

Orphaned and ignored: synthesis of eukaryotic biomarkers by bacteria

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Cyclic triterpenoids, such as hopanoids and sterols, are a broad class of polycyclic lipids produced by bacteria and eukaryotes. They are relevant biologically for their roles in cellular physiology including membrane structure and function and biochemically for their exquisite enzymatic cyclization mechanism. Cyclic triterpenoids are also relevant geobiologically as they are readily preserved in ancient sediments where they can function as biomarkers for ancient life throughout Earth's history. These biomarker lipids are also useful in a modern ecological context - their distribution in aquatic and terrestrial environments is often used as an indicator of physiological conditions correlated with lipid production such as high temperature or pH fluctuations. However, proper interpretation of these biomarkers requires a comprehensive understanding of the taxonomic distribution, biosynthesis and physiological function of these lipids in modern organisms. Here we show how bioinformatics analyses coupled with microbial genetic and biochemical studies in extant bacteria can provide insight in the evolution of cyclic triterpenoids and can address current incongruities in biomarker signatures.