Organic Chemistry of Natural Products

2 – Terpenes (terpenoid)

Examples of terpenes



pinene



limonene

но

geraniol



citral









camphor

menthol

β-selinene

cafestol



Jerehensen

β-carotene

retinol



🗳 Isoprene units

Classification of terpenes

Solution of terpene biosynthesis

key starting materials and intermediates:







mevalonic acid



acetyl-CoA

pyruvic acid

ÔН

0 -он ŌН ОН

dimethylallyl pyrophosphate (**DMAPP**)

О О

isopentenyl pyrophosphate

(IPP)

OH

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arphi Biosynthesis of isopentenyl pyrophosphate (IPP) via the mevalonate pathway ()





Biosynthesis of isopentenyl pyrophosphate (IPP) via the non-mevalonate pathway

E1: 1-deoxy-D-xylulose 5-phosphate synthase (DXP synthase) E2: 2-C-methyl-D-erythritol 4-phosphate synthase;

E5: 2-C-methyl-D-erythritol-2,4-cyclodiphosphate synthase (IspF) E6: 4-hydroxy-3-methylbut-2-enyl diphosphate synthase (IspG)

E7: 4-hydroxy-3-methylbut-2-enyl diphosphate reductase (IspH)

1-deoxy-D-xylulose 5-phosphate reductoisomerase (IspC) E3: 4-diphosphocytidyl-2-C-methyl-D-erythritol synthase (IspD) E4: 4-diphosphocytidyl-2-C-methyl-D-erythritol kinase (IspE)

E8: isopentenyl diphosphate isomerase (IPP isomerase)



 \mathcal{L} Maturation of monoterpenes - E/Z isomerization, cyclization, and rearrangement (④)

 \mathbf{V} E/Z isomerization (4)-1)

Ρ n

geranyl pyrophosphate GPP

neryl pyrophosphate NPP



a-terpineol

α-phellandrene



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Maturation of sesquiterpenes - further complicated structures



cis-humulyl cation

squalene

farnesyl pyrophosphate FPP



Synthesis of squalene, the precursor of triterpene



Summary