

Industrial Biotechnology

CSIRO LAND AND WATER
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We look to the natural world to find inspiration for bio-based technologies that provide new tools for a range of industries, including water and wastewater treatment, mining, energy, chemical manufacture and agriculture.

Environmental and Industrial Biotechnology

We work with industry and universities to develop biotechnological processes and environmental engineering approaches for mining, energy, water supply, waste and wastewater treatment and other related areas. This includes processes to recover value (e.g. water, energy, metals, nutrients) from low grade resources and wastes, treatment of urban and industrial effluents and remediation of sites contaminated with organic and inorganic pollutants. Our science also increases the understanding of microbially induced problems and helps to develop rapid detection, monitoring and control strategies.

Key research areas include:

- Waste/wastewater treatment and resource recovery
- Mining biotechnology
- Bioremediation of contaminated sites
- Microbially caused problems e.g. biofouling, biocorrosion, bioclogging)



Figure 1: Waste batteries for resource recovery

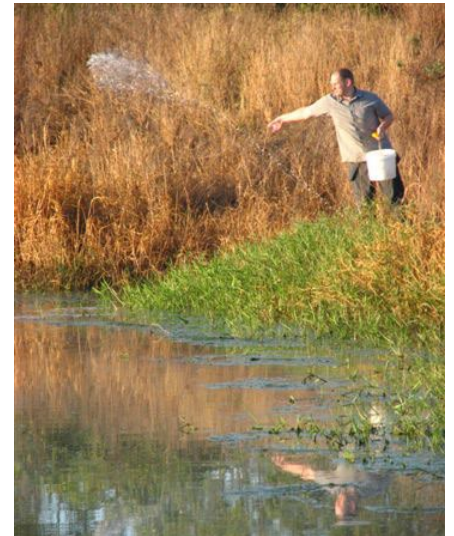


Figure 2: Deploying enzymes for pesticide degradation

Biocatalysis and synthetic biology

Improved industrial sustainability has become a global concern over the last few decades, with a clear need for less reliance on petrochemical feedstocks, reduced energy requirements and the reduction or elimination of waste. Biocatalytic processes provide an excellent solution to many of these issues through harnessing the natural efficiency and selectivity of enzymes. We draw on the amazing versatility of natural enzymes and engineer these enzymes to provide superior bio-based catalysts for a particular application. Sometimes we combine several different enzymes into complex multi-enzyme arrays (or nanofactories) to suit a particular application. More recently we have begun extending the expertise in biocatalysis and enzyme engineering to the development of synthetic biology capability. **Application areas include:**

- Pollution reduction via process improvement and enzyme technologies
- Flavour, fragrance and fine chemical production
- Synthetic biology tools

Metabolomics and Proteomics

We provide systems biology-based solutions towards a deeper understanding of environmental, clinical and bio-industrial challenges using multi-omics (genomics, proteomics, metabolomics) approaches.

The multi-omics approach is used to gain insight into ecosystem health and anthropogenic impacts of contaminants. As an example, systems biology is being applied to investigate colony collapse in honeybees. By looking at the metabolomes, proteomes and transcriptomes of individual bees and larvae exposed to various stressors, we can unearth further biological clues around the causes of colony collapse and broader ecosystem health, and even find early warning biomarkers that indicate that a colony is under stress.

The systems biology approach is also used to deepen our fundamental understanding of the biochemical pathways and the underlying mechanisms of biomarker formation that relate to the various stages of infection caused by pathogens in humans. The multi-omics capabilities can be applied to a wide range of **application areas including:**

- Synthetic biology
- Agriculture and food security
- Health
- Biosecurity
- Environment
- Industrial chemistry



Figure 3: A systems biology approach is being applied to investigate colony collapse in honeybees

Facilities and equipment

Our facilities in Perth, Canberra and Brisbane include well-equipped microbiology, molecular biology, biotechnology and analytical chemistry laboratories with over \$10 million worth capital instrumentation and laboratory infrastructure. Some of the laboratories have accreditation for work with imported samples and genetically modified organisms. We also deploy a range of field equipment and perform research directly on industry infrastructure, such as water production bores, water distribution networks, and industrial wastewater treatment plants.



Figure 4: Modified Robbins device in water pipeline for biofilm research

Research collaboration

We have strong relationships and partnerships with industry, government and universities. Research partnerships extend across many countries and have included a number of visiting researchers and students. We have also strong links with other CSIRO business units enabling the tackling of transdisciplinary research.

Partner with us

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