



## Biological Roles of Terpenoids as Steroids in Plant and Animals

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### DESCRIPTION

In plants, animals, and microorganisms, terpenoids, usually referred to as terpenes, are a varied class of organic molecules. They are made up of isoprene units, which have five carbon atoms and can be organized in a variety of ways to create distinct kinds of terpenoids. Terpenoids play a variety of biological roles and are the chemical compounds that give plants their distinct flavours, fragrances, and therapeutic benefits.

Depending on how many isoprene units a terpene has, it can be categorized. Monoterpenoids have the chemical formula  $C_{10}H_{16}$  and two isoprene units. Monoterpenoids, including limonene, menthol, and carvone, are compounds that give citrus fruits, peppermint, and caraway seeds their distinctive odours. Sesquiterpenoids have the chemical formula  $C_{15}H_{24}$  and contain three isoprene units. Sesquiterpenoids, such as caryophyllene, farnesene, and humulene, are what give certain plants their distinctive fragrances, such as hops, apples, and black pepper.

Diterpenoids have the chemical formula  $C_{20}H_{32}$  and have four isoprene units. Diterpenoids contain phytol and retinol, which are crucial parts of vitamin A and chlorophyll, respectively. Triterpenoids have a molecular formula of  $C_{30}H_{48}$  and six isoprene units. Squalene, a precursor to several steroids, and  $\beta$ -carotene, a precursor to vitamin A, are two examples of triterpenoids.

Animals and fungus both contain steroids, a subclass of terpenoids made up of four fused carbon atom rings. Cholesterol, a substance found in cell membranes, and hormones like testosterone and oestrogen are examples of steroids.

Plants can produce terpenoids *via* the 2-C-methyl-D-erythritol 4-phosphate pathway or the mevalonic acid pathway. Most plants utilize the mevalonic acid route, which generates a range of terpenoids, including monoterpenoids, sesquiterpenoids, and diterpenoids. Some plants, especially those that are photosynthetic bacteria, use the 2-C-methyl-D-erythritol 4-

phosphate route to produce a range of terpenoids, including triterpenoids and carotenoids.

Terpenoids serve a variety of biological purposes, such as luring pollinators, discouraging herbivores, and guarding plants against infections. They are largely used in the food and fragrance sectors and are also responsible for many of the flavours and fragrances of plants. For instance, menthol is used to flavour gum and confectionery, limonene is used to flavour soft drinks and cleaning products, and caryophyllene is used to flavour baked goods and chewing gum.

Additionally possessing therapeutic qualities, terpenoids have been utilised in traditional medicine for many years. Menthol, for instance, is used to treat coughs and congestion, and eucalyptus oil, on the other hand, is used to treat pain and inflammation. Terpenoids are being researched as potential therapies for a number of ailments since they have been found to have antibacterial, antiviral, and anticancer effects.

Terpenoids serve a variety of biological purposes, but they also have a significant impact on the environment. They are released by plants and help create secondary organic aerosols, a significant particulate matter component in the atmosphere. Terpenoids are a source of carbon for numerous microbes; therefore they play a part in the carbon cycle as well.

Terpenoids serve a variety of biological purposes in animals in addition to their roles in plant physiology. For instance, a number of terpenoids have anti-inflammatory properties and are used to treat diseases including asthma and arthritis. The terpenoid curcumin, which is present in turmeric and has been demonstrated to possess strong anti-inflammatory properties, is one well-known example. Another illustration is the topical analgesic terpenoid camphor, which is also present in many over-the-counter cough and cold medications.

Terpenoids have also been intensively researched for their possible application in the treatment of cancer since they possess anti-cancer characteristics. For instance, the pacific yew tree's terpene paclitaxel is utilised as a chemotherapeutic agent for breast and ovarian cancer. Preclinical investigations have also

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**Received:** 27-Mar-2023, Manuscript No. MCA-23-21132; **Editor assigned:** 29-Mar-2023, PreQC No. MCA-23-21132 (PQ); **Reviewed:** 14-Apr-2023, QC No. MCA-23-21132; **Revised:** 21-Apr-2023, Manuscript No. MCA-23-21132 (R); **Published:** 28-Apr-2023, DOI: 10.35248/2329-6798.23.11.408

**Citation:** Casel H (2023) Biological Roles of Terpenoids as Steroids in Plant and Animals. Modern Chem Appl.11:408.

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demonstrated the anti-cancer properties of other terpenoids, including limonene and perillyl alcohol.

Terpenoids are also employed as natural antibiotics and antifungals because of their antimicrobial characteristics. For instance, it has been demonstrated that the terpenoid thymol,

which is present in thyme and other herbs, has significant antibacterial properties against a variety of bacteria and fungi. Similarly, it has been demonstrated that the terpenoid eucalyptol, which is present in eucalyptus and other plants, has antibacterial properties against a variety of bacteria and viruses.