

Owing to its geographical isolation and limited mineral resource, New Zealand developed an economy based on meat, wool, dairy and forestry exports. This was a reasonable historical model for economic development because New Zealand is located in temperate latitudes and has good quality soils for land-based production. Over recent decades, New Zealand expanded its land-based exports into new horticultural products, like kiwifruit.

New Zealand’s research and development investment has assisted with the quality improvement of the commodity products by adding value to meat and wool processing and diversifying milk products as well as improving on-farm productivity. The evolution of biological technology in New Zealand has lead to a strong interest in biotechnology. In fact, Massey University based at Palmerston North, was the first university in the world to establish a Department of Biotechnology in 1965. The strong emphasis on plant and animal science led to a number of industries emerging as a result of these investments, for example New Zealand Pharmaceuticals Ltd.

An outcome of the broad interest in the biological sciences and the desire to commercialize new intellectual property was the establishment of the New Zealand Biotechnology Association (NZBA) in 1989. The NZBA recognized that New Zealand has several unique attributes: it is an island nation with a large fertile land area, with no serious or List A animal diseases, and a relatively small population. Our native plants and animals are unique and we have some of the most ancient tree and plant species in the world that also gives us a unique genetic diversity.

Consequently, the NZBA uses a slightly broader definition of biotechnology than that defined by the Organization of Economic Cooperation and Development (OECD). Our definition of biotechnology is:

"The application of scientific and engineering principals to the processing of material by biological agents and the processing of biological materials to improve the quality of life.”

This definition broadens the concept of biotechnology to include natural products, which we define as “goods of natural origin (existing in or by nature, not artificial) which are unprocessed or minimally processed”.

An outcome of the definitions is that the NZBA has a wide membership including interested members of the public, and scientists and marketers from private companies, government research institutions and the universities.

The constitutional objectives of the NZBA are to:
• Nurture the improvement and diffusion of biotechnology in New Zealand,
• Represent the interests of those concerned with biotechnology in New Zealand,
• Provide a forum for interaction among the disciplines involved in biotechnology,
• Foster an environment conducive to the growth of biotechnology-based industries in New Zealand.

The executive reflects the diversity and strength of the NZBA with its membership from the industry, education and research sectors.

A key function of the NZBA is to hold an annual conference. One reason for the continuing success of the conference is because it provides a forum for people from diverse research and business interests to meet informally to discuss opportunities and to “keep up with the biotech news”. The conference holds a unique role in New Zealand research, science and technology because it encourages speakers from both research and business sectors to bring to the fore the latest developments and opportunities – scientific, technical, and commercial.

The growth and vigor of biotechnology in New Zealand was reflected at the 1999 conference in which almost double the number of delegates attended compared to the anticipated registrations – a number way beyond the NZBA membership.
An important recent development for biotechnology in New Zealand was the creation of a Royal Commission on Genetic Modification (GM). As we in the biotechnology industry know, genetic modification is only a part of biotechnology but the outcome of the Royal Commission could have far reaching consequences for the life sciences and primary industry sectors in New Zealand. The Royal Commission was formed in part because of public concerns over cultural issues, the safety of eating genetically modified foods, perceived risks associated with the field release of GM “weedy” and “resistant” plants and stress on GM animals.

The primary objective of the Royal Commission is to inquire into and report on the strategic options available to enable New Zealand to address genetic modification now and in the future. It may also recommend any changes in the current legislative, regulatory, policy or institutional arrangements for addressing genetic modification technologies and products in New Zealand. The terms of Reference are also available for view on the MoRST website.

A positive development for creating a science-based future for New Zealand was the announcement by the government to establish a high-level Science and Innovation Advisory Council (SIAC), reporting to the Prime Minister.

A statement from the MoRST website describes the purpose of the SIAC as follows:

- increase the public status and recognition for scientists and science,
- promote a long-term, strategic direction for research, science and technology,
- build private-sector commitment to new science and technology policy directions, and
- enable coordination of Government policies and community activities at the highest level.

As you will see from the table of contents and the body of this issue of Asia-Pacific Biotech News, the state of biotechnology in New Zealand is vigorous and flourishing. The Crown Research Institutes are focusing on high quality research and exploring commercial opportunities. The non-traditional private sector is small but growing rapidly in both numbers of businesses and export sales.

Natural products will continue to play an important role in exports from New Zealand. Over the next decade, we will see changes in the type of exports as a result of the application of new intellectual property and new high-tech manufactured products.

We have chosen the organizations in this issue as representative of biotechnology in New Zealand. The list is by no means exhaustive and it is not a “priority list”. It was a difficult decision as to which organizations should be included and which ones left out.

Other activities run or organized by the NZBA include:
- Encouraging the understanding of biotechnology within the secondary school system, where we offer a prize for the best essays on a subject on biotechnology,
- Maintaining contact among the members through a newsletter which has now routinely become a seventy-page journal,
- Operating a website that reports NZBA news and maintaining a directory of organizations in the New Zealand biotechnology sector. Last year the website was chosen as HMS Beagle’s “Web Pick of the Day”, and is listed on HMS Beagle’s “Favourite WebSites” (www.biomednet.com/hmsbeagle). There have been some major changes in the philosophy behind research funding in New Zealand that will heavily impact scientific research. It is led partly from the government-inspired Foresight Project. The Foresight Project was developed to allow the Ministry for Research, Science and Technology (MoRST) to gain insight into where New Zealand wishes to see itself in 10 years’ time. I believe it will also have beneficial outcomes for the biotechnology industry in New Zealand.

In association with the biotechnology export industry-based organization Biotenz, the NZBA submitted a document to the Foresight Project called “The Industrial Biotechnology and Natural Product Sectors 1998 – 2010”. This document, which is available on the NZBA’s website (www.biotech.org.nz), gives an overview of where we see biotechnology in New Zealand in the year 2010. This approach has been used to assist the Ministry in refocusing the direction of government-funded research. An outcome of this effort has been an increased interest in the funding of biotechnology in its broadest sense known as the Strategic Portfolio Outline (SPO) for Advanced Biological Enterprises.

Although this SPO is a key one for biotechnology, there are also areas of biotechnology funding in the medical and health industries. Additionally, horticulture and agriculture as well as the more specific food and animal based industries have biotechnology components. All of these SPOs have evolved from the government positioned document “Blueprint For Change” which describes the Government’s policies and procedures for its research, science and technology investments. The “Blueprint for Change” can be found on the Ministry’s website (www.morst.govt.nz) and the details of the science portfolios on the Foundation for Research, Science and Technology website (www.frst.govt.nz).

We feel that the changes in philosophy by the New Zealand government will provide a considerable boost to the research, science and technology of biotechnology and the overall natural product industry.
Biotechnology in New Zealand

Commentary by Dr. William Rolleston*

New Zealand exports over NZ$100 million (US$51.2 million) worth of biotechnology based goods and services each year. The industry is diverse and incorporates biological processing of products from plants and animals to research in molecular biology.

New Zealand is well known for its clean and natural environment. It has a modern and open economy and is a world leader in agricultural production and research. New Zealanders are renowned for their innovation and their “can do” attitude. These factors provide a backdrop for an emerging biotechnology industry in New Zealand.

Exemplifying that innovative spirit is Maurice Wilkin, a New Zealander who shared the 1962 Nobel Prize in Medicine with Drs. James Watson and Francis Crick for the discovery of the structure of DNA. This was a defining moment in the history of biotechnology and now New Zealand is poised to benefit from the discoveries of one of countrymen through the expanding role that biotechnology has in the economy.

Research in biotechnology in New Zealand has a very local flavor. Of note is the sheep genome project undertaken by AgResearch, a government-owned Crown Research Institute, and the University of Otago. This project is similar to the human genome project and information is readily exchanged between the two projects due to the similarities between sheep and humans. The sheep genome project will not only provide information about the sheep for better production but will also provide valuable information about the human genome. With over 60 million sheep in New Zealand it has been possible to establish that sheep have similar degrees of genetic variability to humans. This allows us to use sheep as animal models to study human disease and the role of population genetics in the distribution of various diseases.

New Zealand has the largest man-planted forests in the world. The principle tree grown here is the Pinus radiata. A project, undertaken by Genesis Research Corporation and funded by Fletcher Challenge, is mapping the genome of the pine tree. Fletcher Challenge, Carter Holt Harvey and several other multinational forestry and paper companies have agreed to collaborate in a wider genetic project to improve paper production from a number of tree species. Genesis Corporation will be a key part of this project.

In 1989 New Zealand produced the world’s first transgenic animal which showed an improvement in a production trait. Transgenic animals have also been used to produce disease models and in the production of recombinant proteins in milk. PPL Therapeutics, recognizing New Zealand’s unique advantages, have begun a program to breed a flock of 10 000 transgenic sheep to produce alpha-1-antitrypsin in milk.

Research undertaken by the universities have produced spin-off companies to develop or produce biotherapeutics in areas such as neurological disease, cancer therapy, osteoporosis, diabetes and brain injury.

New Zealand is a country free from many plant and animal diseases. This has led to high demand for biological products used in pharmaceuticals, functional foods, dietary supplements and traditional remedies such as those used in Traditional Chinese Medicine. Research is underway to establish the active compounds in these products and to build on New Zealand’s reputation for high quality biologics. Natural products are also harvested from the sea such as green-lipped mussel extracts for the relief of arthritic conditions, injury repair and performance enhancement; shark liver oil (a substance high in squalene); and chitosan from squid.

New Zealand is a world leader in the production of animal health products. Animal vaccines are produced for the world market by companies such as CSL, Schering Plough and AgVax. Innovative products for animal reproduction have been developed and produced in New Zealand, such as Interag’s CIDR devices for control of the oestrous cycle in cattle, buffalo, sheep and goats and ICP’s Ovagen — an ovine FSH for superovulation and embryo transfer media which have been used in many animal species throughout the world including endangered species and even racing camels.

The presence of homegrown generic pharmaceutical manufacturers such as Douglas Pharmaceuticals, companies who can sterile-fill injectables and animal health companies complete the spectrum of New Zealand’s biotechnology capability.

If the New Zealand biotechnology has a weakness it is in the ready availability of investment funds. New Zealand is a country with more good ideas than there is money to spend on them. It is investment which is needed to bring many of the good ideas to market for the benefit of producers, consumers and of course the investors.

*Dr. William Rolleston is the Chairman of Biotenz; Biotenz is group of biotechnology exporters which is supported by the New Zealand Trade Development Board.
In New Zealand, the development, field testing and release of genetically modified organisms (GMOs) is now regulated under the Hazardous Substances and New Organisms Act. Approval must be obtained from the Environmental Risk Management Authority (ERMA). The process may include a public hearing. We briefly examine the approach taken by ERMA in the first hearings to various issues raised by submitters on applications to field test GMOs in containment (so far there have been no applications for release).

The applicant must persuade ERMA that the benefits of their proposal outweigh any relevant risks and that those risks can be adequately managed or prevented.

To date, the opponents have attempted to raise doubts about whether the suggested benefits would eventuate, focusing on such risks as horizontal gene transfer and the transfer of antibiotic resistance, impacts on human health and New Zealand’s ‘clean green’ image and organics industry, as well as raising general ethical and philosophical concerns.

Overall, ERMA’s decisions demonstrate a robust approach to the assessment of risk, coupled with a willingness to inquire into the scientific validity or reliability of evidence submitted on any particular issue. In one case, where the health concern raised was of a theoretical nature, in which no scientific evidence was provided, this issue was discounted.

Conversely, ERMA was also willing to consider wider philosophical and cultural concerns. ERMA accepted that to approve some applications would conflict with firmly-held beliefs of some people. However, given the absence of any finding of risks of tangible harm, ERMA was prepared to grant the applications despite the concerns expressed.

The result is a need for applicants to ensure that they have approached risks on a systematic basis, have provided sufficient credible evidence to support their applications, and can demonstrate that benefits exceed any credible risks involved. Provided this is done, a successful application is readily achievable.

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