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An Overview of Lactarane: A New Class of Bio-Active Molecules

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17.1 Introduction

Men have been fascinated by mushrooms and toadstools for a long time. They come in a wide range of colors and shapes. As far as fairy tales and hallucinations go, mushrooms haven't just sparked our imaginations. They're the spore-producing fruit bodies of fungi. For example, people know that some species have good taste and can be dangerous. The first has even led to farming and profiting from it. This is just one example of how mushrooms can be good for us. We've made a lot of medicines based on structures that were found in mushrooms.

Besides sugars, amino acids, fatty acids and nucleotides, which have a well-known and important role, living organisms are also known to make organic compounds that have a less important function, called secondary metabolites. The idea that secondary metabolites in mushrooms are to blame for the effects above led to a lot of research into their isolation, characterization and biological activity [1]. Compounds from mushrooms in the *Lactarius* genus have been found in a lot of different ways. Terpenes, which are also called terpenoids, isopentenoids, or isoprenoids, make up most of our body. It is made up of multiples of the C_5-unit isopentenyl pyrophosphate. Terpenes have a carbon skeleton made up of these units. (2) There are seven types of terpenes: Hemiterpenes (C_5): This repeating unit is also used to classify them. Monoterpenes (C_{10}): This repeating unit is also used to classify them. Sesquiterpenoid C_{15}: This repeating unit is also used to classify them (C_{30}).

Most of the terpenes from Lactarius are sesquiterpenes, and the majority of them have either the ***lactarane*** skeleton (**1**) or the ***marasmane*** skeleton (**2**), but not both at the same time (Figure 17.1). A lot of sesquiterpenes found in nature come from mushrooms in the Lactarius and Russula groups.

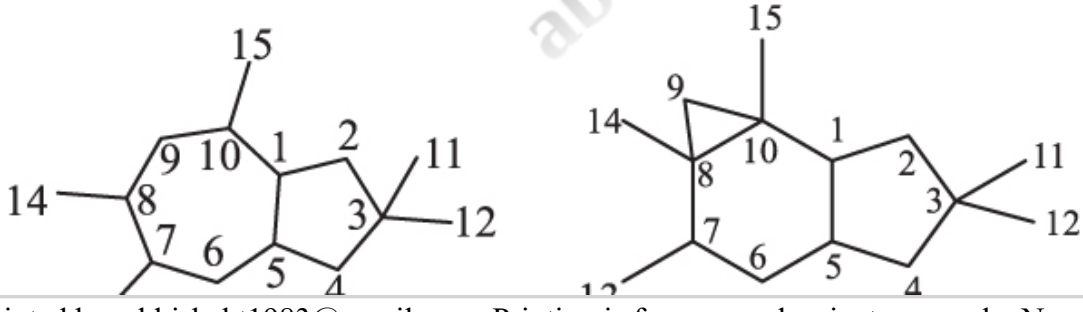
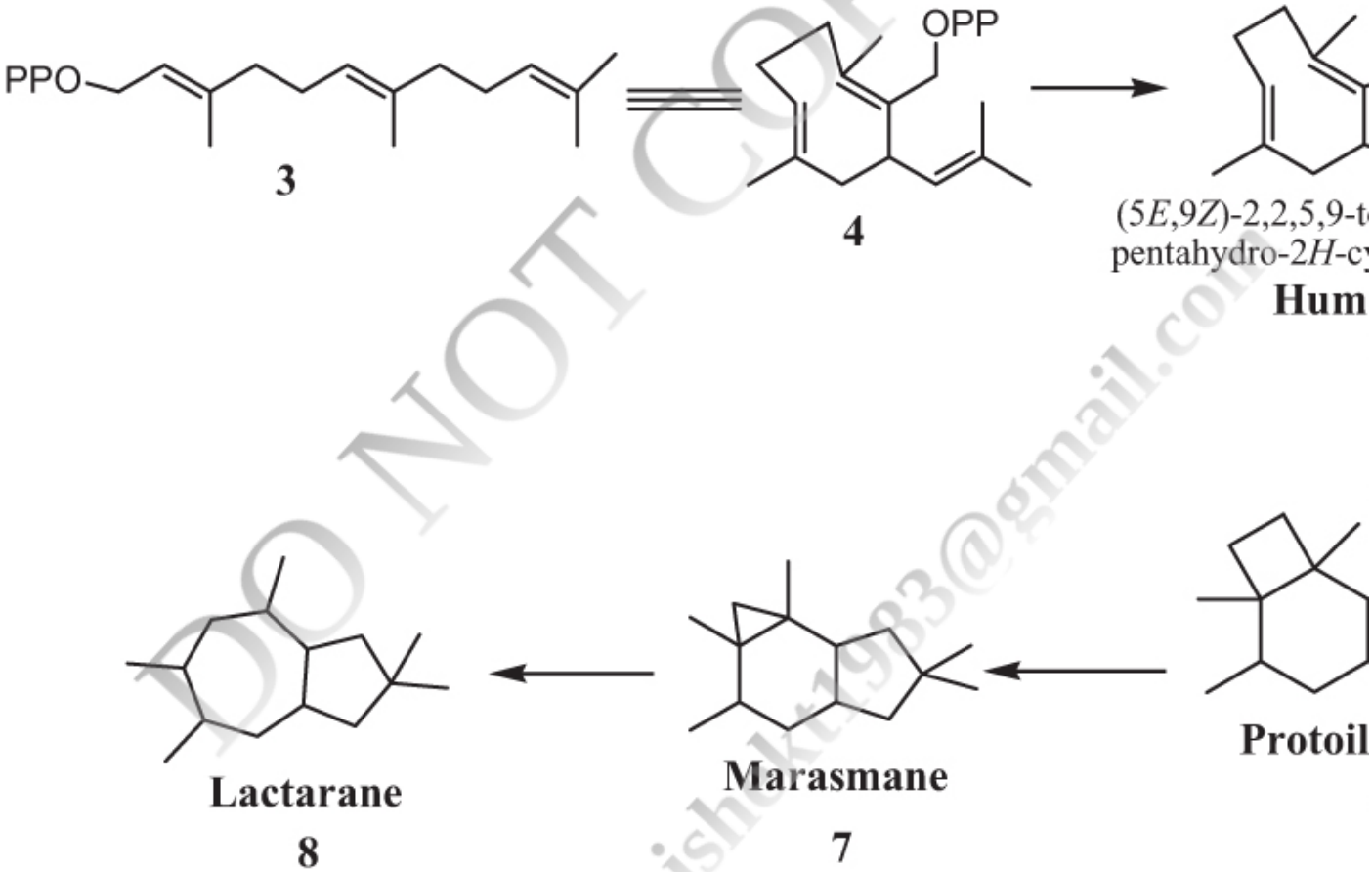


FIGURE 17.1 Carbon skeleton of lactarane and marasmane.

17.2 Biosynthesis of Lactarane and Marasmane Sesquiterpenes

As a general rule, the way to make ***lactarane*** and ***marasmane*** sesquiterpenes is to make farnesyl pyrophosphate (**3**) to humulene (**5**) by connecting the two carbon C_2-C_3 that make up the molecule (Scheme 17.1). Further proton-induced ring closure of (**6**) yields the *protoilludane* carbocation, which via subsequent cyclobutane ring contraction rearranges to the cyclopropylcarbinyl carbocation (**7**). Finally, the rearrangement of cyclopropylcarbinyl carbocation (**7**) results in the seven-membered ring formation of the ***lactarane*** skeleton (**8**) [2, 3, 4].



SCHEME 17.1 Synthesis of *Lactarane* sesquiterpenes from farnesyl pyrophosphate.

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Isolation of *two protoilludanes* (**6**, **7**) from ***Lactarius violascenes*** shows that this biosynthetic route can be used [5]. Another thing we know for sure is that in some mushrooms