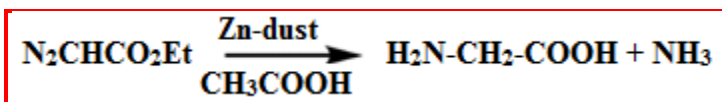
This compound can be prepared by reaction of the ethyl ester of glycine with sodium nitrite and sodium acetate in water.



❖ Reaction:

The reactions of diazoacetic ester are similar to those of diazomethane.

1. It is reduced by zinc dust and acetic acid to ammonia and glycine



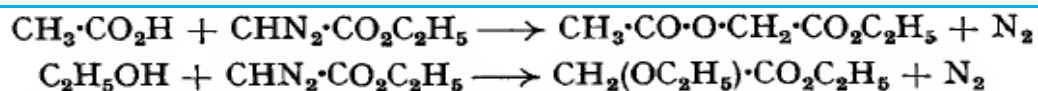
2. When it is boiled with dilute halogen acid, it eliminates nitrogen to form glycollic ester



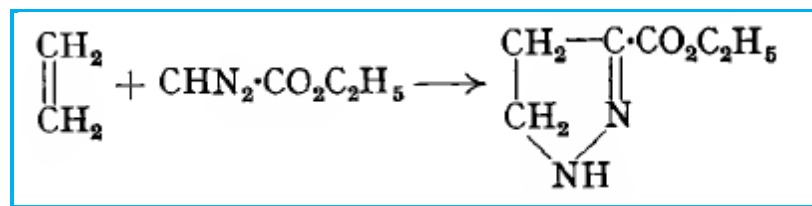
3. When, however, diazoacetic ester is warmed with *concentrated* halogen acid, ethyl halogeno-acetate is formed, *e.g.*,



4. Diazoacetic ester reacts with compounds containing an active hydrogen atom, *e.g.*, it forms acetyl glycollic ester with acetic acid, and the ethyl ether of glycollic ester with ethanol



5. It reacts with ethylenic compounds to form *pyrazoline* derivatives, *e.g.*, with ethylene it forms pyrazoline-3-carboxylic ester



6. With acetylenic compounds it forms *pyrazole* derivatives, *e.g.*, with acetylene, it gives pyrazole-3-carboxylic ester

