Biotechnology New Zealand – Will we miss the boat?

By Jim Watson

A Nobel prizewinning chemist recently predicted that "if this was the century of physics and chemistry… it is clear that the next century will be the century of biology". At the heart of this new century of biology will be the genetic information scientists are just beginning to understand.

Most countries that seek a place in tomorrow's sun clearly see the need for:

- world-leading scientific infrastructure;
- investment in basic research;
- a pool of world-class scientists; and
- an education system that encourages students to enter the sciences and gives them encouragement and the facilities to reach their potential.

Why is it then that in New Zealand we seem to suffer a malaise, a demoralising perception that science is no place in which to develop a career? This is compounded by growing student debt, low salaries and career insecurity.

The malaise has grown from a lack of focus over several decades in government science policies and a failure to decisively address funding issues.

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Historically most science funding has underpinned our primary industries. Our investment funds avoid high technology because of risk. The whole cultural and political environment in New Zealand makes it very difficult for advanced biotechnology companies to prosper.

The issue we must face now – and with urgency – is a simple one. Will the commercial sector in New Zealand recognise the great economic potential of science and technology in time to influence our future economy? Or will we miss the boat?

And what about the public perception of biotechnology?

Production of foods with genetically modified ingredients has evoked strident debate over the control and moral boundaries of biotechnology. Politicians, trapped increasingly by the need to proffer a populist and cosmetic spin, hope public attention will shift to more pressing affairs of state, such as the performance of sports teams or the new Millennium haka.

Equal lack of resolve pervades the scientific community. Scientists are often reluctant to engage in public debate. They feel uneasy about facing potential media hostility and don’t want to risk the stereotypic portrayal of being isolated from the real world.

This opposition not only discourages investment in new genetic technologies but also reaches our youth and sends negative signals to those considering careers in these areas.

WHAT MAKES GENESIS TICK?

We are a young biotechnology company, founded in 1994 by a small group of investors who have kept faith with us as we have developed numerous business opportunities in science.

We are a partnership company. Because of a shortage of resources, we have found our niche in discovery processes and have used partnerships to move into development and marketing. Our first products – which will be therapeutics for inflammatory and autoimmune diseases – are still several years away. But we have built value to date through people skills and a strong intellectual property portfolio.

In partnership with Fletcher Challenge Forests, we have combined basic science skills growing out of the medical world with the business of growing trees. The result must be a template for change that other primary industries could use.

We have had a difficult time attracting new investment in New Zealand. But our heart is ticking strongly.

As we enter the 21st century, we see around us the beginning of a great change that will reshape the world we live in as dramatically as the industrial revolution did in the 19th century and the information technology revolution has done in the 20th.

The deciphering of the genetic basis of living organisms, we believe, is fueling the greatest period of discovery that human history will ever witness. We believe that business opportunities grow from discovery and that the implications for our economy are enormous.

The biotechnology revolution has already changed the face of medicine and agriculture. It will provide enormous opportunities for improving social and economic welfare and for conserving the environment. There is potential to greatly reduce dependence on the use of destructive chemicals in agriculture and to recover land rendered non-arable by salt accumulation. New and safer medicines are emerging along with new strategies for waste treatment and novel natural products.

If New Zealand is to breathe life into a new economy built on new knowledge, then this combination of genetics and information technology must surely be key.

THE RACE TO BUILD NEW LIBRARIES

The biotechnology revolution had its origins in 1953 when Watson and Crick solved the structure of DNA, giving meaning to the nature of genes. In the 1960s the tools of molecular biology were used to decipher how individual gene messages are encoded within DNA and how they are eventually translated into proteins, the working molecules of ourselves.

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When molecular biologists began to “cut and paste” DNA in the test tube in the 1970s, and to use bacteria and yeast as factories to produce large amounts of an individual gene and its protein product, new companies like Genentech emerged on the foundations of this technology.

The human genome project was launched in 1998 as an international consortium funded by partnerships between governments and industry in the United States, Europe and Japan. It has progressed faster than first imagined and within the next 18 months the chemical sequence of most human genes will be public information. All this information is being stored in vast public databanks accessible via the Internet – the information super highway of biology.

Having a human gene library in hand will only fuel the race to develop similar libraries for

pathogenic micro-organisms, valuable crop plants, forestry trees, livestock, forage grasses, fruit trees and aquatic and marine organisms. Some of this is under way today.

Like the information technology revolution, it is difficult to predict how the biotechnology sector will unfold. But there is little doubt that capture of these gene libraries is essential if each of our primary industries is to find new value frontiers.

IT'S NOT PLAIN SAILING

The successes of biotechnology in its infancy have already led to strong counter reactions.

Throughout history the emergence of new technologies – from industrial machines to anesthetics, from automobiles to electricity – has always given rise to great public concern. Gene technology is no different. It has raised complex issues requiring informed discussion and therefore enhanced understanding of genetics by the wider community.

There is strong ethical debate as to whether this technology should be used to transfer DNA from one species to another, as well as growing public concern about the safety of foods that contain components from genetically modified plants.

It was only a few years ago that some of the world's leading chemical and agricultural companies concluded that gene technology would transform the world's food supply.

Monsanto, for example, sold off a giant agrichemicals business to focus on biotechnology. It then embarked on an aggressive science and public relations programme to produce new herbicide-resistant strains of corn, soybean and cotton. No company appeared to believe more deeply in the value of these new crops, or invested more heavily in genetically modified food products.

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As concern about foods containing genetically modified ingredients has spread today from Europe to North America and Asia, baby food producers in the United States and grocery chains in Europe are undecided as to whether they should use genetically modified corn and soybeans.

The public relations programme of Monsanto has antagonised the public worldwide. As a result the potential benefits underlying selective use of gene technology in agriculture have been obscured in an enormous public outcry against the perceived arrogance of large multinational companies. Calls for a moratorium, or abandonment, are widespread and it is increasingly difficult for the public to separate fact from fiction.

Some have argued that in New Zealand a Royal Commission is the answer. However, the most extensive Royal Commission in living memory is the Winebox Inquiry, and who among us is better informed as a result?

Testing is a scientific process; Royal Commissions are not. They review evidence. And where does the evidence come from? Scientific testing. And despite their purpose they tend to become media-driven events.

A credible assessment of the benefits and risks of the use of genetically modified organisms can be achieved only by using scientific method to eliminate confusion and achieve a scientific answer.

WHAT HAVE BEEN THE MILESTONES?

The new biotechnology industry has already led to the production of large quantities of recombinant human insulin and growth hormone to treat diabetes and growth defects. New pharmaceuticals have been produced to treat cancer and arthritis. New vaccines are being developed for use in combating hepatitis, AIDS, malaria and tuberculosis. The human genome project is giving new meaning to the understanding of many disorders – cancer, asthma, diabetes, heart disease, memory loss, addiction, immune deficiency disorders and aging.

Perhaps the strongest safeguards in place to protect the public are the regulatory and manufacturing requirements that are involved in the production and testing of any new pharmaceutical produced by genetically modified organisms before it can be used by the public.

The use of gene technology in modern agriculture, while a contentious issue, is actually based upon solving some real social problems. Modern farming is a chemically intensive activity. A wide range of chemicals is being used worldwide to control pests, weeds and microbes that destroy crops. Many of these chemicals have a long history of causing toxic effects in agricultural workers and contamination of the environment and ground water. The use of genetically modified plants, which can be grown with lower chemical inputs, would seem to offer many advantages.

However, by contrast, public concern has centered around the release of genetically modified plants into the environment and the safety testing and labelling of foods produced from genetically modified plants.

In fact, both are legitimate issues and should be addressed seriously by all.

There is also a contrast between the production and safety testing of new pharmaceuticals and the production with minimal safety testing of new foods. Further, strategies that have been used to seek public acceptance for genetically modified engineered crops and foods have not gone well. And scientists – perhaps averse to the potential negative consequences of the public – have tended to avoid the debate.

As a result, the potential economic and environmental benefits have not been clearly presented to the public.

AND THE FUTURE

The responsibility to solve this problem does not lie solely in the universities. It is a problem of vision and leadership, both in government and in the business community. New Zealand companies invest far less than most other OECD countries in research and development.

The government could take steps to help change this, focussing much more strongly on research and development. R&D is the pillar of a knowledge economy and politicians need to give more than lip service to that.

The government needs to motivate business and investors to put money into science, perhaps by providing incentives. If politicians demonstrated they were serious about R&D, it would have an immediate impact on New Zealand and overseas investment in the area.

The government should also encourage career development in science, engineering and technology. If the student loan scheme must be continued, students could perhaps be forgiven one year of repayment for each year worked in technology or R&D sectors.

However, New Zealanders should not rely on politicians to solve all the problems. Business leaders, the community in general and universities must also take leadership roles.

Much of our science infrastructure lies today in universities and Crown Research Institutes and there is a process of liberation that we must begin.

Revolutions require many ingredients. The most important for biotechnology are also the major ingredients of universities – their students. We need to create a culture and environment where using your brain as a scientist is more highly valued than using your brawn on a rugby field.

This will happen only if political, university and business leaders take on a "mentorship" role with fervor and passion right across our tertiary institutions. The disciplines that must be engaged – science, medicine, computers, engineering, commerce, to name a few – must not be maintained as bunkers that prevent students from harnessing multidisciplinary skills and opportunities.

Biology today is entering a truly exciting era. A career in discovery remains the pathway of choice for any enterprising student.

As the new knowledge economy, much heralded by politicians, takes on real meaning, the business community must recognise that here, in heartland information technology and biology, lies a real new economic future.

The universities have a particular responsibility – of ensuring not only that knowledge is unlocked, but that it is actively and continuously blended in novel ways that reach the public.

This will ensure that academic and business skills cross the brain:business boundary and are used profitably by successive waves of students to revitalise our communities.

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