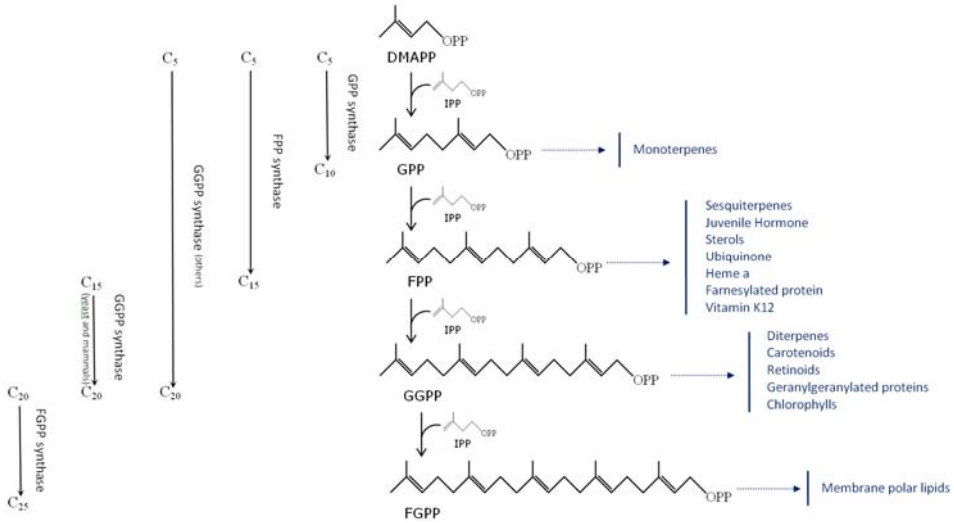
INSECT PRENYLTRANSFERASES: CHARACTERIZATION, ROLES IN INSECT BIOLOGY, AND EVOLUTION

Cusson, Michel[1,2], Sophie Vandermoten[3], Aline Barbar[1,2], Stephanie E. Sen[4], Catherine Béliveau[1]

1. Laurentian Forestry Centre, Natural Resources Canada-CFS, Quebec City, QC, Canada
2. Département de biochmie et microbiologie, Université Laval, Quebec City, QC, Canada
3. Department of Functional and Evolutionary Entomology, Gembloux Agricultural University, Gembloux, Belgium
4. Department of Chemistry, The College of New Jersey, Ewing, NJ, USA

Isoprenoids form the most abundant and structurally diverse group of compounds in nature. In insects, they serve as hormones and pheromones, and they are used in subcellular targeting and regulation (protein prenylation) as well as in electron transport (prenyl chains of ubiquinones). Their biosynthesis proceeds through sequential 1'-4 condensations of isopentenyl diphosphate (C_5) with an allylic acceptor, the first of which is dimethylallyl diphosphate (C_5). The reactions leading to the production of geranyl diphosphate (GPP; C_{10}), farnesyl diphosphate (FPP; C_{15}) and geranylgeranyl diphosphate (GGPP; C_{20}), which are the precursors of mono-, sesqui- and diterpenes, respectively, are catalyzed by a group of highly conserved enzymes known as short-chain isoprenyl diphosphate synthases or prenyltransferases. The longer prenyl chains of ubiquinones ($C_{30} - C_{50}$) are generated by a distinct group of prenyltransferases, whose insect members have so far received very little attention. In recent years, the sequences of many insect prenyltransferases have become available, including those of some GPP and FPP synthases that display uncommon sequence and structural features. Interestingly, some of these enzymes have revealed novel mechanisms of product chain-length regulation. GPP synthases, which are common in plants but very rare in animals (so far found only in beetles and aphids), appear to have have arisen independently in the two kingdoms. Because some of these prenyltransferases display insect-specific structural features, there is interest in designing pest-specific inhibitors for the purpose of developing pesticides that target the isoprenoid biosynthetic pathway.



Vandermoten S, Haubruge É, Cusson M (2009) New insights into short-chain prenyltransferases: structural features, evolutionary history and potential for selective inhibition. *Cellular and Molecular Life Sciences* doi:10.1007/s00018-009-0100-9