

Medicines from the sea

By Margot Hislop

THE SEA IS A GREAT PLACE FOR SWIMMING, SAILING AND SURFING. ITS BEAUTY HAS INSPIRED ARTISTS AND WRITERS FOR CENTURIES. NOW, SCIENTISTS ARE BEGINNING TO DISCOVER THAT THE OCEAN MAY ALSO BE ONE BIG MEDICINE CABINET.

The medicinal properties of many marine plants and animals have long been known in many cultures. For centuries, people from Iceland, Scotland, Pacific Island nations and many Asian countries have used and benefited from these marine organisms. Korean people, for example, wrap their bodies in seaweed to draw out toxins. And Japanese people, who exhibit low incidences of cancer, eat large amounts of seaweed.

Science is now beginning to reveal the secrets of such marine organisms that benefit human health and help prevent disease.

Lurking in the not-so-deep depths of the sea are many plants and animals that contain specific natural chemical compounds, which they use to survive. Scientists perform various tests on these compounds to identify their potential to treat diseases. And, they have found that many of these chemical compounds have the ability to treat illnesses such as cancer, coronary heart disease, viral infections and inflammatory diseases such as arthritis.

SPONGE PHARMACY

Sponges are sedentary organisms that live on the sea floor and filter their food from the water. Because they are unable to move around, sponges produce a range of chemical compounds that help protect them from infection, predators, harsh ultra-violet radiation from the sun, and from being colonised by other animals. Many of these compounds have therapeutic potential for humans.

Piers Ettinger-Epstein, a PhD student at James Cook University and the Australian Institute of Marine Science (AIMS) in Townsville, is researching marine chemical ecology. Piers works with a team of scientists who are studying the biology, physical structure and chemical compounds produced by

sponges. He looks at where sponges live, how they reproduce, and how they respond to their environment.

Piers conducts his research on a species of sponge called *Luffariella*. These sponges grow at depths of between two and 15 metres around Orpheus Island, off the coast of Townsville. Once a month, Piers dives down to the sponge sites to collect small portions for analysis.

"Sometimes we encounter sharks or box jellyfish when we dive," says Piers. "I love working on the Great Barrier Reef. Each time we dive I see something new, and that's exciting."

Once Piers brings the sponge samples back to the surface, he snap freezes them in a cylinder of liquid nitrogen.

Back in the laboratory, the samples are freeze-dried and sliced into very thin sections, ready to view under a microscope. Piers analyses the chemicals present in each sample of sponge, looking for the type and quantity of compounds that have medicinal properties. These compounds may be used in pharmaceutical drugs as anti-cancer agents, anti-allergy and anti-viral treatments.

"I really enjoy this research, as it could have some wonderful practical outcomes in terms of producing a compound which could benefit so many people," says Piers.

MAIN: Piers heads out for a dive to collect sponges off Orpheus Island.

INSET ABOVE: Researchers at AIMS tie sponges onto vertical ropes to conduct experiments on growth rates. INSET BELOW: Piers collects a *Luffariella* sponge from a cage at a sample site.



Sascha Ettinger-Epstein

Carsten Wolff / AIMS

Jane Giotfrel / AIMS



Stephanie Geier, one of the AIMS Bioactive Molecule Team researchers, runs a test on marine extracts.

A CHEMICAL LIBRARY

Australian Institute of Marine Science researchers examine chemicals extracted from a wide range of marine organisms, collected from more than 1,500 sites all around Australia. These include large organisms like corals, sponges and sea squirts, as well as microscopic ones such as bacteria and fungi.

The scientists are looking for particular chemicals with potential for use in medicinal drugs. "We test extracts for their ability to kill cells derived from human cancers, microbes that cause disease and enzymes that may underlie a disease condition," explains Lyndon Llewellyn, who leads the AIMS Bioactive Molecule Team.

Lyndon's team extracts and separates different chemicals from the samples and analyses them using nuclear magnetic resonance (NMR) and mass spectrometry. These techniques enable the scientists to work out the position of the atoms in the chemicals, and the weight of the molecules of the chemicals. This information allows the scientists to determine which chemicals are present in the samples. Once they know what chemicals are present, they can then do further testing to see whether the chemicals have possible therapeutic use.

If these extracts do possess therapeutic qualities, they may be used in future anti-cancer drugs, antibiotics and other medicines.

SEAWEED - SLIPPERY BUT NUTRITIOUS!

Seaweed has been a regular part of many Asian cultures' diets for centuries. It has often been used as food for sick people and has been credited with health-giving properties.

Also, seaweed has been used in traditional medicines by Japanese, Chinese and Korean healers for a wide range of purposes. These include: reducing respiratory congestion, detoxifying the body, fighting worm infections, lowering blood pressure, treating arthritis and cancer, as a part of new mothers' diets and as a supplement for infants.

One of the most commonly eaten species is the brown seaweed, *Undaria pinnatifida*, known in Japan as wakame. Scientists are now investigating brown seaweeds for their potential therapeutic uses. Some species of seaweed have anti-viral and anti-cancer properties, as well as healing properties that benefit immune and inflammatory disorders.

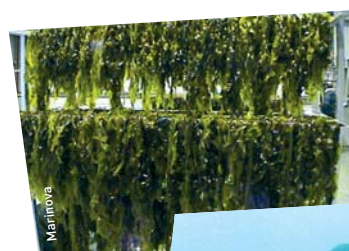
Viral infections, such as herpes viruses (cold sores), chicken pox, Epstein-Barr virus (EBV) and HIV (the virus that causes AIDS), affect millions of people around the world, and doctors, patients and drug companies are always on the lookout for any prevention or treatment. For this reason, they have welcomed the recent research by scientists in Tasmania, which shows that the consumption of *Undaria* seaweed can promote healing and inhibit infection of some of these viruses.

Undertaken by scientists at Marinova Pty Ltd, a biotechnology company specialising in the development of human therapeutics derived from seaweed, researchers monitored a group of patients with herpes infections who were given capsules of dried *Undaria* seaweed. They found that patients with active infections healed faster than usual, and patients with latent infections (dormant, but not active) did not develop any infection. Taking *Undaria* also encouraged the production of human immune system cells, which help fight infection.

Marinova's senior research scientist, Helen Fitton, sees great possibilities for the potential of seaweed's therapeutic qualities and gets very excited about her research. "I think seaweed is wonderful. I even dream about what is in seaweed and what it does," says Helen.

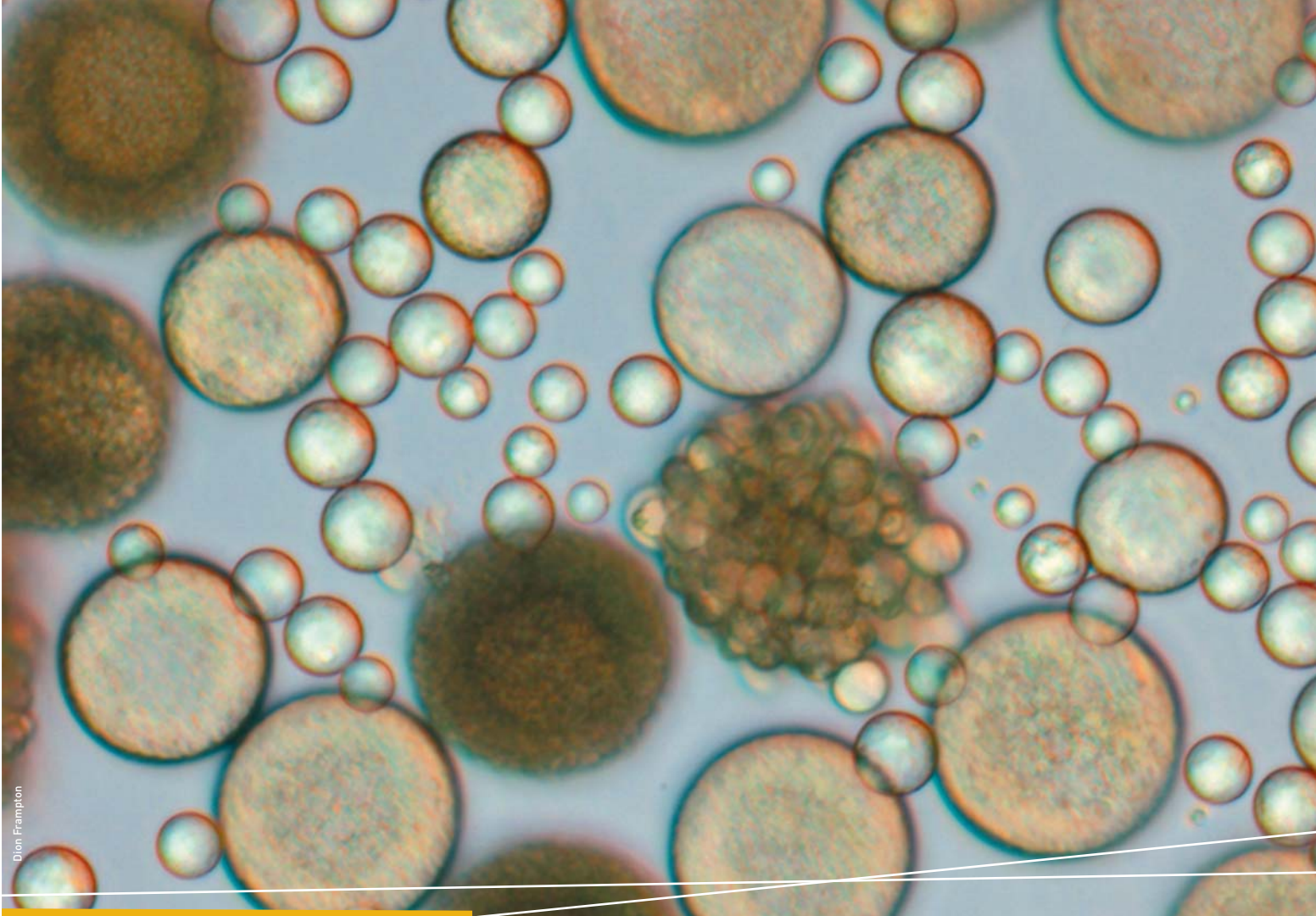
The key to the seaweed's therapeutic properties is the long, branched molecules that they contain, called sulphated polysaccharides. Helen describes the molecules as "a bit like big hairy trees, or a long hairy monster." They are often found in the characteristic slime of seaweeds.

These 'hairy' polysaccharides prevent the herpes virus from entering human cells by filling up the places on the cell where the virus would normally enter - a bit like blocking a doorway. The polysaccharides also stimulate immune activity, helping the body fight off the virus. This is really good news for sufferers of herpes, and other chronic ailments caused by viruses.



ABOVE: *Undaria* seaweed plants are prepared for research by being dried on two-metre-high racks.

BELOW: A regular day on the job for Brian Raven, Marinova's harvest manager, collecting *Undaria* samples.



Dion Frampton

MICRO OILS

These microscopic marine algae have the potential to save the lives of both fish and humans.

Some foods contain ingredients that have important benefits to human health, and the potential to protect us from illness. Some fish species, for example, contain oils that help protect against heart disease and arthritis. Fish oils also help infant brain development and protect against brain disorders such as schizophrenia, attention deficit hyperactive disorder and Alzheimer's disease.

One of these oils is called omega-3. Chemically speaking, omega-3 is a long-chain polyunsaturated fatty acid. For some time, people have accessed omega-3 by either directly eating fish, taking it as a dietary supplement in

the form of capsules, or through other food sources where it's been added. With declining populations of many fish species due to over-fishing and environmental degradation, scientists are looking for new sources of omega-3 oils.

These oils are not actually made by fish, but by microscopic single-celled organisms. The fish actually obtain the organisms, and therefore the oil, in their diet.

Scientists at CSIRO's Marine Research in Hobart have been studying the microscopic organisms that make omega-3 oils. They have discovered a new species of microalgae, a

microscopic marine plant, which contains high levels of the oil.

In the future, microalgae could be used in aquaculture as food for mussels, prawns, lobsters and fish that are farmed for human consumption. As a result, the levels of omega-3 oil in these animals will increase. Then, as we consume these seafood species, we will also obtain omega-3 oil, and the benefits that come from it.