BIO-ORGANIC AND MEDICINAL CHEMISTRY AND SCIENCE OUTREACH

Our research is aimed at using bio-organic and medicinal chemistry to develop important healthcare treatments and to address agricultural problems. Current research is focussed on collaborative partnerships with Indigenous communities for documentation, biological screening and isolation of bioactive compounds from ‘bush’ foods and medicines; and studies on isolation and synthesis of fruit fly attractants and analysis of their effectiveness. Projects on development of educational resources for a science engagement program, the National Indigenous Science Engagement Program (NISEP), and/or evaluation of the effectiveness of the program, are also available.

FRUIT FLY ATTRACTANT AND PHEROMONE COMPOUNDS

Bactrocera fruit flies include some of the world’s most devastating insect pests of horticulture. Air-borne pheromones are used by these insects to communicate, and in synthetic form also have potential as tools for control. Attractant compounds are used to monitor and control fruit fly populations. We are interested in the analysis of fruit fly pheromones to develop new attractants and in understanding the structure activity relationship (SAR) of attractants to fruit flies to help in the design of better lures. We are also interested in how fruit flies react to odours produced by bacteria, as some bacteria are pathogens, some are symbionts, and some are key elements of nutrition. Natural enemies of fruit flies, such as predators and parasites, have a significant impact on the lives of fruit flies but little is known about how these flies might counter such threats. One mechanism is through detection and adaptive response to chemical cues (‘kairomones’) either emitted directly from enemies or deposited as enemies move through the environment.

Projects in these areas may focus on one or more category of compounds, and may encompass extraction of fruit fly pheromones from fruit fly rectal glands, synthesis of novel and known compounds as lures, qualitative and quantitative analysis of pheromones or odour emissions (e.g., by GC-MS), and studies of behavioural responses of Bactrocera fruit flies to these compounds. Activities may include travel for the collection of fruit fly volatile pheromone emissions and assays to test for biological activity (e.g., GC-coupled electroantennogram, wind tunnel, field trials).

ETHNOPHARMACOLOGICAL STUDIES OF CUSTOMARY ‘BUSH’ FOODS AND MEDICINES

Research projects aimed at working with Indigenous people to uncover the potential of their customary (traditional and contemporary) Indigenous ‘bush’ foods and medicines and to isolate and identify novel bioactive compounds from them are available.

The rich customary knowledge on plants possessed by Indigenous cultures from around the world is a proven resource for the provision of commercial native foods, flavours, fragrances, nutraceuticals, therapeutics, healthcare and agricultural products. As just one example, approximately 25% of all pharmaceutical products worldwide have originated from Indigenous medicinal knowledge and the study of this knowledge is of key importance in the discovery of new drugs. In Australia, for many Aboriginal communities this knowledge is being rapidly lost due to limited documentation and little chemical or biological investigations of their bush foods and medicines have been conducted.
We have established strong partnerships with Aboriginal Elder custodians of customary knowledge and various projects are available in partnership with them. This includes firsthand documentation of their bush food and medicines knowledge, conducting antimicrobial and antioxidant assays and undertaking chromatographic methods and spectroscopic studies to elucidate the compounds responsible for the flora’s medicinal properties. Projects may also incorporate metabolomics studies of bush foods and medicines and developing bioinformatics databases to integrate, visualise and analyse both firsthand and public domain customary medical plant data in order to preserve the customary knowledge of Indigenous people and provide information that can be used for their cultural and educational purposes and/or development of community healthcare and nutraceutical products.

NATIONAL INDIGENOUS SCIENCE EDUCATION PROGRAM

Using science as a tool for developing student engagement, the National Indigenous Science Education Program (NISEP) allows secondary students from low SES regions, especially Indigenous youth, to succeed in their secondary education and to make the transition to tertiary education. NISEP is a consortium of Australian universities, high schools and science and Indigenous outreach organisations. NISEP is an award-winning program that has tangible positive educational outcomes for participants and there is demand for its implementation more widely across higher education institutions. Given this demand, it is essential to have science engagement activities of the highest calibre and to identify the critical components of NISEP’s success. Projects will be available to develop effective engagement resources and activities and to build an evidence base for the effectiveness of NISEP.

Selected Publications


3. Akter K, Barnes EC, Brophy JJ, Harrington D, Yaegl Community Elders, Vemulpad RS, Jamie JF, Phytochemical Profile and Antibacterial and Antioxidant Activities of Medicinal Plants Used by Aboriginal People of New South Wales, Australia, Evidence-Based Complementary and Alternative Medicine, 2016, 2016.

