



# The National NCRIS Photobioreactor Facility

The National NCRIS Photobioreactor Facility provides world class infrastructure and expertise to advance Australian research and development into microalgae for biofuel production.

The \$5 million National Collaborative Research Infrastructure Strategy (NCRIS) Photobioreactor Facility, completed in October 2009, is based at the South Australian Research and Development Institute's (SARDI) Aquatic Sciences laboratories at West Beach, Adelaide.

The NCRIS facility provides unique capability for R&D clients to research microalgal growth using state-of-the-art technology at one central location. The facility is an essential step in taking new biofuel feedstock technologies towards full commercialisation.

It provides the capability to research microalgal growth in experimental photobioreactors and raceways, and enables manipulation and monitoring of algal production systems to improve algal biomass and lipid (oil) yield.

## Infrastructure

### Microalgal culture systems

Three systems are available:

- Pilot-scale photobioreactor system comprising a 3.5m<sup>3</sup> Algelink Solutions, tubular bioreactor, illuminated with natural sunlight. A regulated automated injection of nutrients (particularly inorganic sources of nitrogen and phosphorus) and carbon dioxide (dissolved in the water) can be achieved.
- Three 20m<sup>2</sup> (10 x 2 x 0.5m) raceway ponds, including a monitor and control system for automatic injection of carbon dioxide.
- A controlled environment room where manipulative small-scale physiological experiments can be carried out in a 15L Applikon Autoclavable photobioreactor or flasks.

The facility also provides a range of microalgal harvesting systems (e.g. centrifuges) and equipment to store and process the harvested algal biomass.

The overall facility therefore includes testing and optimisation of microalgal growth, lipid and carbohydrate production, harvesting and dewatering technologies and extraction systems.

### Analytical capability

The physiological monitoring system comprises a state-of-the-art relocatable laboratory with instrumentation selected to monitor the health and productivity of the microalgae and environment of the culture system and the water quality parameters of the growth medium.

Three separate laboratories house:

- analytical microalgal photophysiological equipment;
- equipment to isolate and maintain pure cultures of microalgae
- equipment to extract and quantify microalgal lipids and measure microalgal productivity.

Laboratory equipment includes:

- Spectrophotometer (Shimadzu UV-1700) to determine cell densities and the growth rates of the microalgae cultures.
- Spectrofluorometer (Hitachi) to determine the lipid and chlorophyll content in algal media.
- Automatic Soxhlet system (Gerhardt Soxtherm) to extract the lipids out of the microalgae or other oil containing organisms to determine the oil content.
- Nutrient analyser (Aquakem 200cd) to determine the nutrient concentrations in the growing media. It can also be used to adjust the output of the automated nutrient injection system.
- Fluorescent microscope (Olympus BX-61) to enable quantification of intracellular lipid production and the general health of the microalgal cells.
- Flow cytometer (Beckman-coulter Cell lab Quanta SC) to simultaneously measure electronic volume and side scatter to provide unsurpassed population resolution and accurate cell counting. Additionally it measures three fluorescent colours to provide information on lipid and chlorophyll content and the health of the cells.
- Liquid Scintillation Counter (Perkin Elmer) to measure overall productivity and carbon uptake rates, and to trace lipid and carbon pathways.
- Rotovap including classic Soxhlet extraction unit (Buchi R210, Buchi V700 and V850) to remove the remaining solvents from the algal oil. It also provides an all-in-one step oil cold soxhlet extraction method.
- TOC / TN Analyser (Analytic Jenna) to analyse the total organic carbon and total bound nitrogen in liquid and solid samples.
- Phytoplankton physiology analyser to evaluate photosynthetic yield in response to environmental conditions.
- Gas Chromatography system to determine the ester (chemical compound) profile of algal oil. It also determines the conversion of the oil into biodiesel.
- HPLC system to determine the phospholipids and sterol glucosides in the microalgal oil, and also used for protein analyses.
- Automated Gel Electrophoresis Instrument to identify and measure the proteins present in the algal samples.
- Freeze Dryer to process and stabilise harvested algal samples.
- Incubator for carbon uptake analyses
- Karl Fischer Apparatus to determine the moisture content of Biofuels and Bio Oil.
- Viscosity Meter to measure and check the viscosity of liquids and Biofuels.
- Densitometer to evaluate the density of Biofuels
- Inverted Microscope for routine monitoring, training and checking the health and vitality of the algae.

A comprehensive range of additional laboratory equipment is available including an Autoclave (Hirayama HV-110L), Millipore Elix5 Reverse Osmosis system and refrigerated centrifuge (Eppendorf 5810 R).

## Service and costs

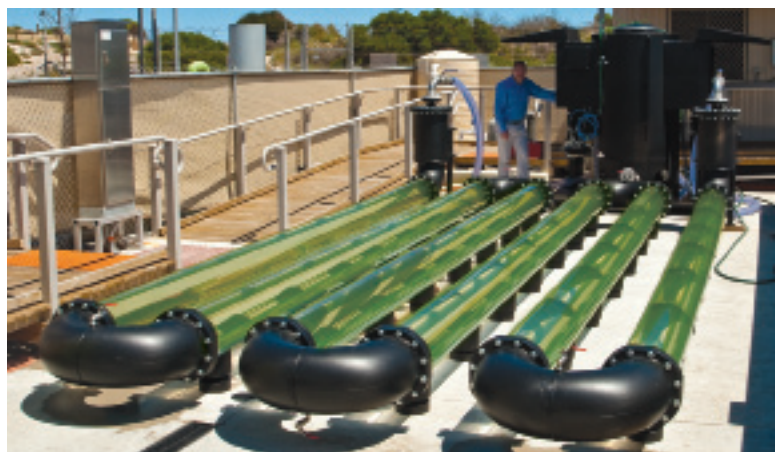
The National NCRIS Photobioreactor Facility offers access to quality facilities, technical expertise and advanced equipment at a subsidised rate for eligible researchers. The overall objectives are to encourage collaboration and reduce duplication of research infrastructure on a national basis.

NCRIS provides the technical expertise to operate and conduct analyses at the request of customers or provide customers with the training they require to undertake the work themselves.

A comprehensive cost structure has been developed and is available on request.

## How to get access?

Researchers wishing to apply for access to the facilities should contact the Ausbiotech NCRIS Program Manager or the NCRIS Photobioreactor Facility Manager.



## Staff

### Barbara Rone-Clarke

#### - NCRIS Laboratory Manager

Barbara holds a BSc (Hons) degree from Birkbeck College, University of London. Barbara has more than twelve years experience managing quality control laboratories, both in Australia and New Zealand in a biopharmaceutical/biotechnology environment. Barbara also has considerable experience analysing oil, gas and water samples having worked in the petroleum industry in the UK and the geothermal industry in Indonesia. Barbara, previously Quality Control Manager for Novozymes Biopharma, Australia, joined the NCRIS Photobioreactor Facility team in January, 2009.

### Maria-Eugenia Segade-Enrique

#### - NCRIS Technical Officer

Maria-Eugenia holds a Licenciatura en Ciencias Biológicas (M.Sc. equivalent) from the University of Buenos Aires, Argentina, and has more than six years experience working in a variety of laboratory environments including the Invertebrate Laboratory of the Argentine Museum of Natural Sciences, and the Southern Seas Ecology Laboratory at the University of Adelaide, conducting chlorophyll analysis and processing water samples as well as rearing animals in aquaria. In January 2008, Maria-Eugenia joined SARDI Aquatic Sciences working with its Marine Environment and Ecology and Wild Fisheries science programs, before being appointed to the NCRIS facility as its Technical Officer in December, 2008.

## Contact

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