Formally, in biosynthesis of terpenes, two or more isoprene molecules are linked to one another. Linking between two isoprene molecules could occur in three ways, given that the head and the tail of the molecule are primarily involved in the linking:

1-1 Linkage

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

![Figure 1](link) 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](link) This link is called a head-to-tail or 1-4 link.

4-4 Linkage

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

![Figure 3](link) 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.

Definition: The Isoprene Rule

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

![Myrcene](image)

*Figure 4: Myrcene*

eg. 2:

![Limonene](image)

*Figure 4: Limonene*

eg. 3:

![Retinol](image)

*Figure 5: Retinol*

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

![β-Carotene](image)

*Figure 6: β-Carotene*

- see also isoprene unit
Contributors

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