PhD Scholarship descriptions

General description

Subject Area: Biomolecular Nutrition (5 projects)
This is an exciting multi-disciplinary research area which brings together nutritional biochemists with expertise in fatty acids & trace elements, molecular biologists, animal physiologists, experts in diabetes and obesity and sensory scientists.

Project 1: Discovering the role of essential nutrients in the brain
Supervisors: Prof Andy Sinclair, Assoc Prof Leigh Ackland, Dr Cenk Suphioglu
The brain is rich in essential nutrients zinc and docosahexaenoic acid (DHA, omega 3). In both zinc deficiency and DHA deficiency, apoptosis (cell death) is a common feature. We have shown that zinc deficiency induces apoptosis in cultured human keratinocyte cells, consistent with a major causal role for apoptosis in the pathology of zinc-deficient skin. Similarly, in neuronal cells, DHA deficiency causes cell damage through apoptosis. **We recently established a link between dietary DHA deficiency, altered zinc transporter expression and zinc accumulation in the brain.** Together, these findings suggest a link between DHA, zinc and apoptosis. This project will explore the molecular basis of this link.

Project 2: What role do essential nutrients have in depression?
Supervisors: Dr Ken Walder, Assoc Prof Tom Cocks, Prof Andy Sinclair
Studies in patients with depression show some significant benefits following the use of dietary supplements of long chain omega 3 fatty acids. Brain cell membrane phospholipids are extremely enriched in docosahexaenoic acid (DHA, omega 3). The molecular basis for this benefit is poorly understood. It may be related to alterations in eicosanoid metabolism, changes in downstream products such as BDNF and/or changes in blood flow. This project will explore the molecular basis of this link by investigating the specific role of the two main essential omega 3 fatty acids (EPA and DHA) in ameliorating depression in appropriate animal models of this condition.

Project 3: Understanding the metabolism of essential nutrients in ruminant animals
Supervisors: Prof Andy Sinclair, Assoc Prof David Cameron-Smith, Dr Giovanni Turchini
Most Australians do not consume enough of the essential nutrients known as long chain omega 3 fatty acids. The richest sources of these in our diet are fish; however lean red meat (muscle tissue) is also a good source. In Australia, approx half the intake is from lean red meat. Interestingly, ruminant tissue is rich in a novel long chain omega 3 fatty acid, known as docosapentaenoic acid (DPA omega 3). The aim of this project is to use molecular techniques to investigate the synthesis of these fatty acids with a view to increase the content and type of specific long chain omega 3 PUFA in muscle tissue in ruminants.

Project 4: Is there a critical period during pregnancy or lactation to supply essential omega 3 fatty acids

Supervisors: Prof Andy Sinclair, Assoc Prof Richard Weisinger

Nutrition of the pregnant animal has long been known to have a significant impact on the health of the offspring. It is regarded now that there is a critical window during pregnancy and/or lactation during which time it is critical to supply the developing foetus/suckling animal with optimal nutrition. Failure to deliver optimal nutrition at this time leads to permanent effects on the offspring when they are adults. We have discovered that failure to provide omega 3 fatty acids during the perinatal period leads to permanently raising the blood pressure of the offspring. The aim of this project is to define the critical period (pre-natal or post-natal) and to explore the molecular basis of this effect.

Project 5: How do olives make a natural anti-inflammatory compound?

Supervisors: Dr Russell Keast, Prof Andy Sinclair

Newly pressed extra virgin olive oils contain a specific phenolic compound, (-)-decarboxymethyl ligstroside aglycone (also known as **oleocanthal**; oleo- for olive, canth- for sting, and al- for aldehyde). Oleocanthal has been shown to mimic the pharmacology of a drug known as ibuprofen, also a pharyngeal irritant, in that oleocanthal has the capacity to inhibit the same cyclooxygenase (COX) enzymes in the inflammatory pathway as does ibuprofen, which means it is a natural non-steroidal anti-inflammatory drug (NSAID). We propose that the anti-inflammatory activity of oleocanthal is partially responsible for the health benefits of a Mediterranean Diet. This project will investigate biosynthetic routes for production of oleocanthal in olives using molecular techniques.