

# Microalgae nutrition by the billion

The beautiful structure of the microalgae *Gephyrocepsa oceanica*, exposed by the electron microscope.

When juvenile oysters at CSIRO Marine Research were fed cultures of the microalga

*Pavlova pinguis*, their growth rate doubled. Such are the nutritional qualities of microalgae, the tiny marine organisms from which all land plants evolved.

This nourishing microalga was cultured in the growing rooms of CSIRO's Collection of Living Microalgae at its Hobart Marine Laboratories. The collection houses every known marine microalgae family: more than 700 strains representing almost 300 species, from tropical to Antarctic waters. More than 80% are Australian in origin. It's a living information bank for research and study, and an important resource for the nation's fast-growing aquaculture industry.

In glistening ranks, flasks of sterilised sea water contain the balance of nutrients that each species prefers. Timing devices

change darkness to daylight, and the ambient temperature is set to suit the collection's billions of inhabitants.

The collection was developed during the 1960s and 1970s by Dr Shirley Jeffrey to support research into ocean phytoplankton. The aquaculture supply service, established in 1986, supplies industry clients and research institutions in Australia and overseas.

CSIRO senior research scientist Dr Susan Blackburn is the director of the collection. 'Hundreds of the smallest microalgae could fit on the head of a pin,' Blackburn says. 'A litre of sea water may contain a billion organisms of these single-celled plants, which are the first links in the marine food chain.'

Like green plants on land, algae use photosynthesis to create new living tissue. Plant pigments absorb sunlight and convert it to carbohydrates from the molecules of carbon dioxide and water. In the process, they absorb carbon dioxide and release large amounts of oxygen. It's the microalgae that make the world's oceans a 'carbon sink', and play a critical role in maintaining balance in the Earth's atmosphere.

These wandering pastures of the sea are grazed by marine animals including zooplankton, fish larvae and filter-feeding molluscs such as oysters, mussels and clams. A single adult oyster may consume 50 billion algal cells each day!

Aquaculture operations use thousands of litres of algal culture daily to feed the larval and juvenile stages of farmed species including oysters, prawns, abalone, barramundi and giant clams. CSIRO supplies starter cultures of selected algal strains, from which operators grow the larger quantities needed for feeding.

'In any farming operation, the nutritional quality of feed determines the production rates and quality of the finished product,' Blackburn says. 'Better feed means better productivity, and improved returns.'

'That's where CSIRO's microalgal collection is of particular value to the industry, because the starter cultures we supply are of the highest quality, grown under the stringent scientific conditions.'

The scientist behind the *Pavlova pinguis*-oyster studies is Dr Malcolm Brown. He and his colleagues have shown links between the specific nutritional content of algal strains and the particular feeding requirements of farmed species. This knowledge enables aquaculture operators to take a finely targeted approach to nutrition.

'The days of "this green one works okay" should be over,' Brown says. 'Now the industry can select an algal strain with the right chemical composition, then adapt its culturing and harvesting techniques to maximise the algae's nutritional quality, boosting growth rates and improving the productivity of the operation.'

Proteins, carbohydrate, fats and vitamins: microalgae pack a lot of nutrition into a very tiny parcel. It's intriguing to know that your next dozen Pacific oysters, pan-fried barramundi fillet, or sashimi prawns may well owe their flavour and succulence to the farming skills of CSIRO's Collection of Living Microalgae.

Contact: Frances Sugden, (03) 6232 5478, fax (03) 6232 5123, email: Frances.Sugden@ml.csiro.au.

Chris Viney



Dr Susan Blackburn attends to some of the billions of inhabitants of the CSIRO Collection of Living Microalgae.