

Developing a biotechnology learning hub for New Zealand

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Introduction

In 2002 the New Zealand Government released its Growth and Innovation Framework, the goal of which is to return New Zealand to the top half of the OECD in GDP per capita rankings. As part of this framework, biotechnology was recognised as one of three areas (along with information and communications technology and creative industries) worthy of special attention.

New Zealand's economy is built on our exceptional ability to add value to agricultural products by applying biological knowledge, and biotechnology is seen as a key to increasing the productivity and "value-added" nature of our primary export industries. Biotechnology also has the potential to contribute to and influence other areas of the economy, from health care and biosecurity, to issues of criminal justice (New Zealand Biotechnology Strategy 2003).

The purpose of developing a hub for biotechnology learning was to promote sustainable biotechnology education in schools. This is crucial both for responsible citizenship and future career training of biotechnologists. Although there are a number of individual initiatives occurring in schools, there's no clear strategy on how to develop a more efficient and effective national approach. Teachers also indicated as part of the National School Sampling Study (Jones et al. 2003) that biotechnology is an area where further resources and information are needed for both science and technology curriculum areas. These resources need to be pertinent to the New Zealand situation, provide scope for both technological and science teaching and learning, and model effective classroom programmes. Teacher access to the biotechnology community allows for the development of authentic educational programmes, but requires a system whereby teachers can access not only the biotechnology community but also relevant materials that demonstrate biotechnology practice.

Our goals in developing a biotechnology learning hub therefore included: raising awareness of the role of biotechnology in the New Zealand curriculum, both with the education and the biotechnology sectors; demonstrating how biotechnology knowledge can be transformed into classroom experiences; and developing an on-line digital framework to link schools with the biotechnology industry. A national team was involved in the project, which was led by the Centre for Science and Technology Education Research at the University of Waikato, and also included NZCER, CWA New Media, and staff from the Faculty of Education, University of Auckland.

The development of the hub (Jones 2004) involved several components, including: a literature review on effective biotechnology and education links (France & Bolstad 2004); classroom-based research (Moreland et al. 2004); and national meetings with the biotechnology sector (Eames et al. 2004). In this article, we briefly discuss the classroom studies, meetings with industry, and features of the Hub itself.

Classroom-based case studies

Classroom-based case studies were carried out in six classrooms (Year levels 5–9) at four schools. The key purpose was to identify ways in which biotechnological knowledge can be transformed into appropriate classroom teaching and learning experiences, and consisted of three phases: a teacher workshop, collaborative development of classroom materials, and the development of case studies of classroom practice.

The findings highlighted that the biotechnology learning needs to be situated in real-life contexts that are relevant to the learners, but that units need to have realisable end-points that take into account the constraints of working with living systems. Knowledge about the nature of biotechnology, as well as the underpinning science and technology, is important. However, this is hard for teachers with little formal science and/or biotechnology background. The students also need to be able to identify and engage with the various scientific and technological concepts, and each biotechnology learning activity needs to be explicitly linked to an overall concept of biotechnology. A biotechnology focus needs to be maintained across the full range of achievement objectives, learning activities, learning outcomes, and assessment tasks. In complex, long-term units the teacher needs to help students to see how the pieces of the project fit together. They need to be guided in the synthesis of ideas from different activities, and benefit from teachers working alongside them to provide immediate, on-going and appropriate feedback.

Comments from the biotechnology industry

The biotechnology sector was invited to participate in the research by discussing their views about school access to modern biotechnological knowledge and ways in which this could be facilitated. Three focus group meetings were held, and involved representatives from six crown research institutes, five universities and 11 private biotechnology companies.

Participants held a range of views of biotechnology, framed by their own endeavours, and felt that any definition of biotechnology needs to reflect the diversity of ways in which a biological system can be applied to produce a process or product. They also stressed that the success of a biotechnology project was dependent on the underpinning science but also the creativity of the team and marketing of the product/process. Skills in mathematics, computing, communication, business and entrepreneurship are also valuable, and because one person is unlikely to be highly skilled in all these areas, teamwork is essential.

Participants also felt that the public had a common perception that biotechnology outcomes posed a threat to New Zealand, rather than being a factor underpinning our long-term wellbeing. They suggested that this requires more of an effort from the biotechnology industry to interact with teachers and students so that future citizens will be able to make informed decisions about the biotechnologies likely to be part of their everyday life. They indicated, however, that it was difficult for an organisation to build relationships with more than a few schools at a time.

The on-line portal

The New Zealand Biotechnology Learning Hub (www.biotechlearn.org.nz) is an on-line portal that was developed as a result of the initial findings. Its principal aim is to bring the biotechnology and education sectors together in a more sustainable way.

A key feature of the hub is the “focus stories” – in-depth case studies of modern biotechnology in action. These have been developed in conjunction with the biotechnology industry and educators and provide authentic contexts in which classroom learning can be situated. Information about the science and technology components are provided in the form of text, video clips, animations and interactive activities, and can be used as teacher background and/or for student investigations. In addition, unit plans include a range of suggested learning activities and have been designed to show how teachers can transform the biotechnology presented in the focus stories into relevant teaching and learning experiences. The “in-the-lab” section includes video and animated explanations of common molecular biology tools, as well as examples of the diverse range of contexts in which the tools are used.



The hub also has personnel and physical resources to respond to teacher and industry needs. The hub is still in its infancy and content for the website is expected to continue to grow in response to the needs of both the education and biotechnology sectors.

References

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Biotechnology Learning Hub

Bringing Biotechnology and Education Together in New Zealand

Home

What is Biotech

Teaching & Learning Gateway

People in Biotech

Accessing Industry

Multimedia

News

The Home page includes a space where you can register for a personal log in. You can also find the latest biotechnology news here and some pithy **Did you know?** facts that could be used to engage students.

You can register and/or log-in to your personal space and **My Biotech** homepage. The personal space is on the left hand side of the screen and is visible on every page once you have logged in. It enables you to bookmark favourite pages for future reference, receive alerts when content of interest is changed or added, and see links to news items related to content of interest.

The **My Biotech** homepage features new site content for easy reference.

Find out more about the different biotechnology sectors, or look for a **focus story** (an in-depth example of biotechnology research in action, with video interviews and suggestions for teaching activities). Click on a sector in the **What is Biotech** page and then look for the **Focus Stories** tab in the left hand column.

You can also find information about **Product Development** here.

The best way to find specific information is by using the **Teaching & Learning Gateway**. Search by specific content area (such as agriculture, environment, etc) or look for resource types (such as unit plans, interactives, video clips, people profiles, etc).

How to Use the Gateway

The Hub content is sorted according to biotechnology sectors and resource type. To find something specific, use a word search. If you're a little less clear about what you're looking for, select a biotechnology sector that interests you and / or a resource type. For example, you might want to find a unit plan that has something to do with biotechnology and health, or a news article about biotechnology and the environment.

If you're looking for role models, **People in Biotech** is the place to go. Each profile includes a video clip and information about what the person does and why he or she enjoys the work.

Interactions with the biotechnology community can make learning more relevant and interesting. Although the Hub, through its content, provides you with one way of accessing the biotechnology community, you may still want to arrange for your class to meet someone in person. **Accessing Industry** gives you examples of things to think about and presents case studies of interactions that have worked well.

Multimedia is the place to go if you're looking for a video clip or an image. It is also where you can find **In The Lab** – resources on commonly used molecular biology techniques like gel electrophoresis and DNA sequencing.

All **Multimedia** content can also be found through a search on the **Teaching & Learning Gateway**.

News about the latest biotechnology research is featured throughout the Hub, with the news page storing all current and past articles.

Focus Stories

Focus Stories are in-depth explorations of biotechnology in action. Each one contains information about a particular biotechnology project, explanations of the processes involved, teaching and learning suggestions, and an introduction to some of the people and organisations involved.

You can access the focus stories from the **Teaching & Learning Gateway** or from the **What is Biotech** page (click on a sector, or look for the focus story tab on the left hand side).

The focus story is a great place to start if you're a teacher looking for ideas for a biotech unit!

The screenshot shows the Biotechnology Learning Hub interface. At the top, there's a navigation bar with tabs for Home, What is Biotech, Teaching & Learning Gateway, People in Biotech, Accessing Industry, Multimedia, and News. Below this is a search bar and a 'Teaching & Learning Gateway' section with filters for Word Search, Sector, Resource Type, and Focus Story. A 'Did you know?' box highlights that New Zealand's population is expected to reach 5 million by 2050, with a significant increase in the number of people aged 65 and over. The main content area displays a focus story titled 'Biological Control of Possums', which discusses the impact of possums on New Zealand's biodiversity and the challenges of controlling them. The story includes sections for 'What is Biotech', 'Unit Plans', 'Interactives', and 'People'. A sidebar on the right provides additional information about the focus story, including a 'Did you know?' box and a 'Sector' dropdown menu.

RESOURCE TYPE SEARCH FOR:	SECTOR
Sector profiles	SEARCH FOR INFORMATION ABOUT BIOTECH AND:
Focus stories	Agriculture
Unit plans	Aquaculture
Case studies	Bioprocessing
Did you know facts	The Environment
Person profiles	Food & Beverages
News articles	Forensics
Lab processes	Health
Infosheets	

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