



TERPENOIDS

COMPOUNDS DERIVED FROM MEVALONIC ACID

- The largest and most variable group of natural compounds (monoterpenes, sesquiterpenes, diterpenes, sesterpenes, triterpenes, polyterpenes)
- Relative both in general biosynthetic origin and reciprocal structural relationship
- Formed by multiples of five carbon unit
- Pyrolysis produces carbohydrate isoprene (2-methylbutadiene) → isoprenoids. Isoprene is not a natural compound.



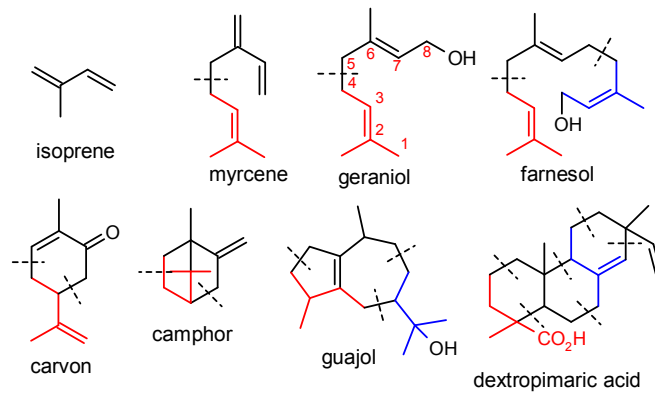
TERPENOIDS - OCCURRENCE

- Prevalent majority of terpenoids is found free in plant tissues (Lamiaceae, Asteraceae, Rosaceae, Rutaceae, Apiaceae....)
- Exceptionally glycosides
- Esters with organic acids
- Combination with proteins

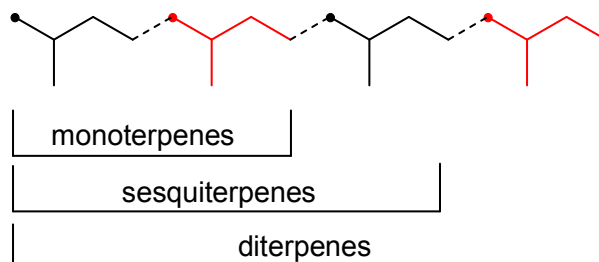
- Lower members of group (C_{10} and C_{15} substances) are volatile – distillation with water steam (hydrodistillation) (essential oils – olea etherea, Etheroleum menthae)
- Higher members (C_{20} and more) are not volatile – extraction with organic solvents



ISOPRENE RULE

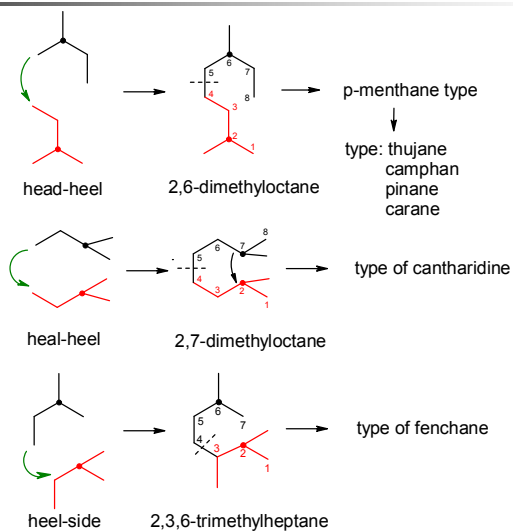


WAYS OF C₅ UNITS CONDENSATION „HEAD – HEEL“





WAYS OF C₅ UNITS CONDENSATION

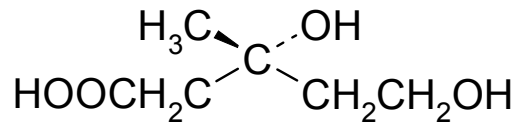


BASIC SUBDIVISION OF NATURAL TERPENOIDS

LABELING	NUMBER OF C ₅	OCCURRENCE
HEMITERPENES	1	constituent of ergot alkaloids; some C ₅ acids
MONOTERPENES	2	volatile constituents of essential oils (geraniol, menthol, camphor)
SESQUITERPENES	3	constituents of essential oils (farnesol, farnesen); some bitter substances (artabsin)
DITERPENES	4	constituents of essential oils, resins, balsams (for example abietic acid); vitamin A; gibberellins (phytohormones); constituent part of some alkaloids (<i>Aconitum</i>); phytol (building block of chlorophylls)
TRITERPENES	6	squalene; pentacyclic triterpenes; steroids; cardioactive glycosides; some bitter substances
TETRATERPENES	8	carotenoids; xanthophylls; some lipophilic plant pigments
POLYTERPENES	n	cautchuc (cis) gutta-percha (trans)



BIOGENETIC ORIGIN

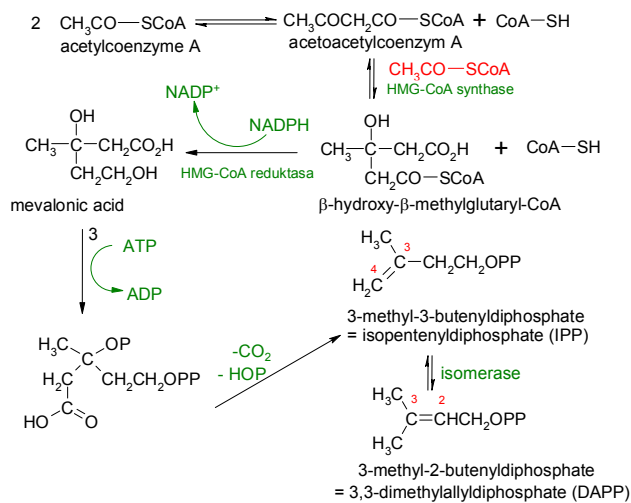


(R)-mevalonic acid



BIOGENETIC ORIGIN OF IPP (1)

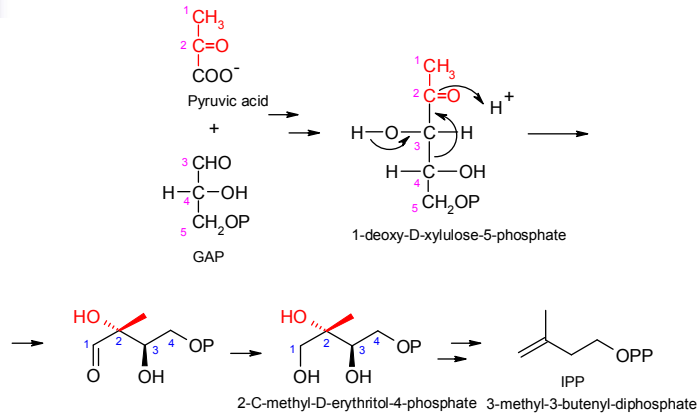
(takes place in cytoplasm of plant cell)





BIOGENETIC ORIGIN OF IPP (2)

(takes place in plastides)

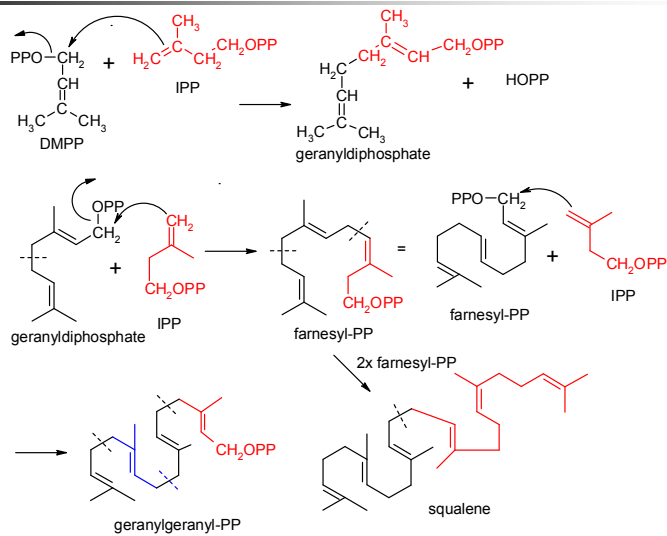


Lange B.M., Croteau R.: *Biochem. Biophys.* 365 (1), 170-174 (1999)

Isoprenoid biosynthesis via a mevalonate-independent pathway in plants: Cloning and heterologous expression of 1-deoxy-D-xylulose-5-phosphate reductoisomerase from peppermint.

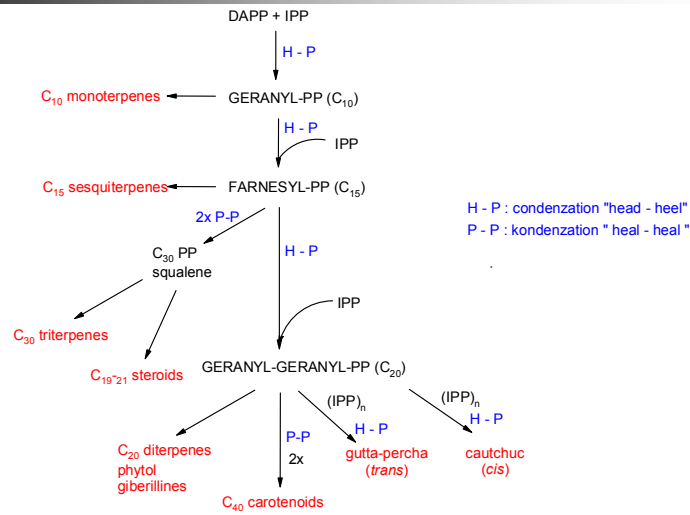


POLYMERISATION REACTIONS

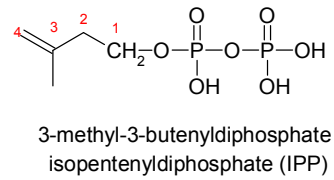
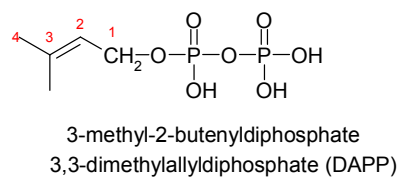
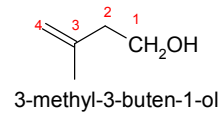
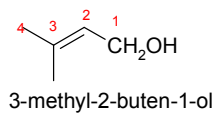




FORMATION OF BASIC TERPENOIDS

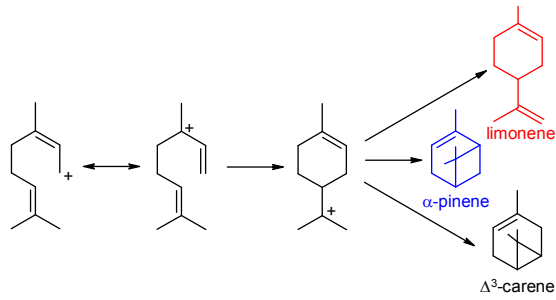
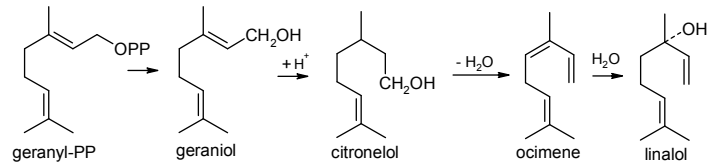


HEMITERPENES

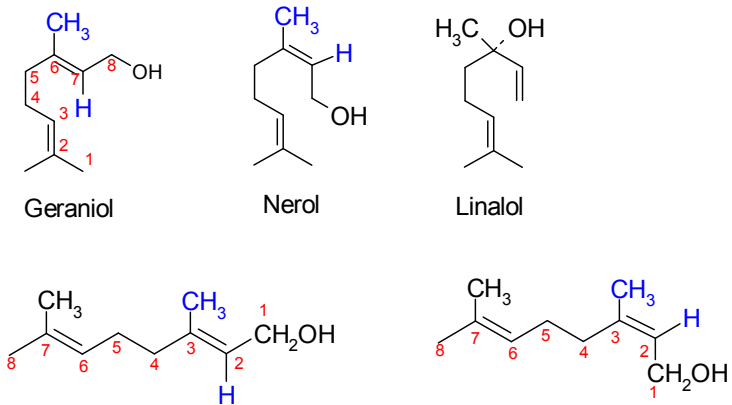




MONOTERPENES

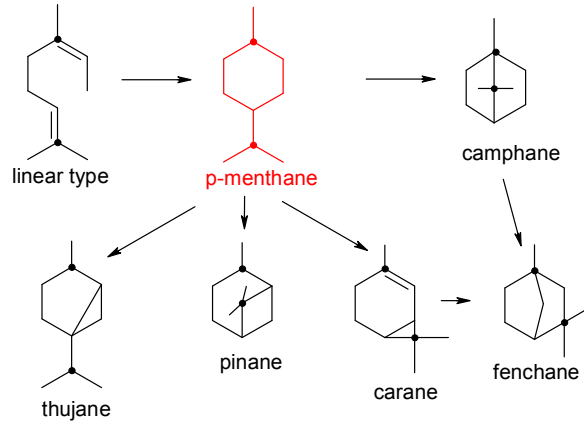


GERANIOL; NEROL; LINALOL

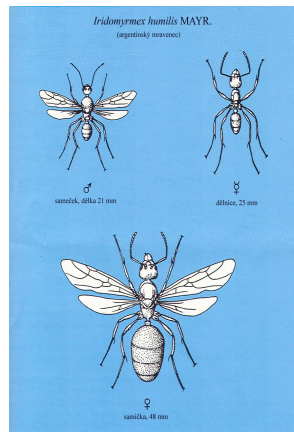
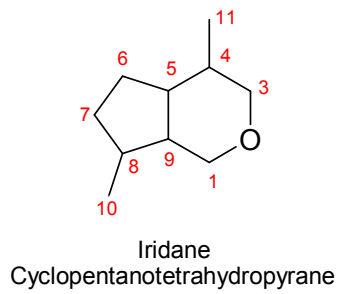




BICYCLIC MONOTERPENES

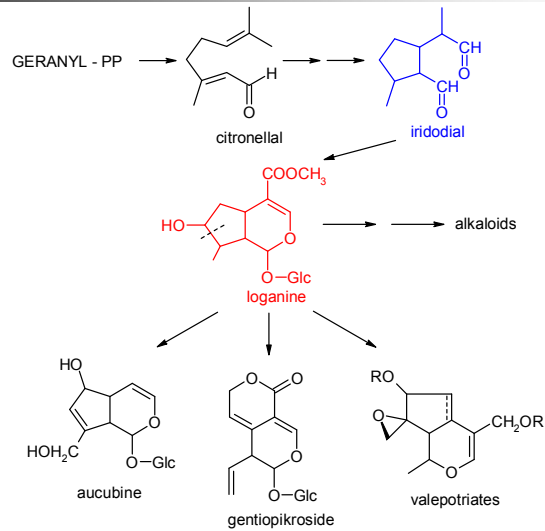


IRIDOIDS





IRIDOIDS

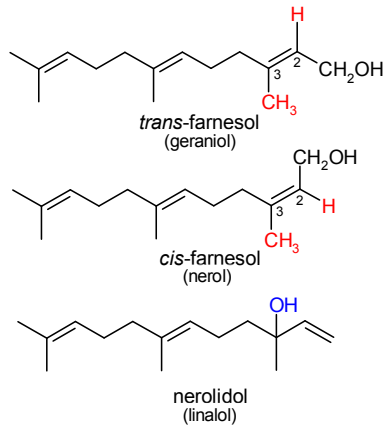


SESQUITERPENES

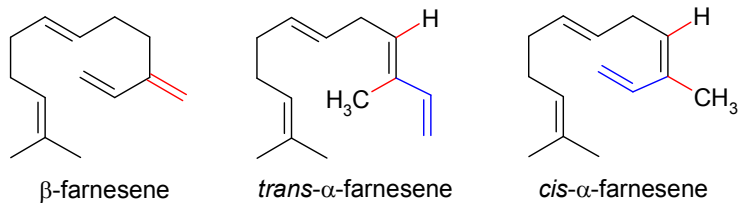
- THE MOST WIDESPREAD GROUP OF NATURAL COMPOUNDS
- GENERAL ORIGIN IN ORIGINAL CATIONOID PRECURSORE
- BETWEEN SINLE GROUPS SHARP DISTINCTIONS
- OCCURENCE OF SOME GROUPS CHEMOTAXONOMICALLY LIMITED TO CERTAIN PLANT SPECIES
- USEABLE FOR CHEMOTAXONOMY



ACYCLIC SESQUITERPENES

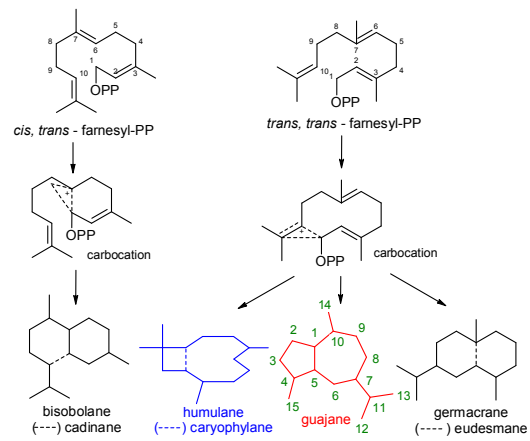


SESQUITERPENIC CARBOHYDRATES

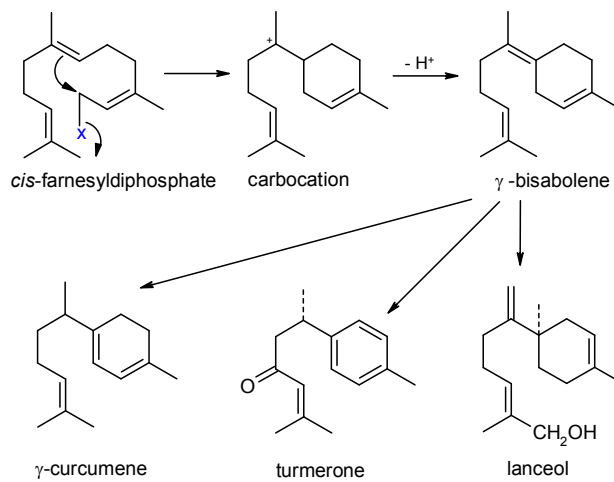




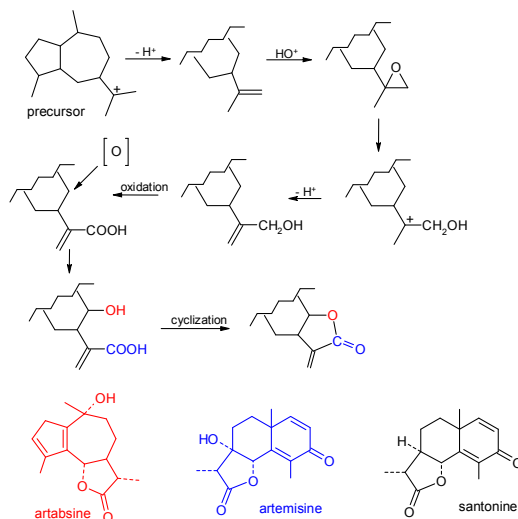
CYCLIC SESQUITERPENES



γ -BISABOLENE



SESQUITERPENIC LACTONES (Asteraceae)



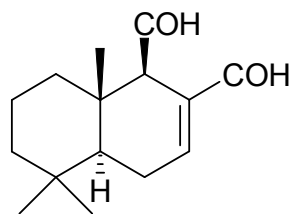
ANTIFEEDANTS

Sesquiterpenic dialdehyde

Plants of Polygonaceae,
Canellaceae, Winteraceae
families

Molluscs (class *Arthropoda*)

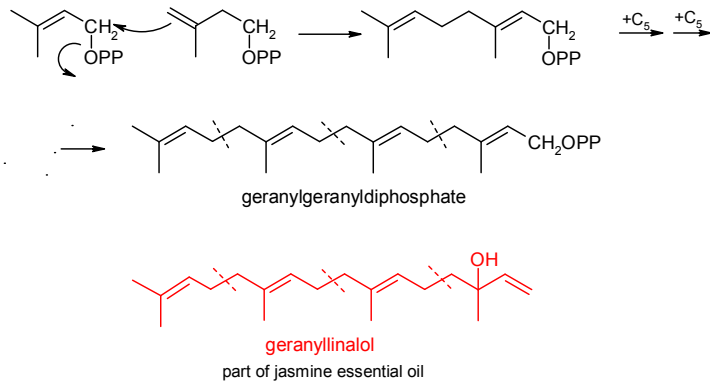
Only once the fish try to
eat...



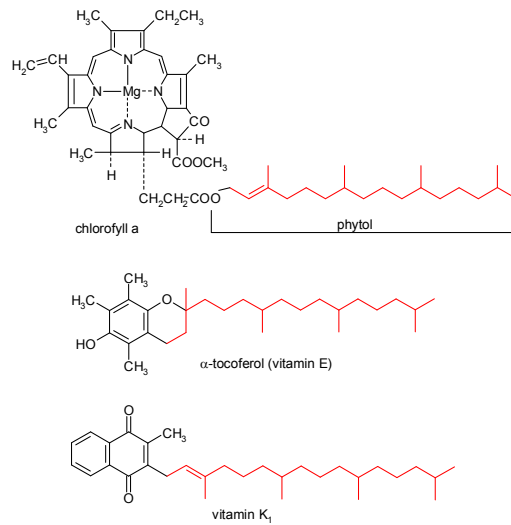
Polygodial



DITERPENES



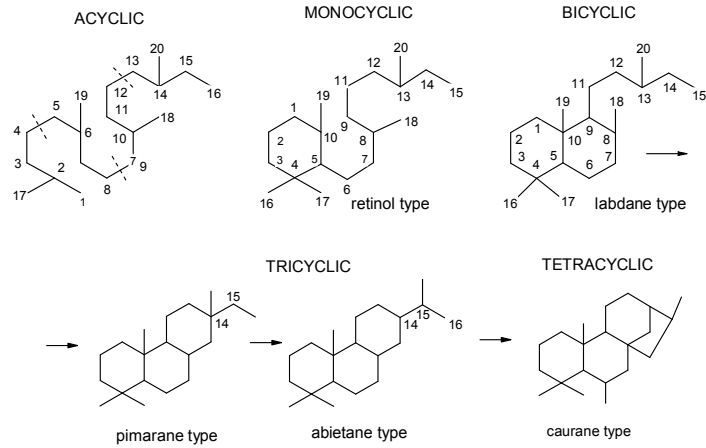
DITERPENES



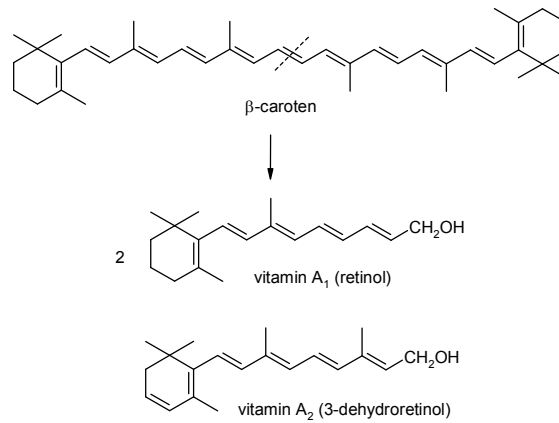


BASIC TYPES OF CYCLIC DITERPENES

DITERPENES

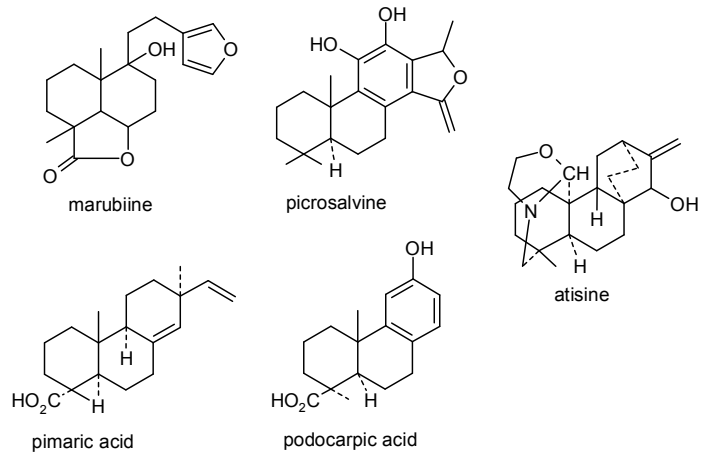


MONOCYCLIC DITERPENES

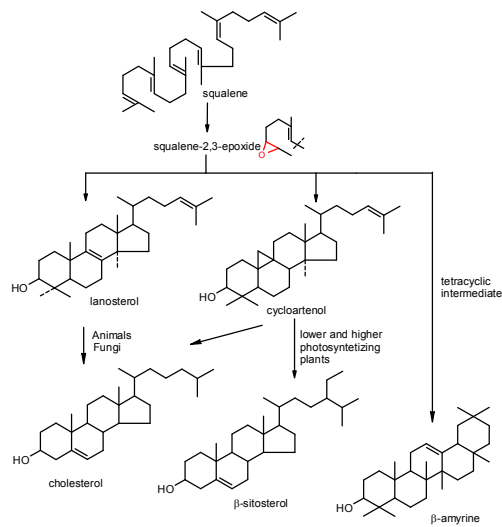




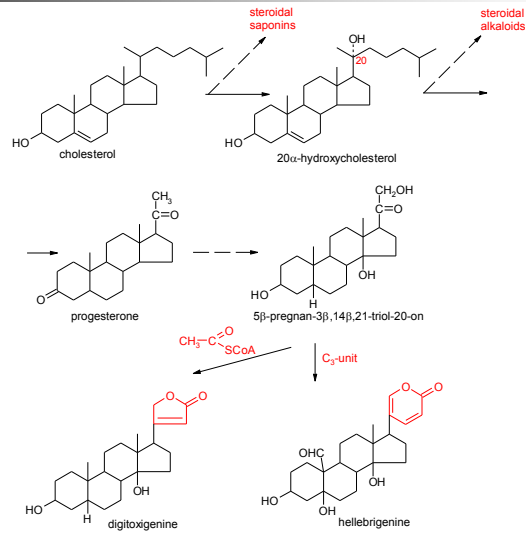
BICYCLIC AND POLYCYCLIC DITERPENES



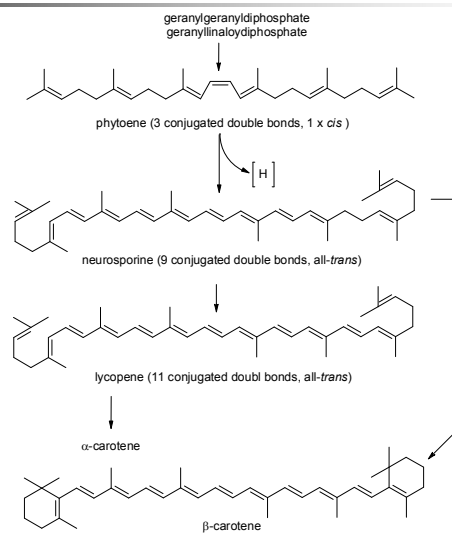
TRITERPENES



FORMATION OF AGLYCONS OF CARDIOACTIVE GLYCOSIDES

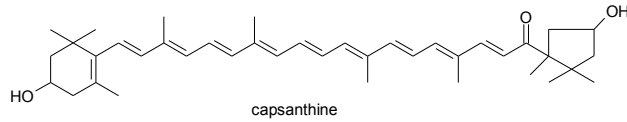


BIOSYNTHESIS OF TETRATERPENS

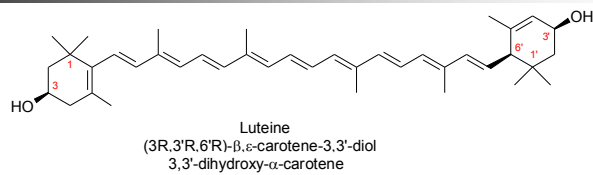




TETRATERPENES



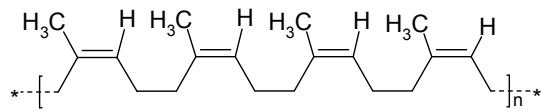
TETRATERPENES



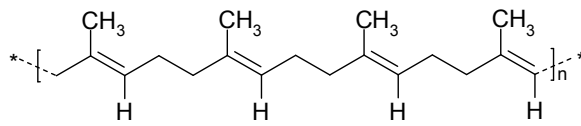
- Belongs to carotenoids of xanthophyll group
- Contains the same chromophore as α -carotene, it is isomeric with zeaxanthine.
- Yellow pigment, present together with carotene and chlorophyll in all green plant parts
- Present in many yellow and red flowers and fruits, it was observed also in animals, for example in feathering, yolk, and in corpus luteum.
- Can be present as free substance or as ester; it possesses no activity of vitamin A.
- Luteine was firstly obtained in crystalline state 1907 by Willstätter from stinking nettle, later from chicken yolk. Structure was resolved by P. Karrer in 1951.
- Protectum, Vitalux Plus 6, Ocuville ... macular defects of eye.



POLYTERPENES



cautchuc (all - *cis*)
degree of polymerisation 20.000



gutta-percha (all - *trans*)
degree of polymerisation 2.000