

6.6: Saccharolipids, polyketides, and prenols

Learning Objectives

- Define and understand the basic structural features of saccharolipids, polyketides, and prenols.
- Define mono-, sesqui-, di-, and tri-terpenes and recognize isoprene units in terpenes, terpenoids, and steroids.

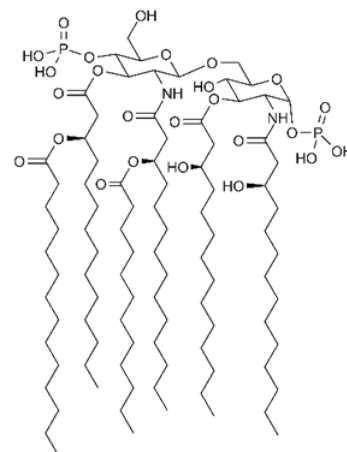
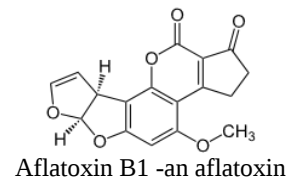
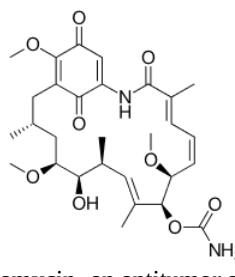
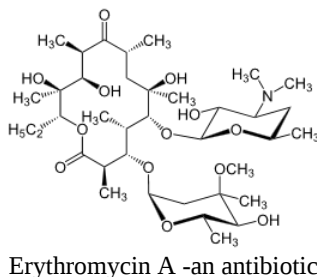
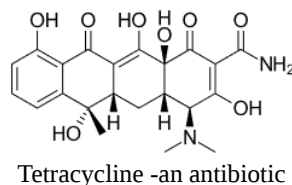
Saccharolipids

Saccharolipids are fatty acids linked to a saccharide (carbohydrate) backbone by linkages other than glycosidic linkages. They are compatible with membrane bilayers. For example, saccharolipid lipid A found in *E. Coli* is shown in the figure on the right.

Polyketides

Polyketides are a broad class of natural products derived from β -polyketones, i.e., compounds

containing $[-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-]_n$ repeat units in their backbone or their reduced forms, such as $[-\overset{\text{OH}}{\underset{|}{\text{C}}}-\text{CH}_2-]_n$, and $[-\text{CH}_2-\text{CH}_2-]_n$. Polyketides are important in the pharmaceutical industry. They are used as antimicrobial, antiparasitic, and anticancer agents; some are toxins. About 20% of the top-selling medicines are polyketides. Some examples of medically important polyketide products are shown below.



Prenols

Prenols are synthesized from five-carbon isoprene precursors: isopentenyl pyrophosphate (IPP) and dimethylallyl pyrophosphate (DMAPP), as shown in Figure 6.6.1 (left). The five-carbon skeleton of isoprene units in these products can often be easily distinguished, as shown in by different color sections of some examples in Figure 6.6.1 (right). Since they contain a multiple of five C' s in their skeleton, they are also classified as monoterpenes (10 C' s), sesquiterpenes (15 C' s), diterpenes (20 C' s), triterpenes ((30 C' s), and tetraterpenes (40 C' s). Terpenoids are modified terpenes that contain additional functional groups, usually oxygen functional groups as those shown in 6.6.1 (right).

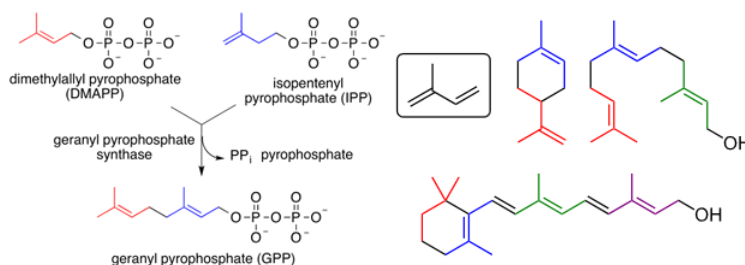


Figure 6.6.1: Dimethylallyl pyrophosphate (DMAPP) and isopentenyl pyrophosphate (IPP) condense to produce geranyl pyrophosphate, a precursor to all terpenes and terpenoids (left, Copyright; Andrew Murkin, CC0, via Wikimedia Commons) and structure of Isoprene, limonene, farnesol, and retinol, respectively, showing isoprene skeleton in these products in different color sections (right, Copyright; Calvero., Public domain, via Wikimedia Commons)

Steroids -other lipids described later are derived from triterpene squalene, as illustrated in Figure 6.6.2.

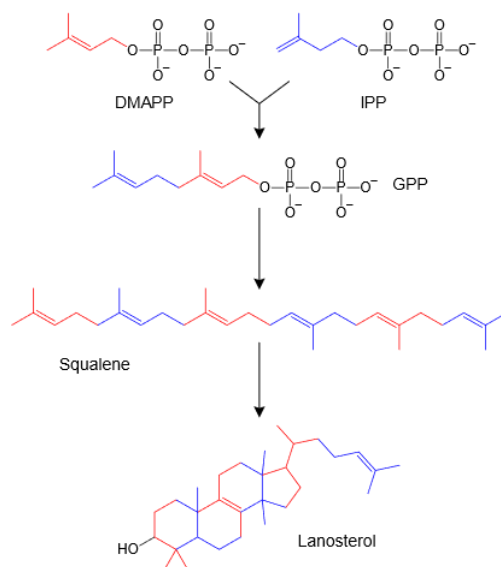


Figure 6.6.2: A simplified scheme for steroid biosynthesis via terpenoid intermediates: isopentenyl pyrophosphate (IPP), dimethylallyl pyrophosphate (DMAPP), geranyl pyrophosphate (GPP) and squalene. (Copyright; Fvasconcellos, original by Tim Vickers, Public domain, via Wikimedia Commons)

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