

Understanding insecticide detoxification in key hoverfly pollinator guilds

Supervisory team:

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Project description:

Chemical insecticides have been used to control insect pests for many decades and remain essential to ensure a supply of affordable food and as part of disease vector control for the foreseeable future. A key requirement for the development of insecticides is that they are pest specific and not harmful to the main pollinator species which play an essential role in ensuring production of seeds in a remarkable range of flowering plants. Recent research on three managed bee species has demonstrated that specific enzymes can also be critically important in determining the sensitivity of bees to insecticides. Specifically, cytochrome P450 enzymes belonging to the CYP9Q and CYP9BU subfamilies have been shown to provide protection to certain insecticides from three different classes including N-cyanoamidine neonicotinoids. This leads to an important question – is the presence of insecticide-degrading P450s universal to all pollinator species, and if not, what are the implications for insecticide sensitivity in species that lack these enzymes?

Hoverflies are an important family of pollinators known to visit over half of globally important food crops worth a combined US\$300 million to the global economy each year. In addition, they provide ecosystem services not found in bees, related to their aphidophagous or saprophagous larval stages. These stages expose these guilds to unique selective pressures on enzymes to detoxify chemicals found in these environments. This studentship aims to develop a detailed molecular and biochemical understanding of how insecticides interact with the aphidophagous marmalade hoverfly *Episyrphus balteatus* and the saprophagous dronefly *Eristalis tenax*. Such understanding will allow the molecular basis of differential selectivity within different chemical classes of commercial insecticides to be elucidated and so facilitate the rational design of novel pollinator-safe compounds. Furthermore, such information will help to develop molecular tools to classify, optimise and improve early candidate selection as well as the synthesis of pest selective compounds.

The student will be trained in a variety of state-of-the-art approaches that are highly sought-after by employers in academia and industry including molecular approaches and bioinformatics. The student will be based in a thriving research environment comprising multiple PhD students and post-doctoral researchers and will also benefit from exposure to industry through the Bayer link/placement.