My research goal is to understand general principles of how animal nervous systems produce and control complex behaviours in challenging environments. To do this, we need to understand important features of an animal’s environment, how its nervous system detects these features, and how decisions are made to generate appropriate responses.To address this issue, I study behavioural and neurophysiological aspects of adaptive insect flight. I use model systems in which there is a strong background of behavioural and physiological knowledge upon which to build. These models include collision avoidance in locusts and visually guided orientation in bees. My research uses a combination of physiological and behaviour recording techniques that permit direct correlations between aspects of an insect's environment and locomotion behaviour as well as combined activity within the nervous system. These approaches incorporate a virtual reality-based insect flight simulator in conjunction with multi-neuronal recording techniques from the insect's central nervous system. We also use data to construct computational rules to guide artificial systems (computer models and robots). Additionally, we study how stressors (starvation, pesticides, etc.) impair visual detection and natural behaviour in locusts and bees.

Examples of upcoming undergraduate projects, through research courses or summer employment, in my lab include:

1. Effects of starvation on neural responses and flight behaviour in locusts.
2. Locust avoidance responses in a new visual arena
3. Responses of bees to different visual stimuli