



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Chemistry

SUB. CODE- BSCC2402

For B.Sc. 4th Semester

(Terpenes)

Module-VII

Terpenoids: Classification and Isoprene rule

By

Dr. Rosy Mallik

Assistant Professor,

***CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT,
ODISHA***



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Terpenoids

Terpenes, or terpenoids, are a large class of plant secondary products with a major role in defense against plant-feeding insects and herbivores.

However, not all terpenoids act as secondary products. Many have important roles in primary processes, such as photosynthesis, stability of **cell membranes**, signaling, and as source compounds for several **plant hormones**.



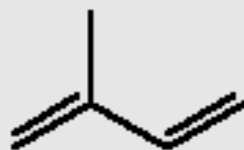
Centurion
UNIVERSITY

Shaping Lives...

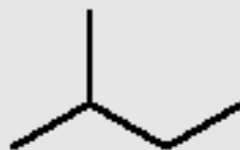
Empowering Communities...

Terpenoids: Isoprene Unit

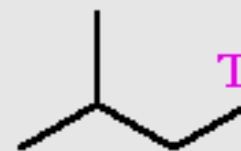
Terpenes are characterized by their basic structural element, the five-carbon **isoprene** unit:



Isoprene



"Isoprene Unit"



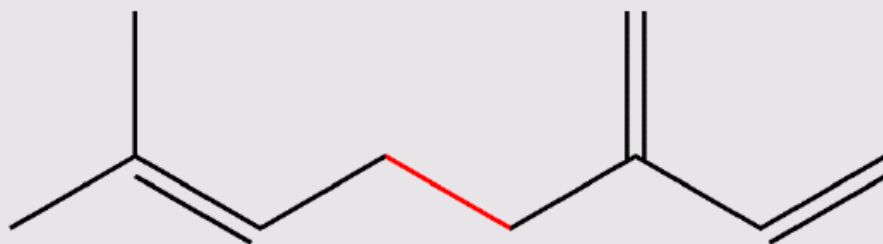
Head

Tail

isoprene unit



isoprene unit





Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

Terpenoids: Classification

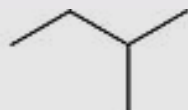
Terpenes may be considered to be made up of isoprene (isopentane) units, an empirical feature known as the **isoprene rule**. Because of this, terpenes usually have $5n$ carbon atoms (n is an integer), and are subdivided as follows:

Classification	Isoprene Units	Carbon Atoms
monoterpenes	2	C ₁₀
sesquiterpenes	3	C ₁₅
diterpenes	4	C ₂₀
sesterterpenes	5	C ₂₅
triterpenes	6	C ₃₀



Centurion
UNIVERSITY

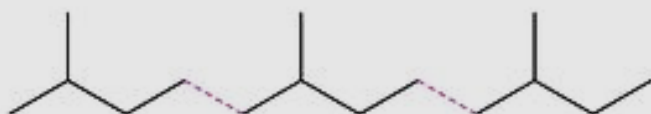
*Shaping Lives...
Empowering Communities...*



C_3 Hemiterpene (1 isoprene unit)



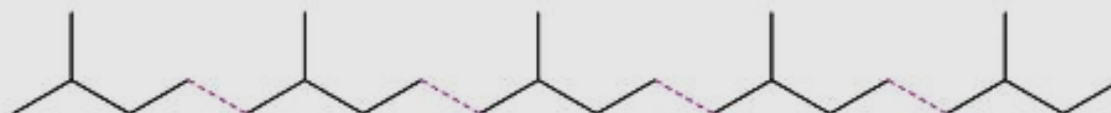
C_{10} Monoterpene (2 isoprene unit)



C_{15} Sesquiterpene (3 isoprene unit)



C_{20} Diterpene (4 isoprene unit)



C_{25} Sesterpene (5 isoprene unit)



C_{30} Triterpene (6 isoprene unit)

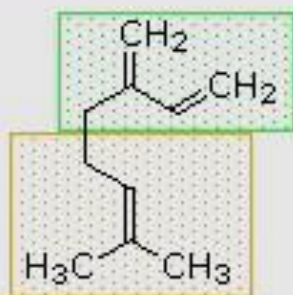
C_{40} Tetraterpene (8 isoprene unit)



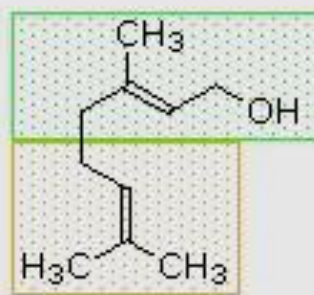
Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

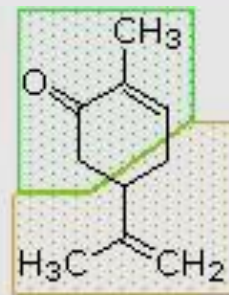
Monoterpenes



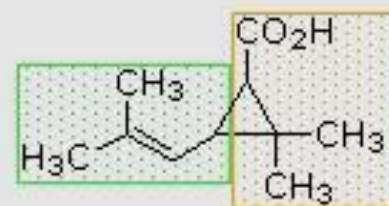
myrcene



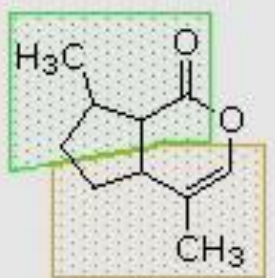
geraniol



carvone



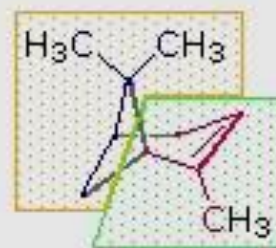
chrysanthemic acid



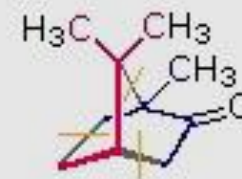
nepetalactone



menthofuran



α -pinene



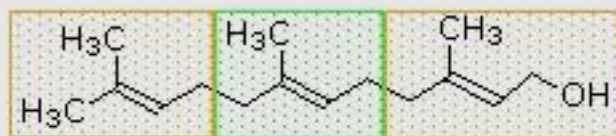
camphor



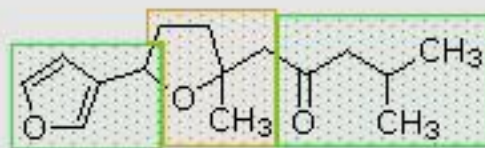
Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

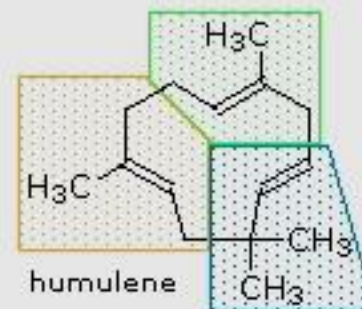
Sesquiterpenes



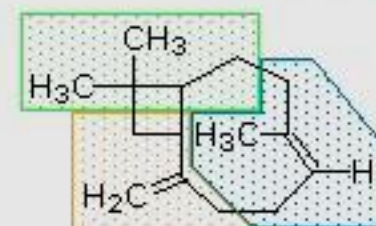
farnesol



ngaione

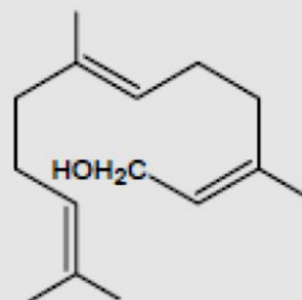


humulene



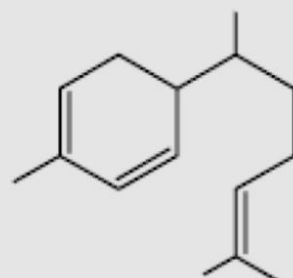
caryophyllene

i) *Acyclic sesquiterpenoids*



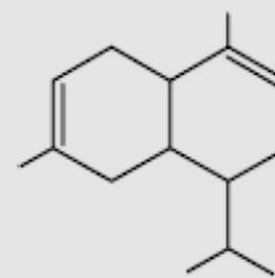
Farnesol

ii) *Monocyclic sesquiterpenoids*



Ziniberene

iii) *Bicyclic sesquiterpenoids.*



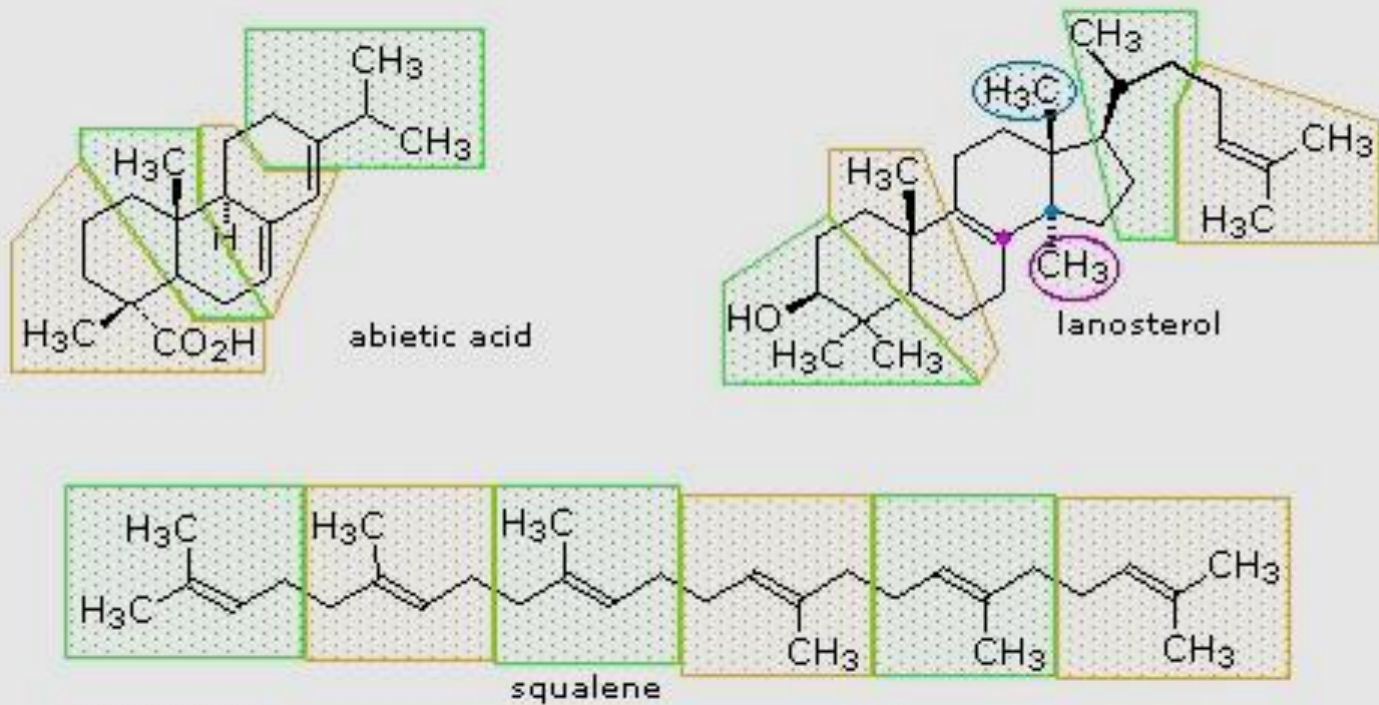
Cadinene



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Di- and Triterpenes





Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

1-1 Linkage

The head of one isoprene molecule could link with the head of another isoprene molecule.

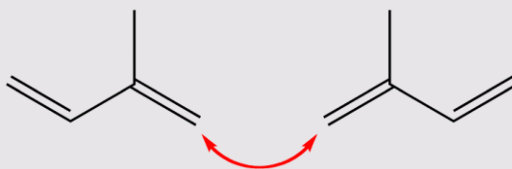


Figure 1: This link is called a head-to-head or 1-1 link.

1-4 Linkage

The head of one isoprene molecule could link with the tail of another isoprene molecule.

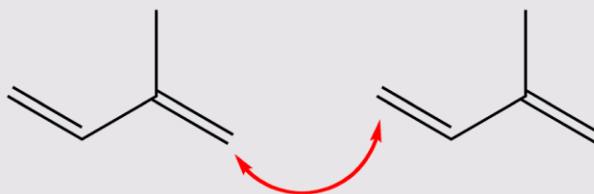


Figure 2: This link is called a head-to-tail or 1-4 link.



Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

4-4 Linkage

The tail of one isoprene molecule could link with the tail of another isoprene molecule.



Figure 3: This link is called a tail-to-tail or 4-4 link.

Cyclic terpenes also contain links that are neither 1-1, 1-4, nor 4-4, which are called *crosslinks*.



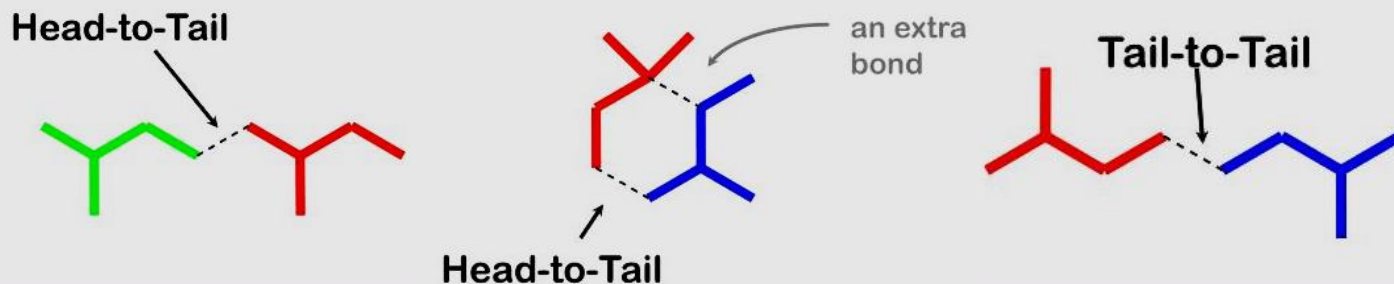
Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

The isoprene rule

This **rule** proposed by Ingold in 1925.

According to this **rule** “the **isoprene** units in terpenoids are joined by head to tail linkage or 1,4- linkage (The branched end of **isoprene** unit was considered as head and other end as the tail)



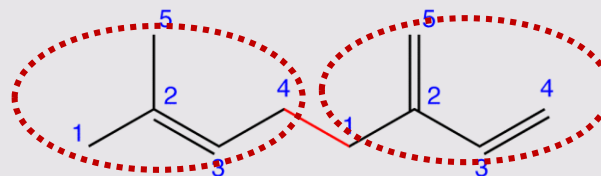
The isoprene rule states that, in most naturally occurring terpenes, there are no 1-1 or 4-4 links.



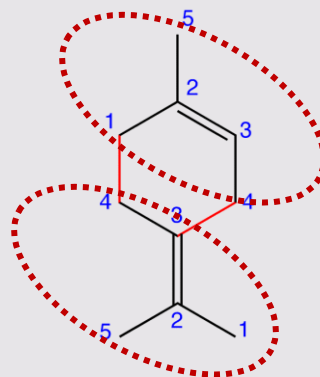
Centurion
UNIVERSITY

Shaping Lives...
Empowering Communities...

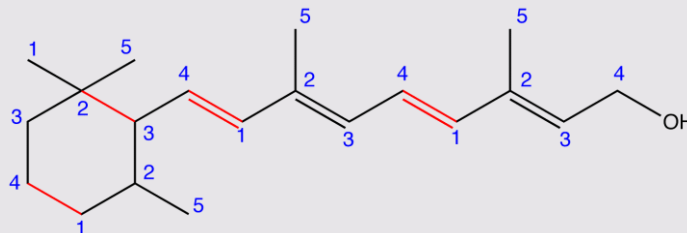
Myrcene



Limonene

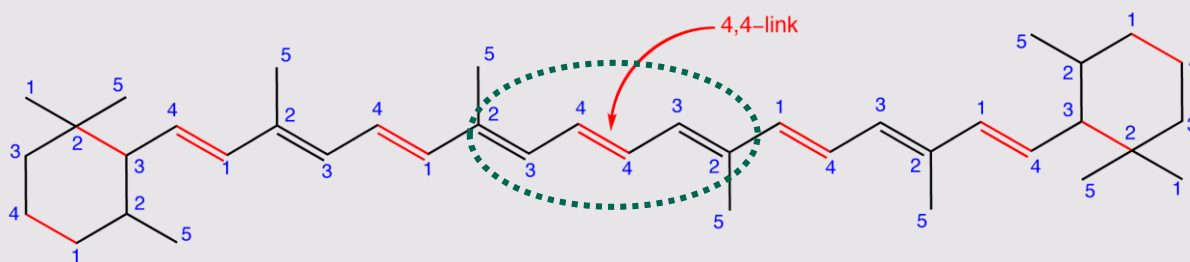


Retinol



A terpene that does not obey the isoprene rule is called an irregular terpene. eg:

β -Carotene





Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

References

1. K.D Sharma and Y. R. Sharma, Kalyani Publishers, Unit-III page-319;
2. University Chemistry, Vol-IV, Dr. U. N. Dash, Dr. K. K. Ojha, Himalaya Publishing house, Unit V, page-408