Amino alkaloids or alkaloidal amines:

General characteristic features:

Proto-alkaloids

Have no nitrogen as the part of the heterocyclic ring (nitrogen atom found in side chain), so it is called atypical alkaloids

Derived from amino acid like phenyl alanine or tyrosine

Physiologically active compounds:

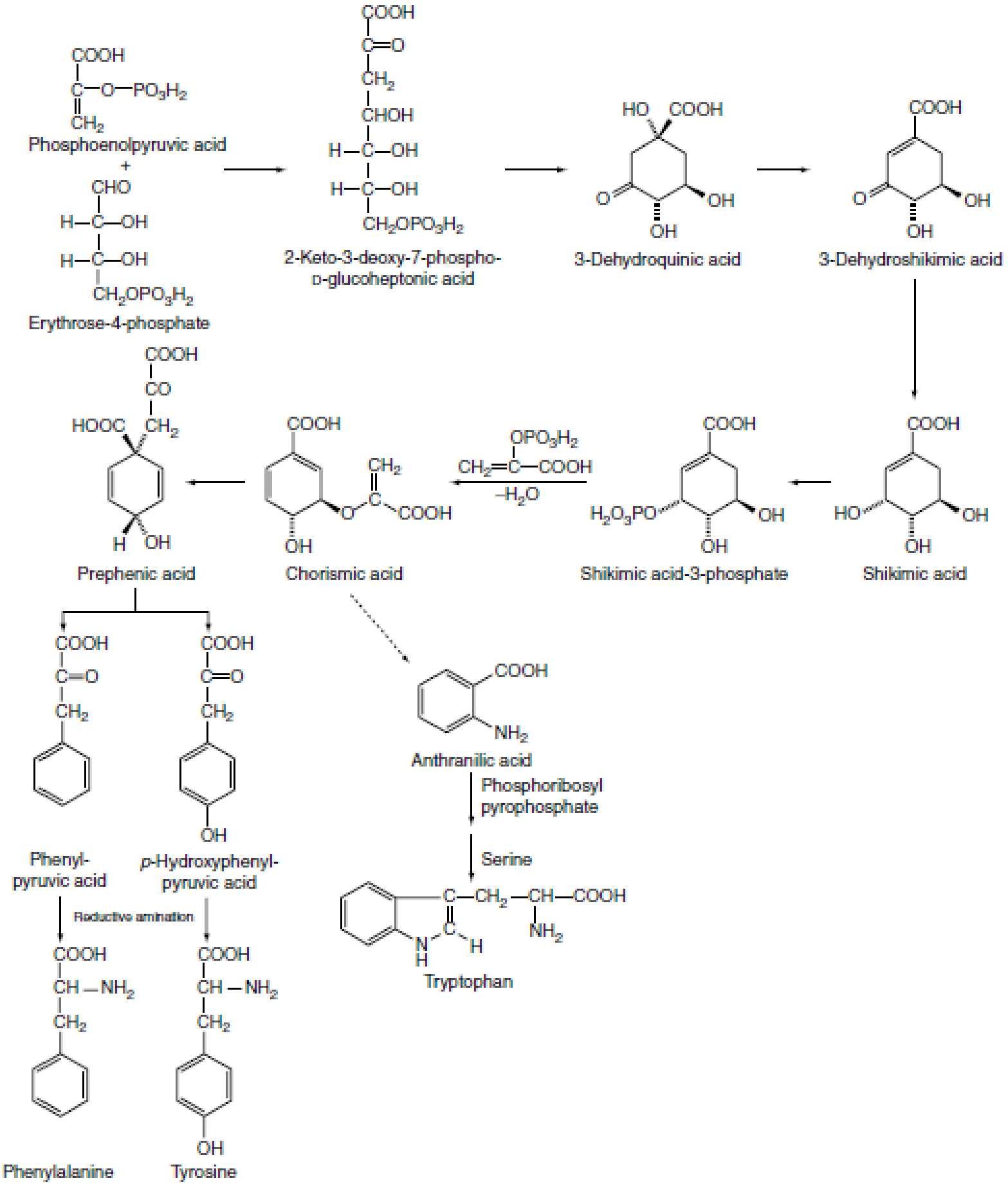
- ❖ Ephedrine (*Ephedra* species)
- ❖ Colchicine (*Colchicum autmnale*)
- ❖ Cathinone (*Catha edulis*).
- ❖ Mescaline (*Lophophora williamsii*).

BIOSYNTHESIS OF AMINO ALKALOIDS:

Amino alkaloids are derived from amino acid through shikimic acid pathway. The pathway finds its route from carbohydrates for the biosynthesis of C6-C3 units (i.e., phenylpropane derivatives) like phenyl alanine and tyrosine.

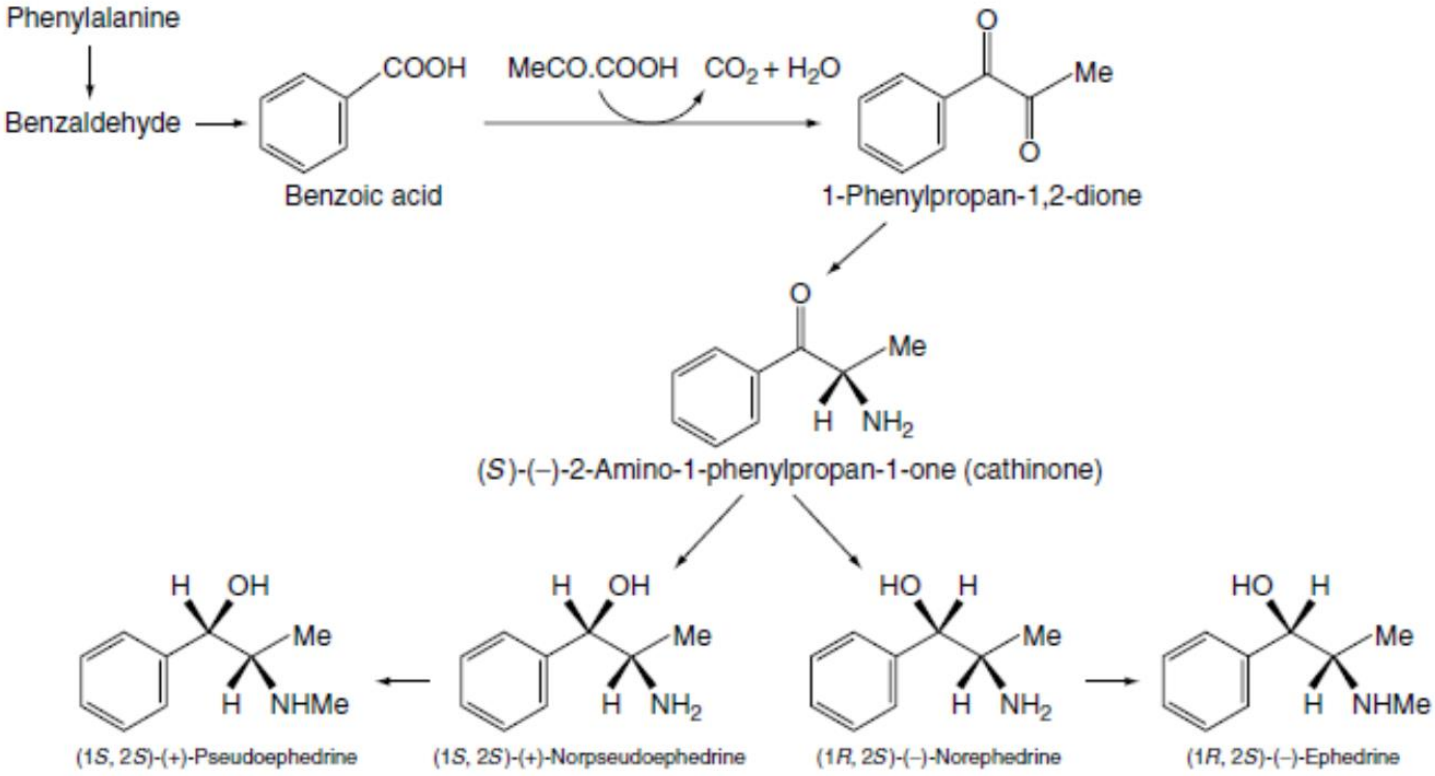
Shikimic acid through a series of phosphorylated intermediates yield chorismic acid which is an important branch-point intermediate. One branch leads to anthranilic acid then to tryptophan. The other leads to prephenic acid which is the last non aromatic compound in the sequence.

Prephenic acid can be aromtized in 2 ways. The first proceeds by dehydration and simultaneous decarboxylation to yield phenyl pyruvic acid, the direct precursor of phenylalanine. The second occurs by dehydrogenation & decarboxylation to give p-hydroxy phenyl pyruvic acid, the precursor of tyrosine.


Phosphoenolpyruvic acid
+
Erythrose-4-phosphate
2-Keto-3-deoxy-7-phospho-D-glucoheptonic acid
3-Dehydroquinic acid
3-Dehydroshikimic acid
Shikimic acid
Shikimic acid-3-phosphate
–H2O
Chorismic acid
Prephenic acid
Anthranilic acid
Phosphoribosyl pyrophosphate
Serine
Tryptophan
Phenyl-pyruvic acid
p-Hydroxyphenyl-pyruvic acid
Reductive amination
Phenylalanine
Tyrosine

Ephedra:

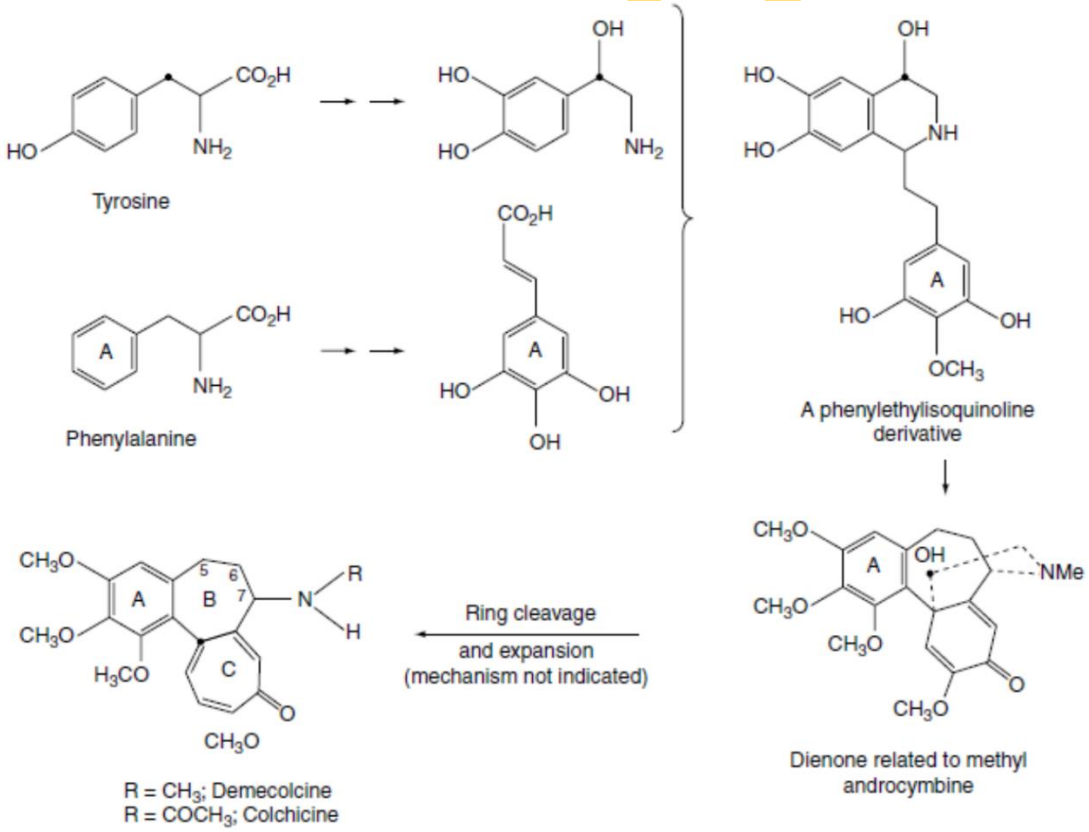
It consists of dried young stems of *Ephedra gerardiana* F. (Ephedraceae). Ephedrine is produced either by extraction of plant material or by chemical procedure or could be produced by fermentation of sugar in the presence of benzaldehyde & methyl amine. By using 13C- and 2H-labelled precursors in feeding experiments have shown that benzoic acid combines with the intact CH_3CO group of pyruvic acid to form ephedrine and related alkaloids with 1-phenylpropan-1,2-dione and (S)-(−)-2-amino-1-phenylpropan-1-one (cathinone) serving as intermediates.

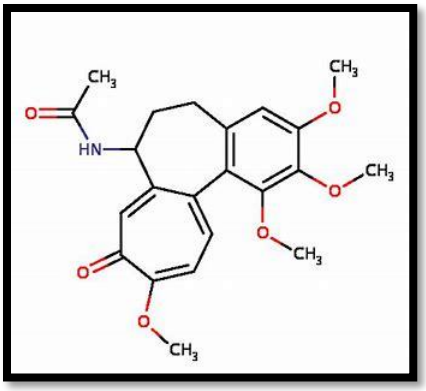


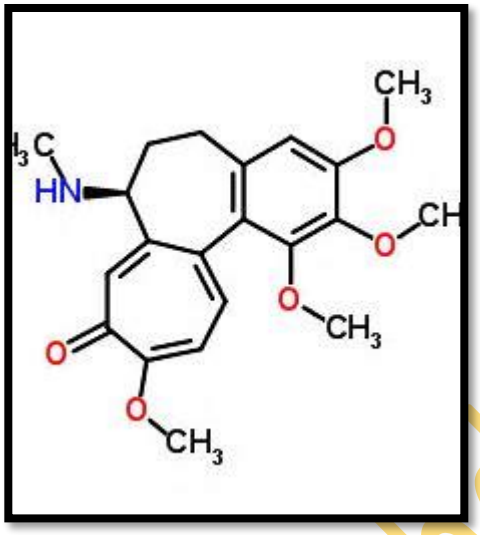
Ephedrine is an adrenergic compound used as Bronchodilator in asthma, it is a potent Sympathomimetic. It excites the sympathetic nervous system cause vasoconstriction, cardiac stimulation & rise in blood pressure. It works mainly by increasing the activity of nor epinephrine (nor adrenaline) on adrenergic receptors. It is used as a stimulant, concentration aid, decongestant, appetite suppressant & to treat hypotension associated with anesthesia also in the treatment of allergic conditions like hay fever.

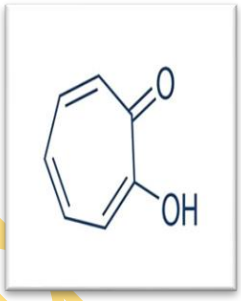
Colchicum:

It consists of dried ripe seeds and fresh or dried corms of *Colchicum autumnale* Family: Liliaceae. The main alkaloids found in this plant Colchicine which is used in the treatment of gout. Colchicine lacks basicity & does not form a well-defined series of salts as do other alkaloids, it is used in gout to increase the secretion of Uric acid









colchicine Structure **demecolcine structure** **tropolone ring**

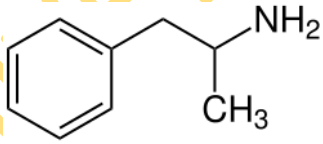
Ring A and carbons 5, 6 and 7 are derived from phenylalanine; the tropolone moiety arises from tyrosine by ring cleavage followed by closure to give a seven-membered ring. In contrast to mold metabolism, acetate does not contribute directly to the tropolone ring but is merely effective in supplying the N-acetyl group. An intermediate formed early in the pathway as the result of union of the two amino acids is a 1-phenylethylisoquinoline derivative.

Khat or Abyssinian tea:

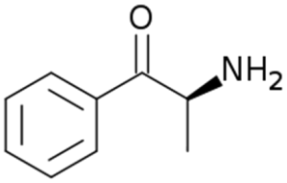
This consists of the fresh leaves of Catha edulis. (Celastraceae).

Khat contains a potent phenylalkylamine alkaloid called (Cathinone). It has pharmacologic properties analogous to those of amphetamine and is of similar potency with a similar mechanism of action. the alkaloid cathinone, a stimulant, cause excitement, loss of appetite, and euphoria.

The World Health Organization (WHO) classified it in 1980 as a drug of abuse that can produce psychological dependence, although the WHO does not consider khat addiction to be a serious problem.

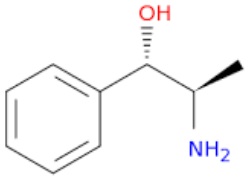


Amphetamine

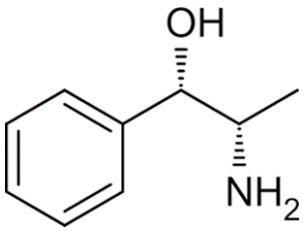


Cathinone

Cathinone is not very stable and breaks down to produce cathine and nor ephedrine. These chemicals belong to the PPA (phenylpropanolamine) family, a subset of the phenethylamines related to amphetamines and the catecholamines epinephrine and norepinephrine.



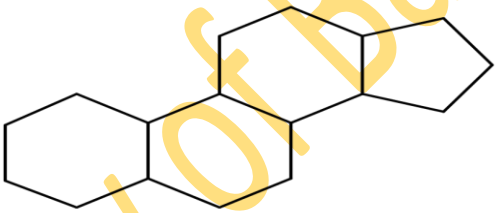
norephedrine



Cathine

Steroidal Alkaloids:

- These contain the **perhydrocyclopentano-phenanthrene skeleton** characteristic of sterols.
- They usually occur in **glycosidal combination** with sugars and thus called **glucoalkaloids** e.g. *Solanum* and *Veratrum* alkaloids.

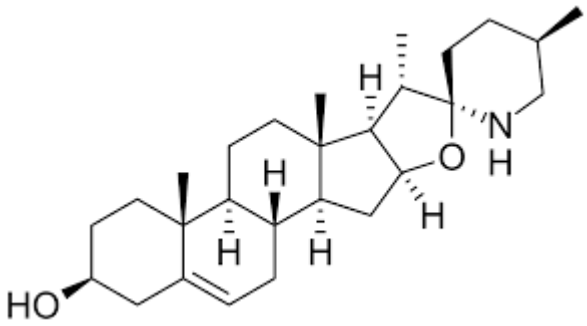


Cyclopentaphenanthrene

1- *Solanum* alkaloids

many plants belonging to *Solanaceae contains several steroidal alkaloids based on C27 cholestane skeleton such as solasodine* , tomatidine, solanidine. These alkaloids usually occur in genus *Solanum (exp. S. nigrum, S. oviculare*)

Solasodine is a poisonous alkaloid chemical compound that found in plants of Solanaceae family . Solasonine and solamargine are glyco alkaloid derivatives of solasodine. Solasodine is teratogenic used as precursor for the production of steroidal compounds like contraceptive pills.



Solasodine

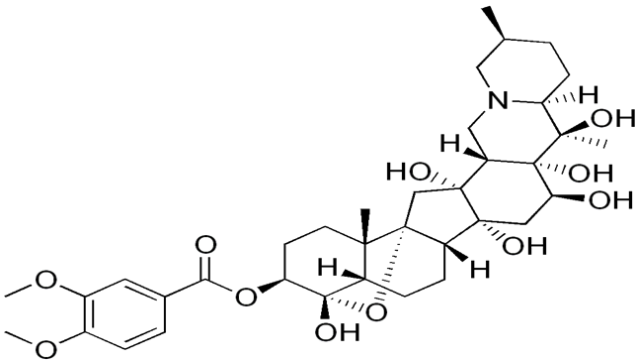
2- *Veratrum* alkaloids (Hellebore)

contain highly toxic steroidal alkaloids that activate sodium ions channels and cause rapid cardiac failure and death if ingested, all parts of plant are poisonous specially root & rhizomes.

They are of 3 types:

1. Group 1 consists of esters of steroidal bases (alkamines) with organic acids like cevadine, germidine, veratridine
2. Group 2 consists of glucosides of the alkamine like pseudo jervin & veratrosine
3. Group 3 consists of the alkamines themselves like germine, jervine, veratramine

The 1st group only is pharmacologically active & used as hypotensive and cardiac depressant and sedative.



veratridine