Overview
Lipidomics is concerned with the identification and quantification of lipids (fats) within a given biological system; it also seeks to elucidate how individual molecular species affect lipid metabolism and the function (or dysfunction) of the system as a whole. The field has recently emerged as a crucial component in the broader push to arrive at an integrated picture of the role of genes, proteins, and metabolites that fully describes cellular function. It is a fast emerging field internationally with large-scale collaborative projects underway in both Europe (European Lipidomics Initiative, ELI) and the USA (LIPID MAPS, $USD 85 M).

The lipidomics team at UOW has two main research streams. The first is the development of new lipid analytical techniques and hardware. The aim of this stream is to create tools that will allow us to distinguish and measure isomeric lipids at a molecular level. An ability to measure lipids at this level of specificity is important as small changes in lipid structure, i.e. double bond isomerism can have a significant effect on metabolic fate and pathogenesis. We have already had some success in this area, e.g. the development Ozone-Induced Dissociation (OzID; US patent US 7,771,943 B2).

The second stream ranges from basic molecular research through to clinical nutrition and is aimed at understanding the role of lipids and lipid metabolic pathways in the development of various pathologies. These pathologies include: cardiovascular disease, Alzheimer’s disease, cataract, dry eye, presbyopia, Parkinson’s disease, type 2 diabetes and obesity. The lipidomics laboratory is equipped with state-of-the-art, automated instrumentation, which along with novel technologies such as OzID, provides UOW with unique capabilities for determining the links between lipid biochemistry and various pathologies.

Key People

**UOW Chief Investigators:**
Dr Todd Mitchell, Assoc. Prof. Stephen Blanksby, Prof. Brett Garner, Prof. Paul Else, Assoc. Prof. Barbara Meyer, Prof. Peter McLennan, Dr Andrew Jenner, Dr Jessica Hughes and Prof. Roger Truscott (UOW/USyd).

**US Collaborators:**
Prof. Robert Murphy, University of Colorado Health Sciences Center
Prof. R Graham Cooks, Purdue University
Prof. Mason Freeman and Assistant Prof. Mike Fitzgerald, Harvard Medical School
Prof. Gavin Reid, Michigan State University
Prof. Ryan Julian, University of California Riverside
Prof. Kevin Schey, Vanderbilt University

Caption: MALDI-MS image of palmitoyl dihydro-sphingomyelin distribution in the human lens at 23, 64 and 70 years of age

Caption: Determination of double bond position in molecular lipids by Ozone-Induced Dissociation (OzID).
Strengths:

- Australian Health Services Research Institute
- Centre for Archaeological Science
- Centre for Health Initiatives
- Centre for Medical Bioscience
- Centre for Medical Radiation Physics
- Centre for Medicinal Chemistry
- Centre for Statistical & Survey Methodology
- Engineering Manufacturing
- Engineering Materials Institute
- GeoQuEST Research Centre
- Information & Communication Technology Research Institute
- Institute for Conservation Biology & Environmental Management
- Institute for Innovation in Business & Social Research
- Institute for Mathematics & its Applications
- Institute for Social Transformation Research
- Institute for Superconducting & Electronic Materials
- Institute for Transnational & Maritime Security
- Intelligent Polymer Research Institute / COE for Electromaterials Science
- Interdisciplinary Educational Research Institute