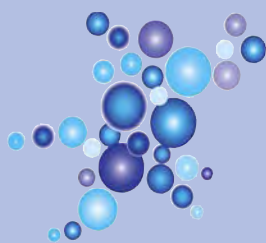


Enviro Biotext

News from the Environmental Biotechnology CRC



Prof. Linda Blackall
EBCRC Research Director

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Biotechnology benefiting the environment

What is Environmental Biotechnology?

Environmental biotechnology (EB) is a relatively new concept in the biotechnology sector. There are several definitions but one from the Australian Government is: 'the development of products or processes using plants, animals or microorganisms.'

Environmental: "relating to the natural world, especially to its conservation"

The Department of Environment and Heritage has a web site devoted to the topic of environmental biotechnology (www.deh.gov.au/industry/biotechnology).

Biotechnology has been applied to environmental research for some time in fields like wastewater treatment. However, there have been major advances in fields such as genomics, proteomics and nanotechnology that can be exploited by EB; taking it to levels not previously possible.

For example researchers can understand what motivates microorganisms to carry out a specific feature like the metabolism of an environmentally damaging chemical.

By utilising this information, that chemical can be removed from the environment with confidence and in the most cost effective manner using the microorganisms.

EB is a field with a high requirement for multidisciplinary professionals. These include biologists (geneticists, biochemists, microbiologists, ecologists), agricultural scientists, engineers (process, environmental, chemical, geotechnical), chemists, and computer scientists (modelling, bioinformatics).

The International Society for Environmental Biotechnology is an interdisciplinary federation of scientists, engineers, and other individuals who are interested in various aspects of environmental biotechnology.

The ISEB defines the field as: "the development, use and regulation of biological systems for remediation of contaminated environments and for environment-friendly processes (green manufacturing technologies and sustainable development)".

One of the oldest centres in this field formed in 1986 is the Center for Environmental Biotechnology at the University of Tennessee. This centre was formed to foster a multidisciplinary approach for training the next generation of environmental scientists and solving environmental problems through biotechnology.

Worldwide, the new area of work is increasing in profile within the biotechnology and environmental sectors. The time is right to capture the benefits of Environmental Biotechnology for Australia.





Australia and Environmental Biotechnology

The EBCRC is the largest collection of professionals in the EB field in Australia, it encompasses much of Australia and includes several world-leading scientists.

Australia has many researchers engaged in EB. Two key centres are located at LaTrobe University (Bendigo) and the University of Southern Queensland. Flinders University in Adelaide has recently opened a new school dedicated to EB - see last page.

EBCRC research focuses on communities of mixed microbial organisms rather than single monocultures for natural bioprocesses.

Our major interests are in the use of wastes (solid, liquid and gas) for product generation, the exploitation of biological knowledge to generate novel products, and improvements in environmental sustainability and health.

The CRC will establish EB as a mainstream sector in the biotechnology industry.

The portfolio of our current research includes:

1. Pathogen detection in the environment
2. Bioproducts from agricultural wastes
3. novel biofilm control strategies
4. generation of "living paints"
5. improved nutrient removal processes from high-strength wastewaters
6. integrated biosystems for agriculture
7. biocompost from municipal solid waste
8. bioremediation of toxic chemicals
9. improved pumpability of oil tanks

An example of EBCRC's research projects involves the development of Biopaints. We are studying the addition of biologically produced

chemicals to paints and adhesives to achieve property and cost improvements across a range of applications.

Paints will be made which include biological chemicals, enzymes or even whole organisms, which are targeted to improve specific properties. A key feature of the research is the study of delivery methods whereby the biological material can be added to the paint and still function

In another project, rapid pathogen monitoring in drinking water distribution systems is likely to improve the management and detection of bacteria in water treatment and distribution systems.

With fast, accurate, quantitative assessments of pathogens the need for time consuming lab based analyses is reduced to confirmations rather than process control.

The processes being developed could be employed by anyone in the water treatment/consumption industry including water utilities, household owners, farmers and those in the food processing industry.

Future applications from research in EB will provide new technologies for water reuse (highly relevant to Australia), bioenergy production (globally relevant), and products from waste.

Technologies that will become standard applications will include biosensors (many formats), microarrays for multiple simultaneous analyses, and delivery mechanisms for natural bioactives in the environment.

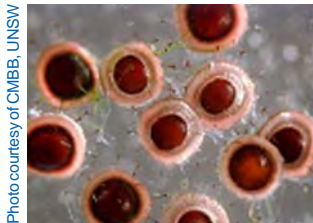


Photo courtesy of CMBB, UNSW

Common marine fouling organism Bryozoan (*Bugula neritina*)

First Patent Application for EBCRC

EBCRC files its first Provisional Patent

Congratulations to inventors Jeremy Webb, Nicolas Barraud and Staffan Kjelleberg

24 May was a significant day for EBCRC with Patent Attorneys Spruson & Ferguson filing the first provisional patent for EBCRC.

The invention came from our Biofilms project and relates to methods and compositions for regulating programmed cell death in micro-organisms and for promoting or inhibiting dispersal of micro-organisms from biofilms.

This is a good example of how EBCRC is focu-

-ssing its R&D capabilities on building inter-related portfolios of commercially valuable IP to underpin knowledge based products and services that meet market needs.

Preference is given to technologies for markets that exceed \$100m, technologies that have multiple application fields, and technologies where EBCRC members can provide a route to market.





EBCRC Student wins QLD Award



Outcomes from this research can be applied to QLD government policy development

In April, Queensland Premier Peter Beattie presented EBCRC PhD student Luke Burow with a Queensland Government Smart State Award for PhD research that will foster evidence-based public policy development.

Following a competitive selection process Luke's research was chosen to receive support from this program, based on its likely relevance to government policy.

Luke said he was delighted to win the award. "The Smart State Award is unexpected but appreciated. PhD research is about discovering how things work and it is great to know that outcomes from this research can be applied to government policy development."

"The award allows me to leverage other funding sources to travel to overseas labs to gain important experience and advice from international collaborators," he said

Luke was awarded the prize for his research into understanding how microorganisms remove phosphorus from wastewater to optimise the biological treatment process.

Excessive levels of nutrients such as nitrogen and phosphorus in water is called eutrofication and is a major cause of algal blooms.

Removing nutrients from treated wastewater before it is release will prevent shifts in the bacterial & plant life which upset the delicate ecosystems of our rivers.

To remove phosphorus from wastewater, a biotreatment process known as enhanced biological phosphorus removal is used.

Polyphosphate accumulating organisms (PAOs) are critical to this process and an understanding of their fundamental physiology is required for process optimisation.

PAOs must compete successfully within a diverse mixed microbial community under stressful conditions in order to survive and proliferate.

Biochemical and molecular data will be gathered to characterise the activities of these microorganisms and clarify aspects of nutrient transport mechanisms and their capacity to remove nitrogen.

Benefits and Risks of Gene Technology

Risks of Genetic Engineering need to be prevented or minimised while realising benefits

The potential environmental impacts of genetically modified organisms (GMOs) vary. Specific benefits and risks will depend on the introduced trait and the environment into which the GMO is to be released.

Like every technology there are possible risks, but gene technology has much potential to contribute to environmental sustainability, natural resource management, and biodiversity conservation.

Environmental benefits can be realised not only from GMOs currently being developed for other purposes, but also from GMOs specifically developed to protect biodiversity, enhance environmental protection, or otherwise solve environmental problems.

Current environmental applications of gene technology in Australia include the control of weeds and feral animals, the deployment of GMOs that reduce use of toxic chemicals (eg.

use of GMO derived vaccines to provide protection from cattle ticks), the use of bacteria to decontaminate toxic waste sites, and the use of GMOs in cleaner production and environmentally friendly power generation.

Policy does not allow the EBCRC to use GM organisms in the Environment

The novelty of GMOs, the fact that like all organisms they may continue to reproduce after release, the complexity of natural environments and ecosystem processes, and the unknown evolutionary fate of inserted genes, all contribute to the difficulties of predicting environmental impacts.

There are government regulations that closely monitor and assess the generation and use of GMOs in fundamental and applied fields.

Thank you to the Department of Environment and Heritage for this story



Australian Government
Department of the Environment and Heritage





New Biotech Department at Flinders

Flinders University has brought in the experts to develop a new Environmental Biotechnology department.



Prof. Andy Ball, Flinders University

Professor Andy Ball arrived in Australia in April 2005 to take up the position of Foundation Chair in Environmental Biotechnology at Flinders University of South Australia. Previously Andy spent 16 years working at the University of Essex in the UK

Environmental issues such as contaminated land and water, climate change and loss of biodiversity are key issues both at a local and international scale.

Flinders University is committed to strengthening research, both fundamental and applied in this area, having established Flinders Bioremediation in 1999 out of a successful environmental biotechnology teaching and research program.

Andy's research is focused on the response in terms of activity and diversity of microbial communities to environmental perturbations.

Andy's main interest is in the bio-remediation of contaminated land and water. This research examines the potential role of microbial communities in the treatment of waste oils and also in the factors limiting the breakdown (natural attenuation) of contaminants in contaminated sites.

At Flinders, along with continuing his research Andy will participate in the teaching of the Bachelor of Biotechnology (Honours) Degree and the Masters of Biotechnology Studies.

The focus of these courses is in the scientific principles and current knowledge in the study and implementation of biotechnology.

Students on these programmes are able to carry out research in the area of Environmental Biotechnology and through Flinders Bioremediation there are opportunities to carry out applied research.

Upcoming Events

Our website is kept updated with details of all EBCRC-related events

Ausbiotech 2005
Perth 23-25 November

Annual Research Showcase
Brisbane 30 November

Environmental Biotechnology will be a key session at Ausbiotech in Perth this year. EBCRC will also have an exhibit at the conference, so please come and say hello.

Our first research showcase last year was a great success. If you would like to come along to the event this year, registration details will be available soon.

Contact and Publication Details

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