

Mevalonic Acid Pathway

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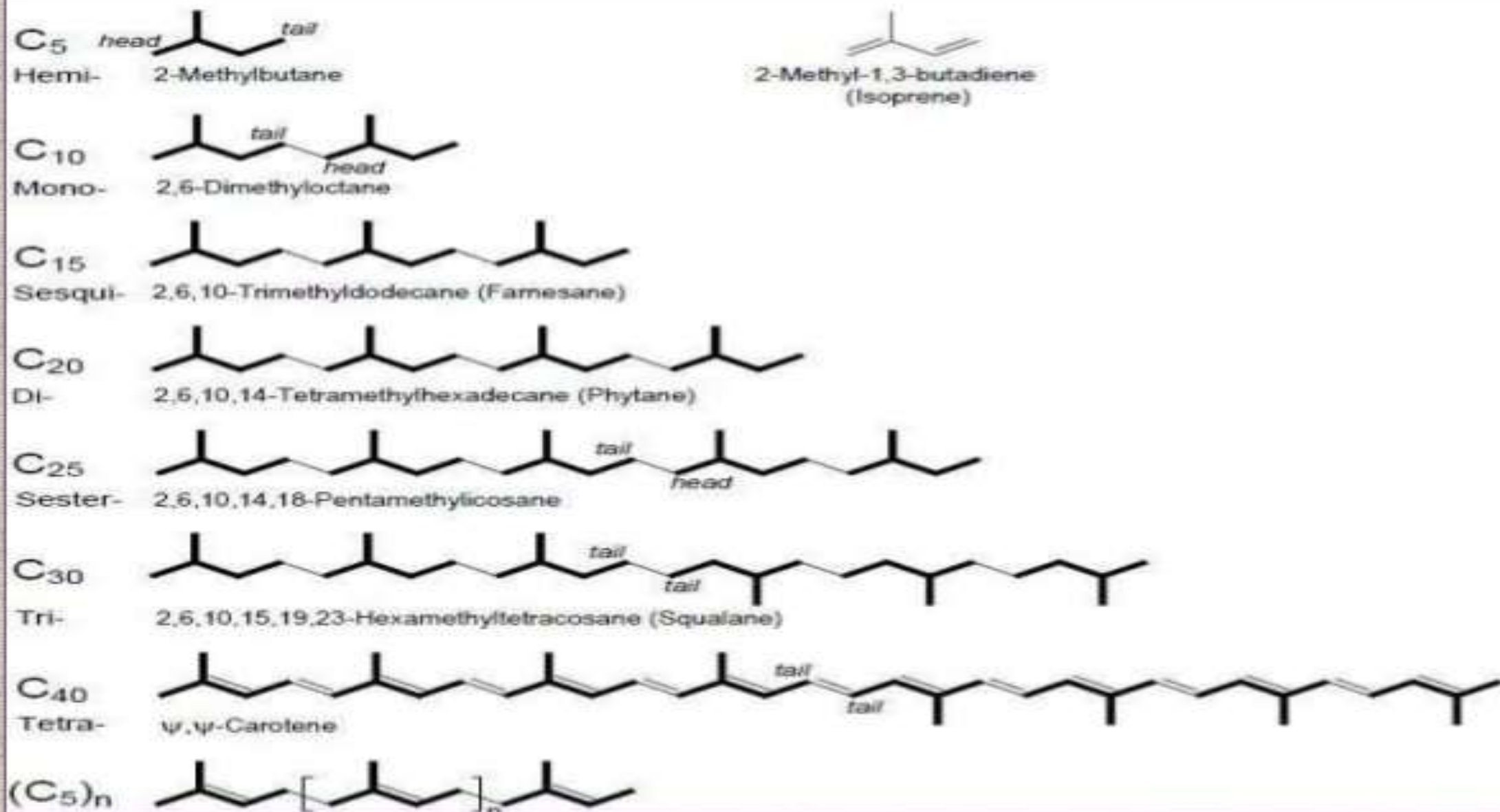
The logo of Galgotias University is a circular emblem with a stylized 'G' in the center. The 'G' is composed of three curved segments in shades of yellow, blue, and red. The background of the emblem is a gradient of light blue and white.

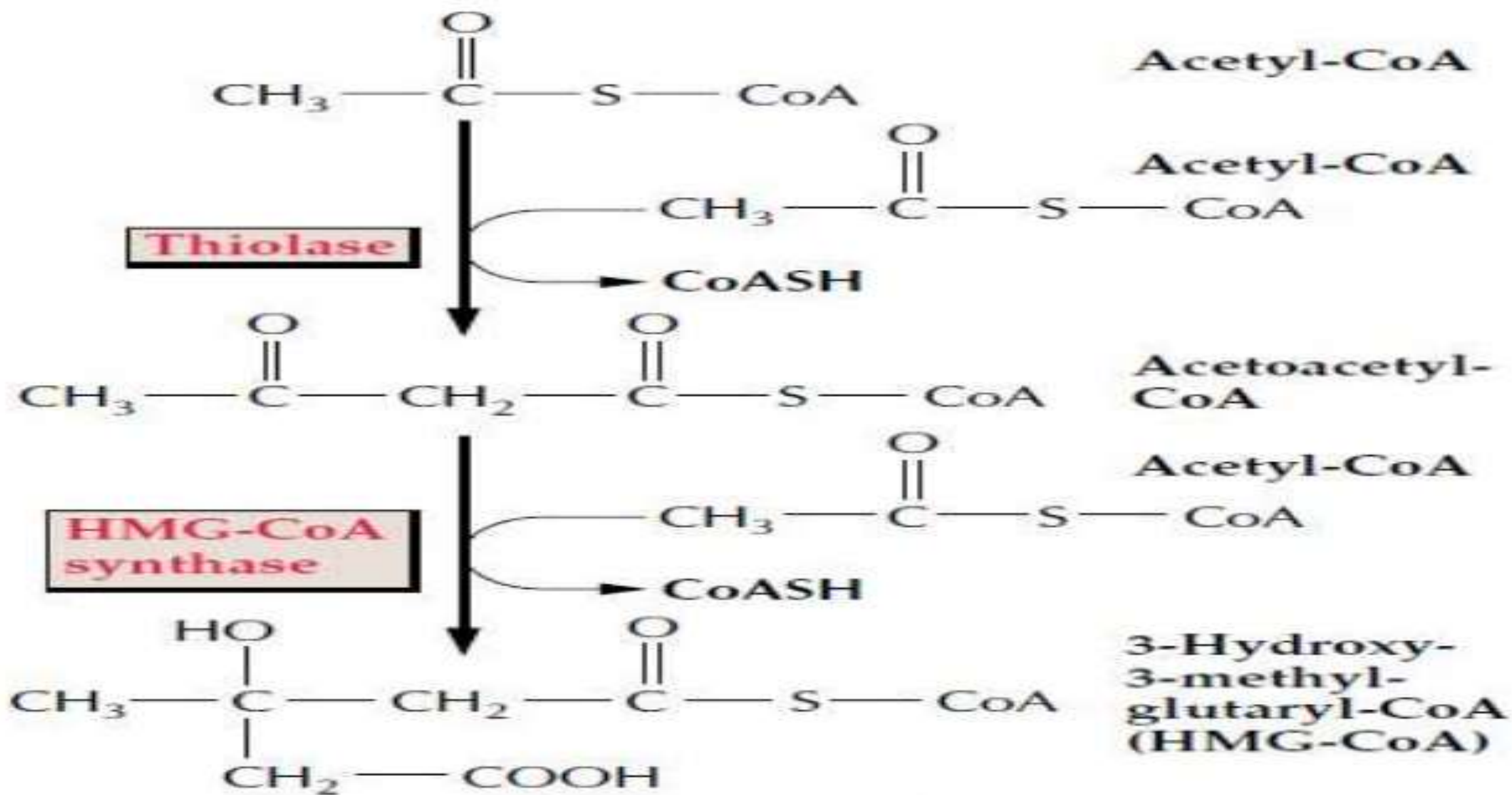
DISCLAIMER

ALL THE CONTENT MATERIAL PROVIDED HERE IS ONLY FOR TEACHING PURPOSE.

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Table 1. Parent hydrocarbons of terpenes (isoprenoids).



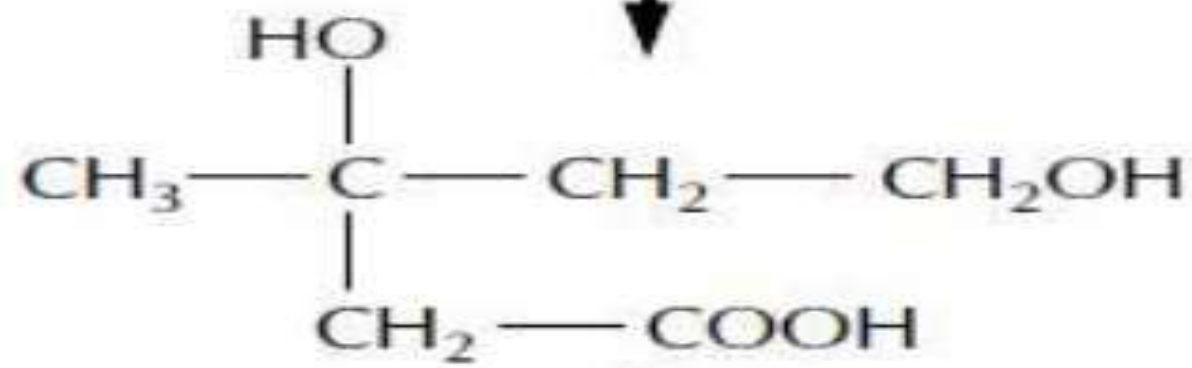


**HMG-CoA
reductase**

2 **NADPH**

2 **NADP⁺**

CoASH

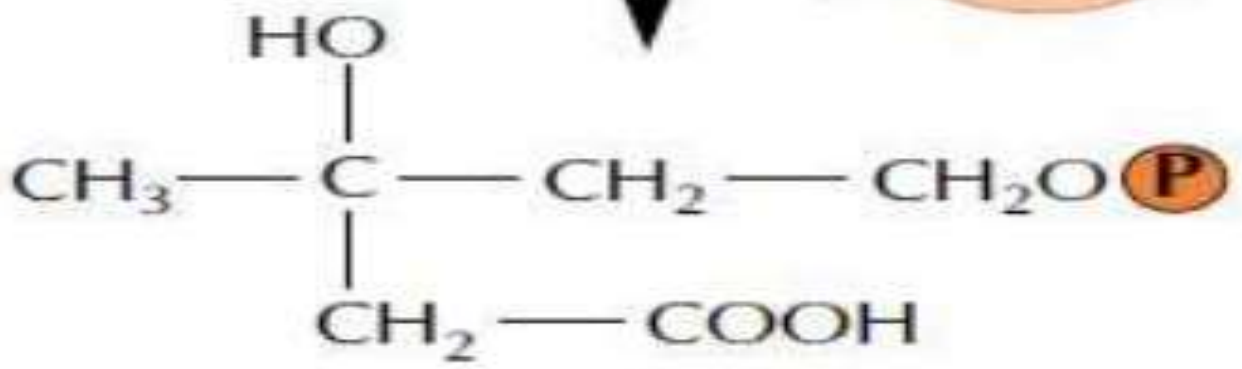


**Mevalonic acid
(MVA)**

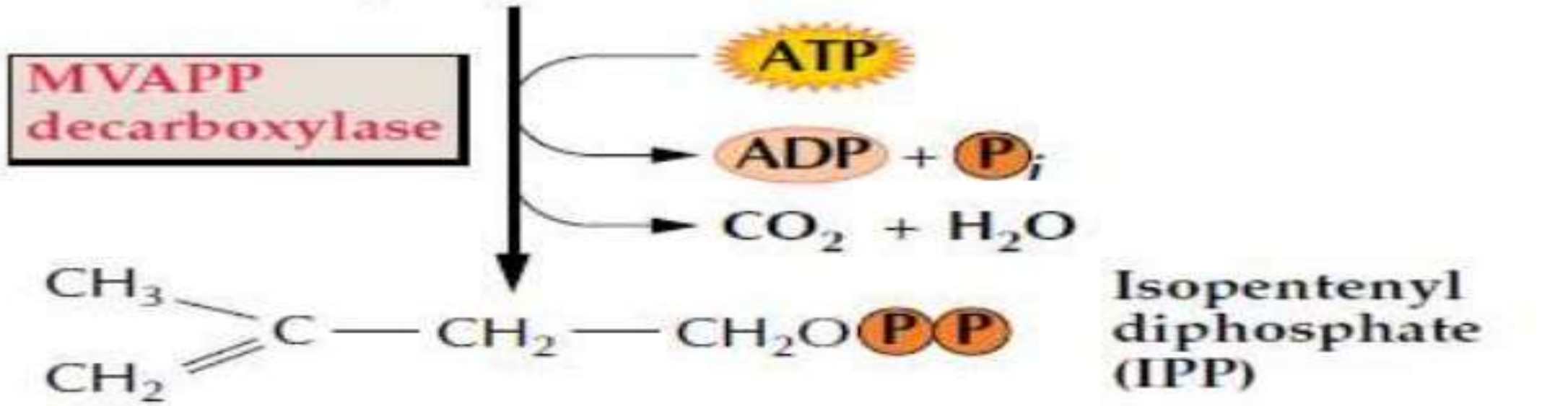
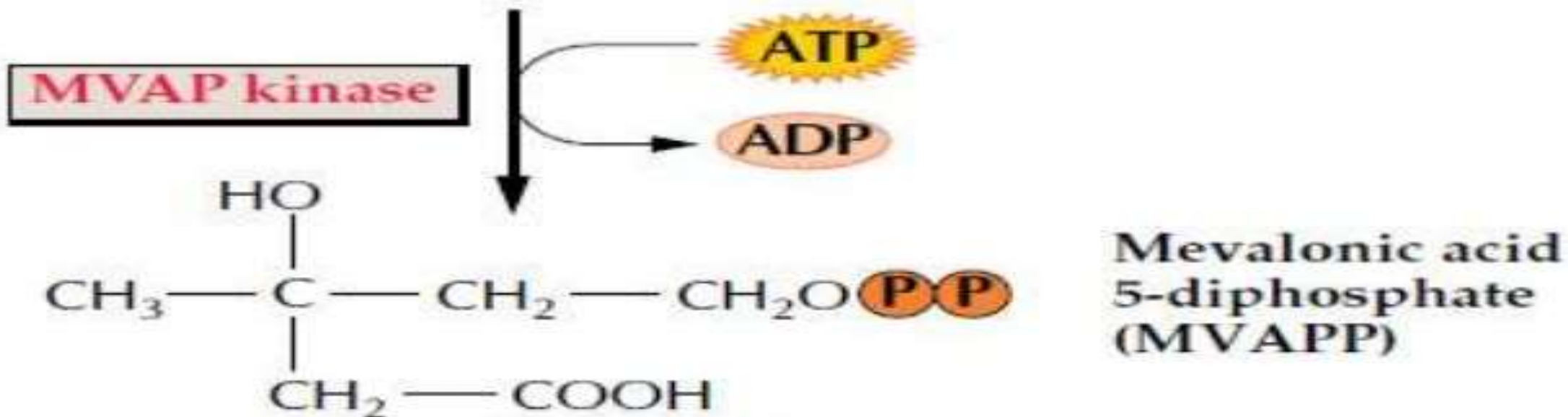
MVA kinase

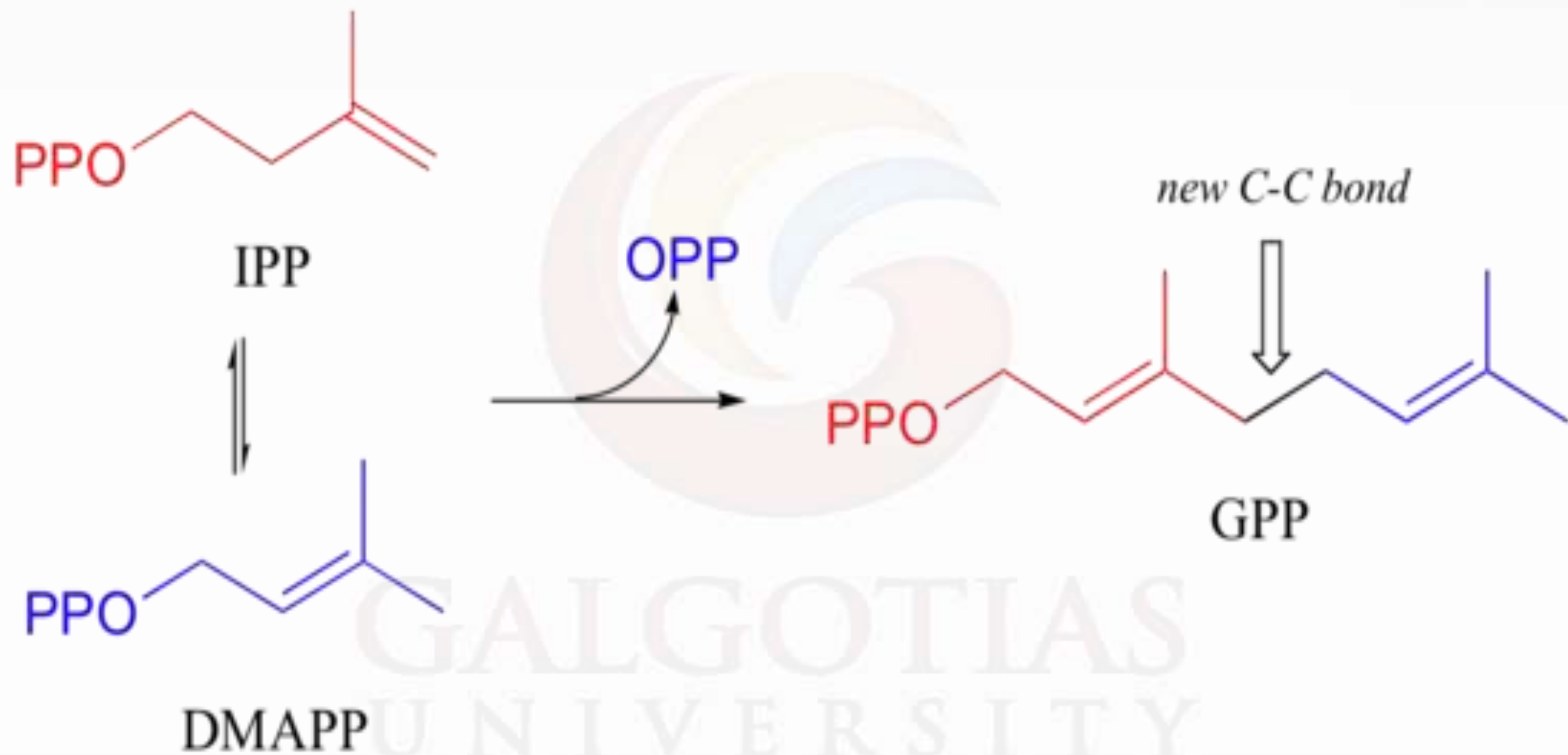
ATP

ADP



**Mevalonic acid
5-phosphate
(MVAP)**





3 Acetyl CoA → **MVA⁺ (mevalonate)** → **IPP** → **DMAPP**

DMAPP + IPP → **GPP (C₁₀)** **Monoterpenes**

GPP + IPP → **FPP (C₁₅)** **Sesquiterpenes**

FPP + IPP → **GGPP (C₂₀)** **Diterpenes**

GPP + FPP → **GFPP (C₂₅)** **Sesterterpenes**

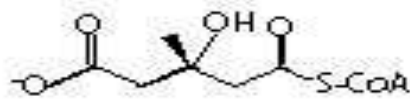
FPP + FPP → **2FPP (C₃₀)** **Triterpenes**

GGPP + GGPP → **2GGPP (C₄₀)** **Tetraterpenes**

acetyl CoA + acetoacetyl CoA

HMG CoA synthase

HMG CoA



HMG CoA reductase

mevalonate



mevalonate PP



farnesyl PP

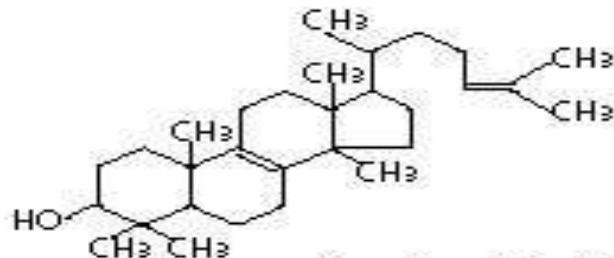


farnesylated proteins

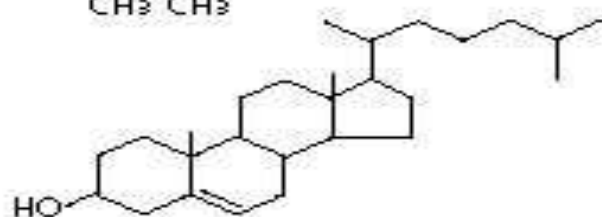
squalene



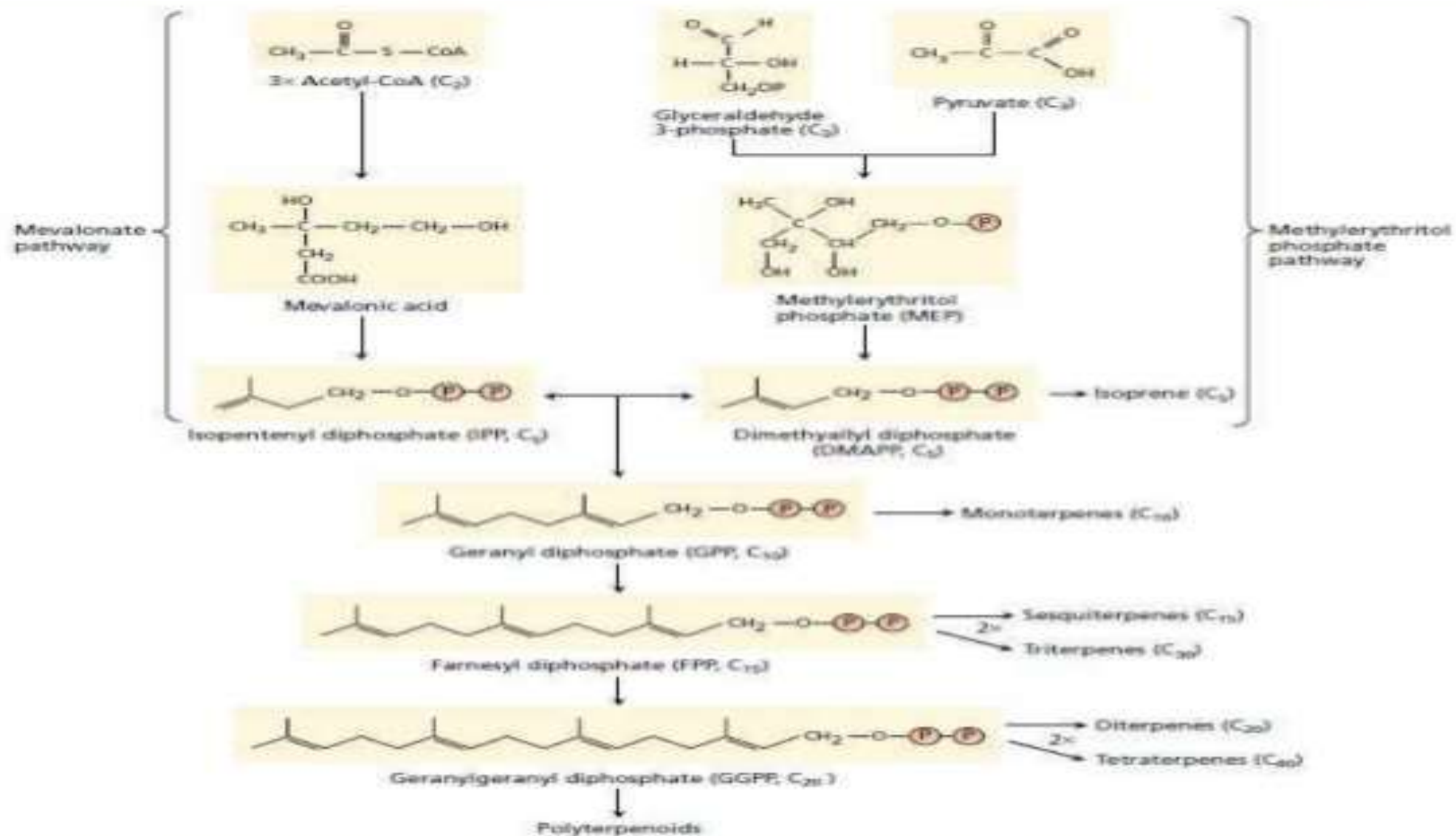
lanosterol



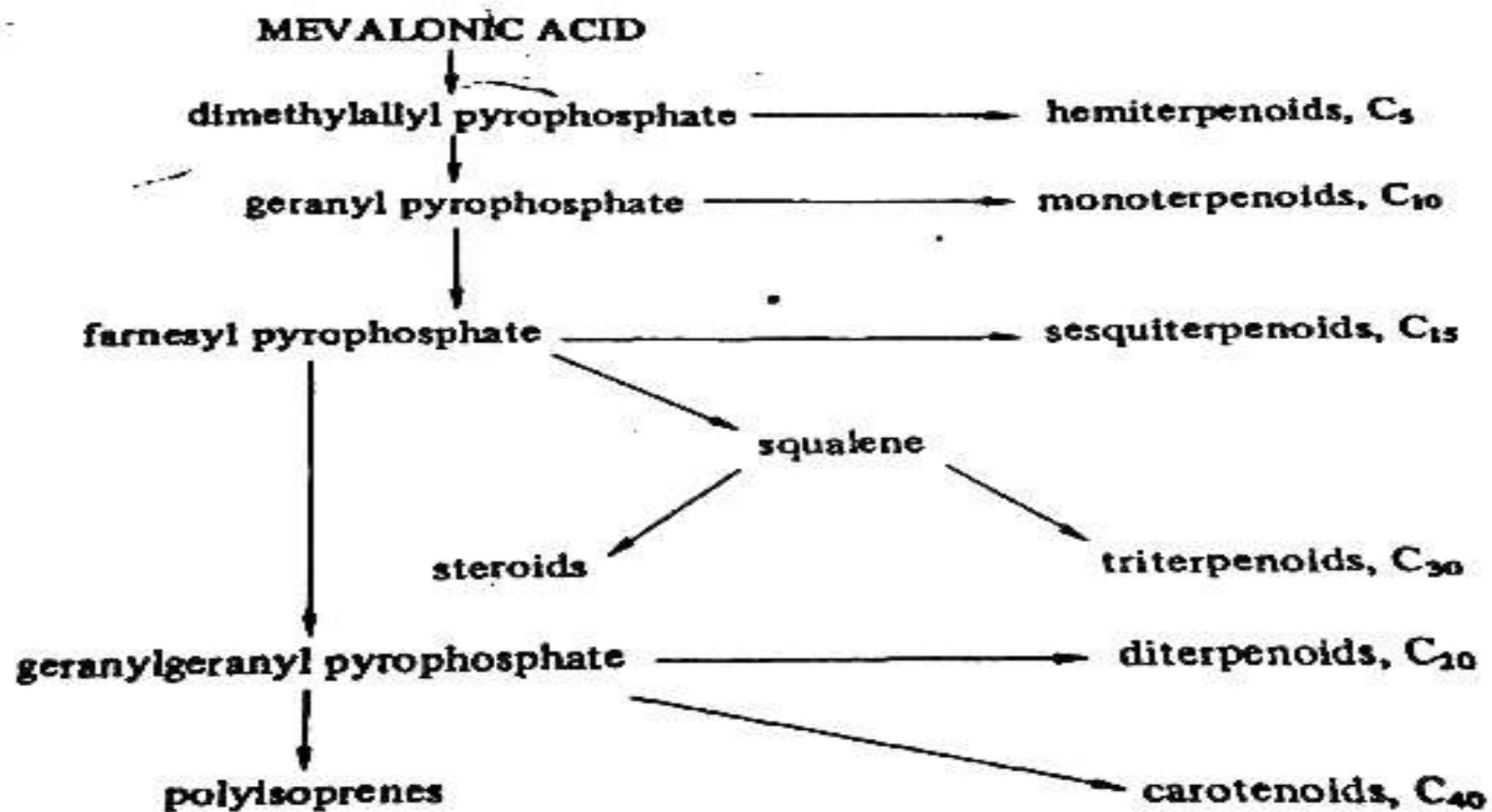
cholesterol



steroid hormones,
vitamin D,
bile acids



Compounds biosynthesised by the Acetate- mevalonate pathway

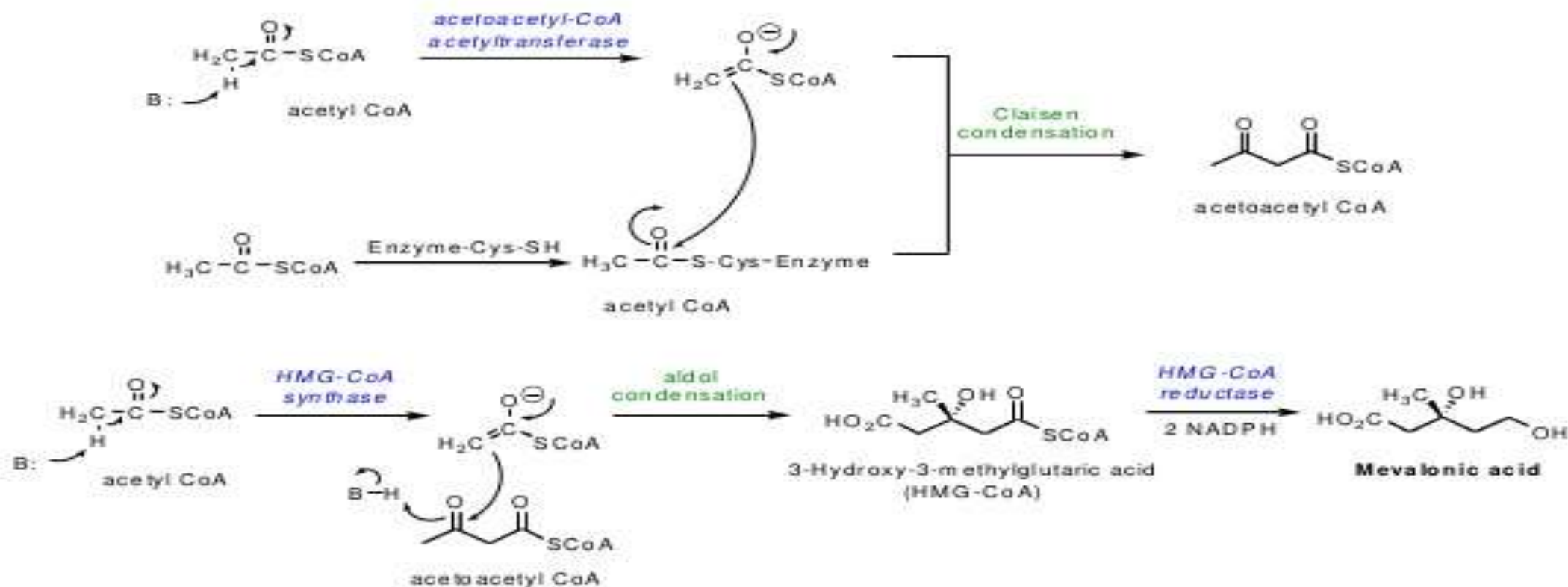


Isopentyl Diphosphate: The Biological Isoprene Unit.

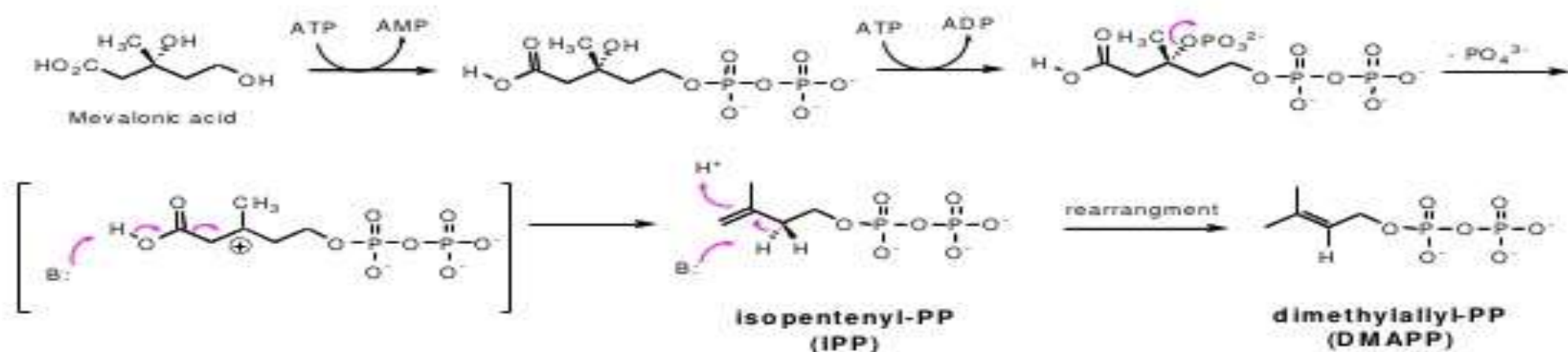
Mevalonic acid is the biosynthetic precursor to the actual C₅ "isoprene units," which are isopentyl diphosphate (IPP, tail) and dimethylallyl diphosphate (DMAPP, head)

The Pathway from Acetate to Isopentenyl Diphosphate.

Mevalonate Pathway

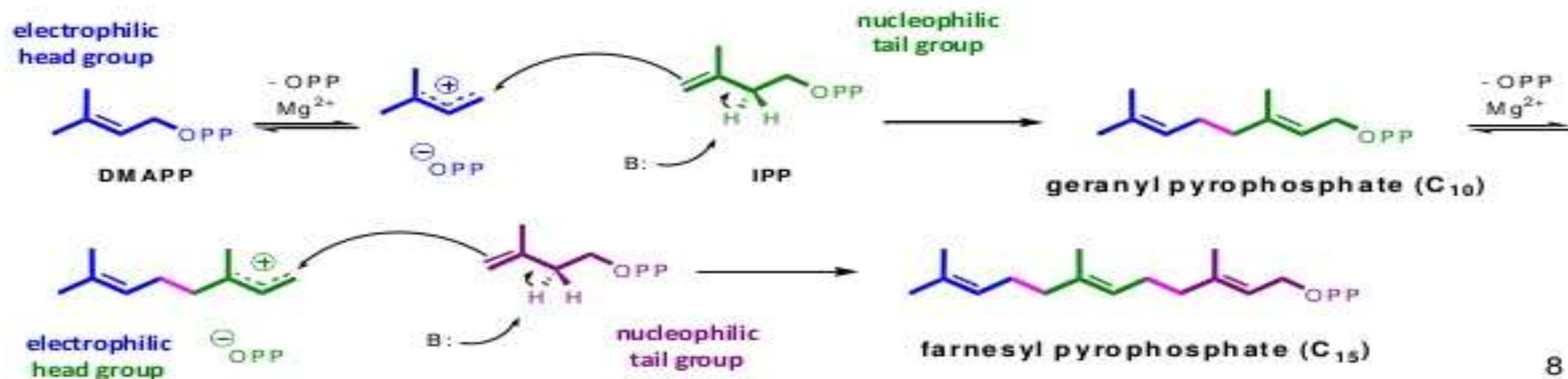


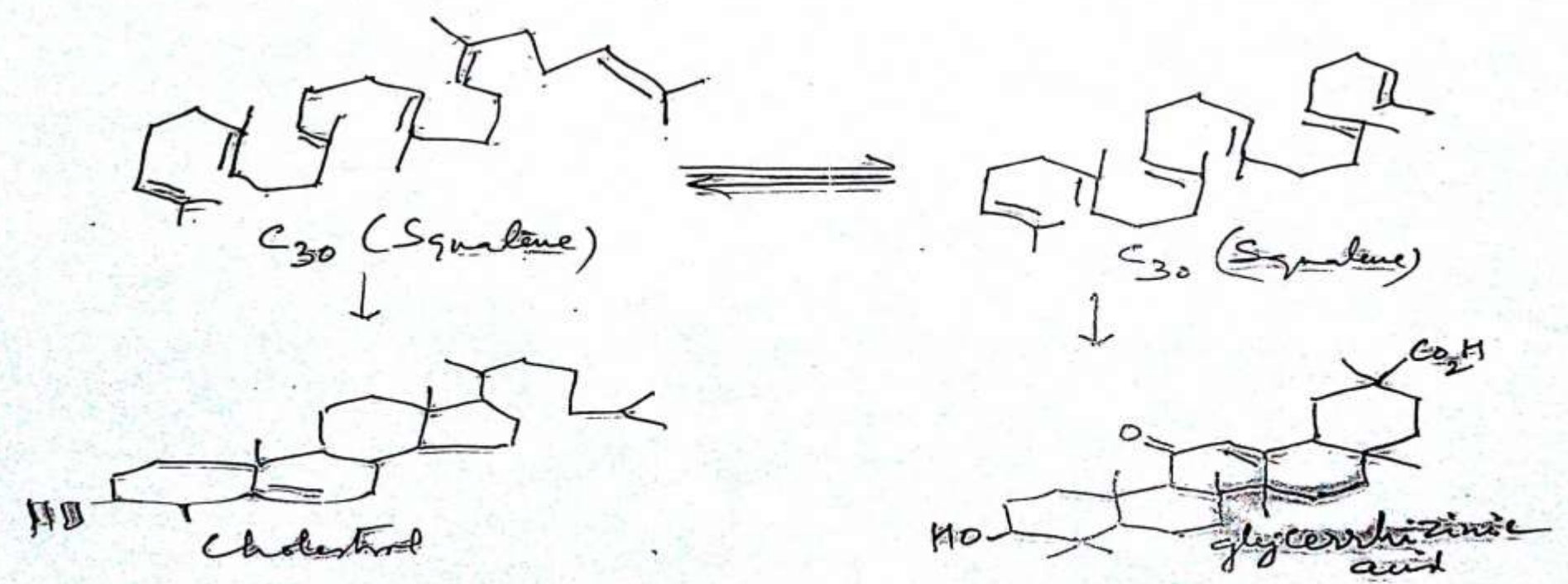
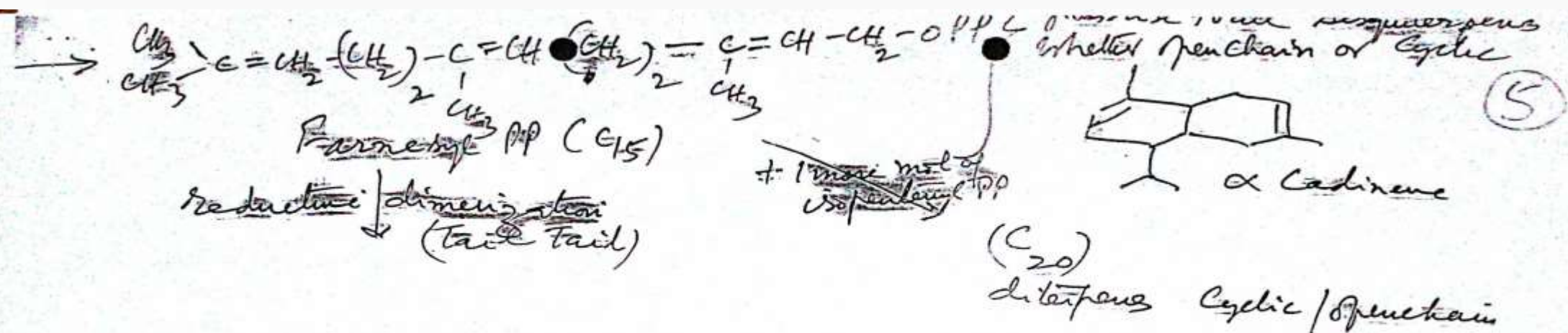
Conversion of mevalonic acid to IPP and DMAPP

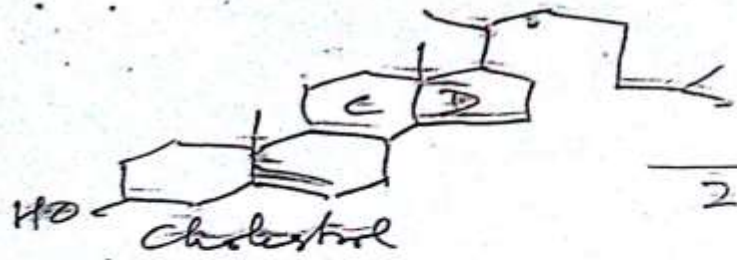


Carbon-Carbon Bond Formation in Terpene Biosynthesis.

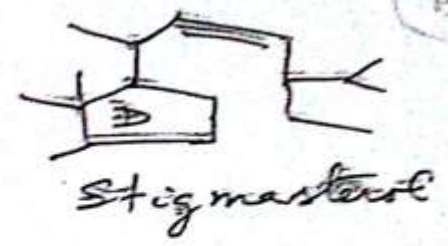
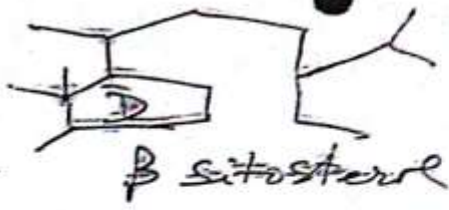
Conversion of IPP and DMAPP to geraniol-PP and farnesyl-PP



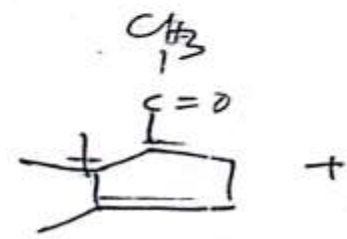
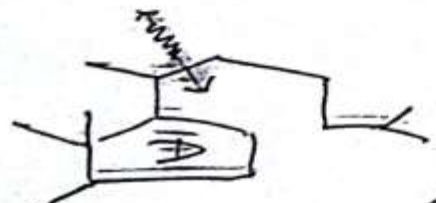




$2 C_1$
 additions



cleavage enzyme

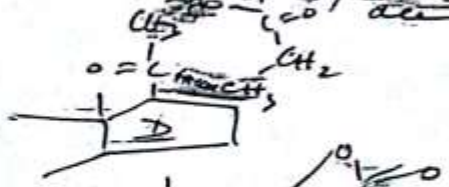


CC(C)CCCC=O
 Dimethyl acetylaldehyde

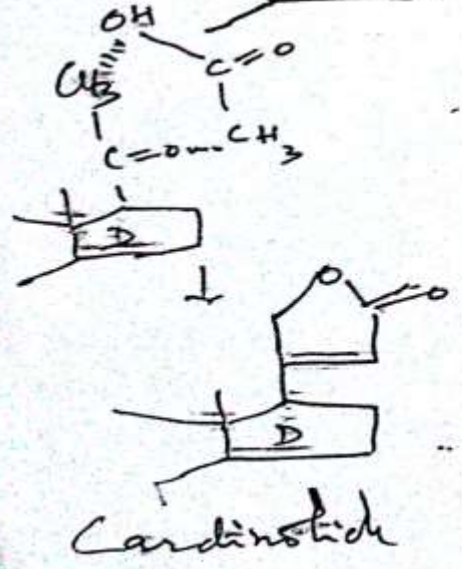
C_2 Addition
 (CH₃ COOH)

Pregnenolone

C_3 Addition
 Propionic acid



Bupropionamide...



References :

1. <https://www.biochemden.com/citric-acid-cycle>.
2. Weinstein, L. H.; Porter, C. A.; Laurencot, H. J. (1962). "Role of the Shikimic Acid Pathway in the Formation of Tryptophan in Higher Plants : Evidence for an Alternative Pathway in the Bean". *Nature*. 194 (4824): 205–206.
3. Brown, Stewart A.; Neish, A. C. (1955). "Shikimic Acid as a Precursor in Lignin Biosynthesis". *Nature*. 175 (4459): 688–689
4. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/shikimic-acid-pathway>
5. <https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/mevalonate-pathway>
6. Banerjee A, Sharkey TD. (2014) Methylerythritol 4-phosphate (MEP) pathway metabolic regulation. *Nat Prod Rep* 31:10431055