

WAVES OF CHANGE FOR AUSTRALIA'S MARINE BIOTECH

AN INTERVIEW WITH PROFESSOR WEI ZHANG, DIRECTOR OF THE CENTRE FOR MARINE BIOPRODUCTS DEVELOPMENT AT FLINDERS UNIVERSITY, AND PRESIDENT OF AUSTRALIAN NEW ZEALAND MARINE BIOTECHNOLOGY SOCIETY

For Australia, marine biodiversity is a significant resource. Our sustainable development is inherently linked with the health of our oceans, which are facing major threats related to climate change, pollution and over-fishing. As the world's population continues to increase, so too does the demand for food, as well as employment, from the ocean's resources. The solution is to protect the marine environment while maximising its resources through a sustainable marine biotechnology industry that provides not only food, but economic prosperity, as well.

Australasian BioTechnology speaks with Professor Wei Zhang, director of the Centre for Marine Bioproducts Development at Flinders University, and president of Australian New Zealand Marine Biotechnology Society, about the current state of Australia's marine biotechnology, along with its future potential.

Can you tell us what you are working on at the moment?

What we have been working on is an exciting field of research for the future of marine biotechnological development. We are working in the marine biotechnology space, and with bioproducts. That means that we are developing the processing technology based on biological machinery for the translation or conversion of our marine biological resources into new products. The ocean occupies around 70 per cent of the earth; in Australia, the ocean is almost double the territory of our land. This represents a huge opportunity for Australia. So, we are working to develop the technology and products from our great marine biological resources.

What are you particularly excited about at the moment?

Many things! In terms of our Centre for Marine Bioproducts Development at Flinders University, we

aim to be one of the first centres in Australia that is fully dedicated to the development of sustainable marine bioprocessing technology, and also focused on the products oriented to commercial development. We are more or less industry- or market-driven applied biotechnology.



Prof Wei Zhang

Australia is one of the biggest marine nations, but we haven't done much in the marine biotechnology space in reality; it's negligible.

In Australia, the focus of marine biotechnology—in fact, 90 per cent of the focus—is on seafood and aquaculture: the fisheries. But the value of aquaculture in Australia, including fisheries, is only \$2.6 billion, which is a very small industry. So, the value of marine biotechnology is really nothing: maybe \$100 million.

What this means is that there is a great opportunity for Australia, and there is a technology and knowledge gap. We are investigating how we will be able to make use of all our marine biological resources to convert them to a new industry, a new economy and new jobs. There are exciting opportunities in marine biomaterials, functional foods, biopharmaceuticals and biofuels.

What's happening in the marine biotechnology industry to make the most of these opportunities?

Our new society, the Australia New Zealand Marine Biotechnology Society, now has about 150 members. I am the president of the society, and in April this year, we organised our first symposium that attracted about 100 attendees, which is a great start for this new era. But most importantly, in August 2015, the Australian Government officially launched the National Marine

Science Plan 2015–2025. Our Society has been working together with the National Marine Science Committee, and biotechnology and marine biotechnology have been included in the plan for the first time. Our industry has been recognised in a very significant way: the plan includes marine biotechnology as part of the 'blue economy' [an economy in which ocean ecosystems bring economic and social benefits that are efficient, equitable and sustainable].

The Australian Marine Science Plan 2015–2025 has an ambitious goal: over the next 10 years, it aims to grow the blue economy by double through emphasising how the science can be translated into products. This is an eight per cent growth rate, compared to the current 2.5 per cent GDP growth per annum. This would represent a jump from \$47.2 billion to over \$100 billion by 2025. That goal is inspirational, but it is also quite ambitious. It presents a great opportunity for Australia to grow! There are a number of proposed funding schemes that are likely to be implemented in marine biotechnology and product commercialisation in the future.

This needs our attention, because the blue economy is not just happening here, but also in other countries, and it is happening enormously. We don't want to be left behind.

What are the main challenges in developing a blue economy in Australia?

The challenges are in both the government's perspective, and also in the scientific and the general communities. Currently, the biggest challenge we have is that there are no drivers locally.

The general community and the government have an attitude that Australia is good enough. For example, in terms of seafood, people think, 'We don't need to grow too much. If we don't have seafood, we can just

eat meat because we have lamb and beef'. So, the local market is a low driver.

From the government perspective, there is no immediate driver; the perception is that we would need too much infrastructure. Now it is becoming a little different because of international competition from emerging economies, given that Australia's economy isn't in good shape. It's putting the pressure on decisions about what we are going to do, and what the future generations will do, apart from mining things from the soil. We need to look at a future that is sustainable, and competitive globally, for Australia.

The challenge with the general community is to change the mindset towards the big-picture future that will result in a sustainable economy for Australia and long-term prosperity. That is where the challenge is. It's a challenge for politicians, and also the Chief Scientist of Australia, and for the biotechnology community. That is one challenge.

It is because of this challenge that the investment is not there. Investment in marine biotechnology and bioproducts is quite low. The majority goes to seafood aquaculture and fisheries, rather than going beyond that.

The third challenge is that while we have great marine science being done in terms of understanding our oceans, our resources and our biodiversity—and environmental and ecological surveys, which is all good for the public and necessary to maintain our resources in a sustainable way—the reality is that we are not investing enough in our marine biotechnology and product innovation. Investment into translational product development can leverage our marine science capability, and demonstrate that the research can also be doing well for the economy.



Australian Kelp Products was bought by Chinese company Gather Great Ocean Algae Industry Group Co, which is harvesting wild seaweed from the South Australian shore and turning it into organic soil conditioner. iStock, Joakim Leroy

What is the potential for growth in Australia's marine biotechnology sector?

We have a significant opportunity to grow. The aquaculture industry in Japan is worth about \$14 billion. In China, it is worth about \$40 billion. Australia's industry is worth around \$2.6 billion, while our ocean territory is 10 times that of China and four times that of Japan. We can grow it to the level of China, but we haven't done it yet because our minds are not there. This is where the marine biotechnology and marine products can come in and present significant growth in jobs and the industry to make the blue economy possible. We need to get the message across to key influential players in the country.

Do environmental concerns come into play in this reluctance to develop a blue economy?

A lot of arguments are around Australia having great oceans, and that we want to preserve our marine environment, which is perfectly fine. People don't want to do anything with our oceans because they think it will damage our environment. But that is wrong. We don't have to sacrifice our environment. Marine biotechnology is taking the approach of preserving our biodiversity, and our environment, but in a way that makes meaningful use of the biological resources to sustain Australian economic growth.

Ridiculously, we are producing around 230,000 tonnes of seafood per year, and exporting around 40 per cent. But we are consuming around 345,000 tonnes per year and importing more than 75 per cent of our seafood. We cannot even meet our own seafood demand, and with such a vast ocean territory.

We've spoken a bit about food production. What are the other bioproducts that you think will be most rewarding in a blue economy?

Excluding seafood, it will be functional food, nutraceutical, supplements, pharmaceuticals, cosmetics and preventative medicines that use seaweed and microalgae. We are focusing on South Australia because South Australia hosts almost 15 per cent of the world's wild brown and red seaweed species. But we don't farm those; we don't have the large resources. These plants have a significant product potential in biomaterial supplements and preventative medicine.

In terms of the number of new marine compounds discovered, Australia is number four globally. Japan is number one and Korea is two. We have great

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discoveries, but not one single pharmaceutical product on the market.

Is this an issue with the commercialisation process, or perhaps a lack of investment?

Yes, there are two main issues. The first issue is policy and legal uncertainty, and restrictions about where biological resources come from. The second issue is lack of investment in translational research, and local commercial drivers. All over the world, the growth is quite significant in this space.

Do you see benefits in international collaboration?

Yes, significant benefits. In the last five years, two international joint industry laboratories focused on macroalgae and microalgae biotechnology have been set up to work towards understanding the great resource we have been working on. They have an investment of about \$2 million.

Another example is that Australian Kelp Products, an Australian company, was bought by Chinese company Gather Great Ocean Algae Industry Group Co, which also bought a license to harvest wild seaweed from the shore in South Australia and turn it into organic soil conditioners. That license is ongoing, but looking into high-value products using the advanced technology developed in our centre.

Are the benefits from overseas mostly funding related?

Yes, and because of that investment and that international engagement, the state government is realising the opportunity and is very supportive. There are now several local commercial partners in the food and cosmetics areas that are developing high-value products. There's a promotional opportunity to bring international investment into our R&D and into our local industry. Oceans of opportunity for Australia! 🌊

Wei Zhang will be speaking at the 17th International Biotechnology Symposium (IBS 2016).

