

Victorian Biotechnology Annual Report 2010

DEPARTMENT OF BUSINESS AND INNOVATION



Foreword from the Minister



The 2010 Annual Report on Victoria's biotechnology sector demonstrates the importance of the sector to an innovative, competitive and growing economy that is equipped to address the significant challenges Victoria is likely to face over the next decade. The report also reinforces biotechnology's great potential to deliver very substantial benefits to Victorians in a range of areas, including healthcare, agriculture and food production, manufacturing and environmental management.

These are exciting times for Victorian biotechnology. In the past year, our biotechnology firms have taken their products to new global markets and formed major new international alliances. Acrux and Starpharma signed potentially highly lucrative deals with the pharmaceutical giant Eli Lilly; and Mesoblast, the largest publicly listed stem cell developer in the world, entered into a major partnership with Cephalon. Time magazine named the bio-printer developed by Melbourne company Invetech as one of the best 50 inventions of 2010.

Victorian scientists also enjoyed an outstanding year, with exciting breakthroughs reported in the development of the bionic eye and the treatment of Alzheimer's disease, HIV and cancer. Researchers in the Department of Primary Industries continued their leadership in agribiotechnology, with one team developing a test to control a deadly virus that threatened to destroy Australia's multi-million dollar abalone industry.

With such world-class companies and researchers forming the foundation of Victoria's biotechnology sector, there is little doubt that the sector has a bright future. The Baillieu Government believes that the sector's future can be further enhanced by driving the broader uptake of biotechnology across other industries and by positioning the sector to take advantage of the exciting prospects emerging from the convergence of biotechnology with other new technologies.

We are committed to building a business environment that will enable innovation and technology to flourish. We have created a new Department of Business and Innovation, directly aligning the interests of Victorian business and industry with policies to drive greater innovation and technology convergence and uptake across the Victorian economy.

The Baillieu Government believes that a vibrant and active partnership between government, private companies and industry organisations is essential to the future success of Victorian biotechnology and we are committed to strengthening this partnership. In 2011, the government will create a new Victorian Biotechnology Advisory Council to ensure that Victoria has a coherent and coordinated approach to biotechnology and that industry is actively engaged in policies and activities to keep Victoria in step with global advances in biotechnology.

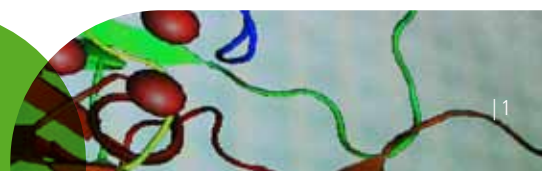
On behalf of the Baillieu Government, I thank our industry partners for their involvement in and commitment to the growth, development and success of Victorian biotechnology. I look forward to working closely with them to secure the future of this vitally important industry and to ensure that Melbourne and Victoria continue to rank among the world's leading centres for biotechnology.

The Hon. Gordon Rich-Phillips MLC
Minister for Technology

Front cover image: Dr Brian Smith from the Walter and Eliza Hall Institute and Dr Genevieve Evin from the University of Melbourne are developing compounds that could improve treatments for Alzheimer's disease. Photo courtesy Walter and Eliza Hall Institute. Page 17 photo courtesy of the Bio21 Cluster.

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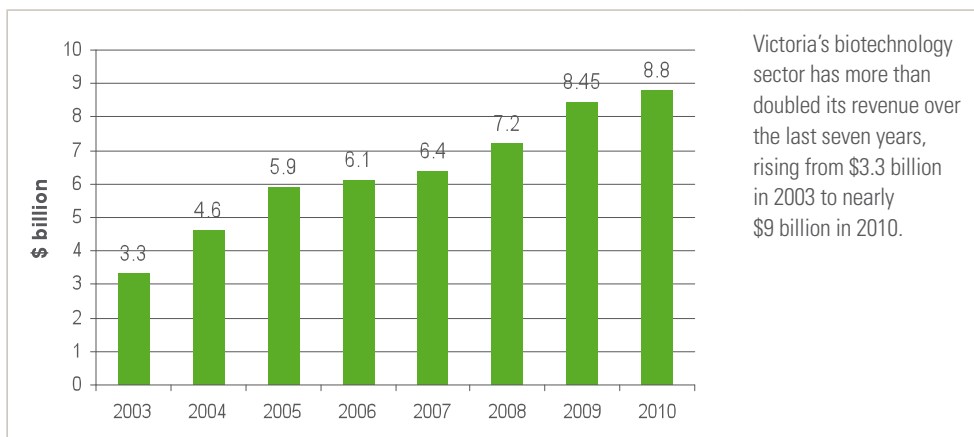
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Victorian biotechnology sector in 2010

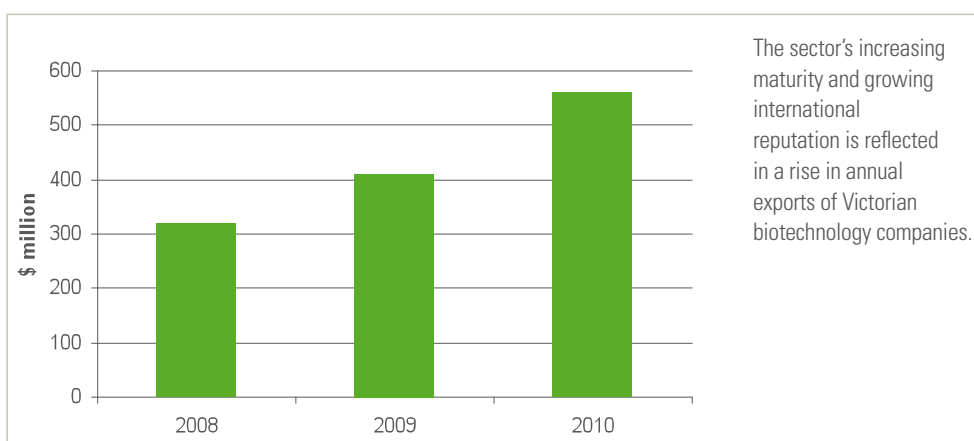
Victoria continues to move ahead as one of the world's top biotechnology locations. While the Global Financial Crisis has affected the sector, it has shown great resilience and maturity.

Revenue growing



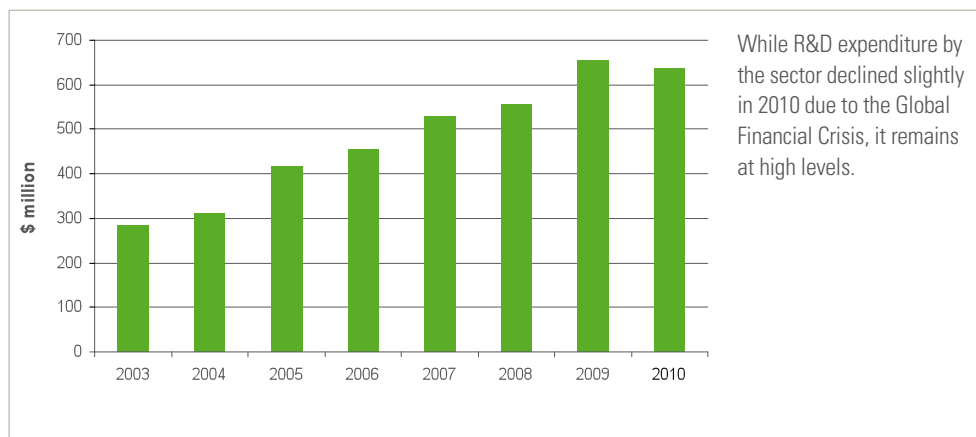
Source: Blake Industry and Market Analysis Pty Ltd

Export revenue rising



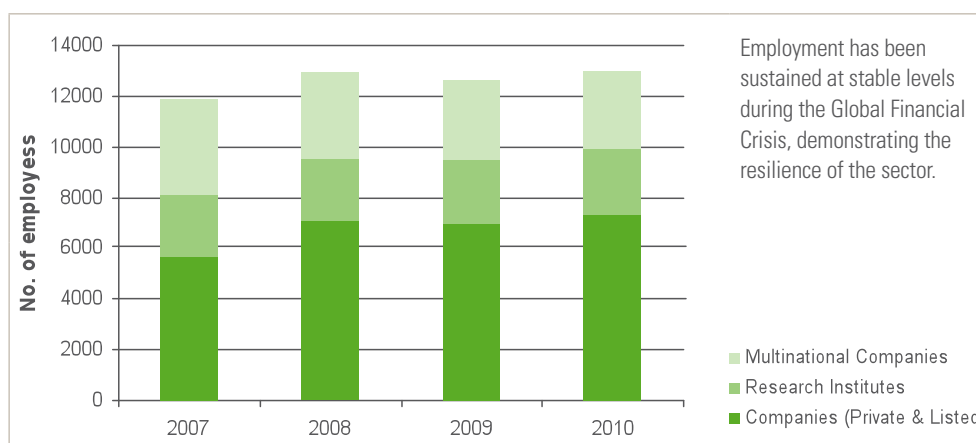
Source: Blake Industry and Market Analysis Pty Ltd

R&D expenditure staying high



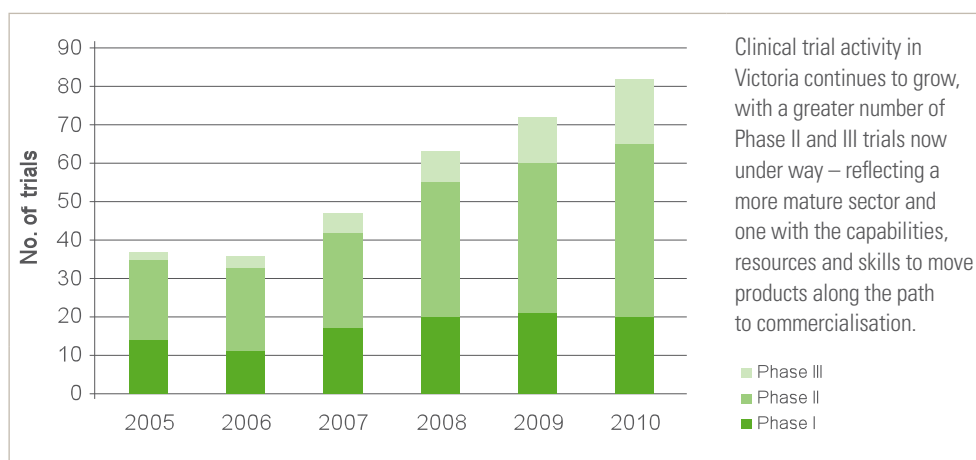
Source: Blake Industry and Market Analysis Pty Ltd

Employment stable

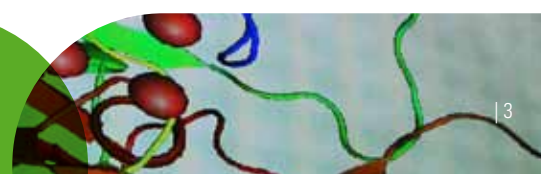


Source: DBI Operational Support Program and Blake Industry and Market Analysis Pty Ltd

Clinical trials growing



Source: Blake Industry and Market Analysis Pty Ltd



Highlights for 2010

2010 saw Victorian companies achieve major successes in developing new products, forging international alliances and gaining approvals to trial and market breakthrough products. Victorian researchers continued to make groundbreaking discoveries with the potential to treat life-threatening and debilitating diseases and conditions, improve agricultural productivity and better protect the environment.

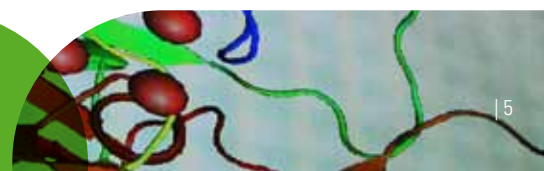
Company achievements

- > Acrux received approval from the US Food and Drug Administration for its male testosterone replacement drug, Axiron, and signed an exclusive deal with pharmaceutical giant Eli Lilly to market the drug worldwide. The deal means that Acrux will be eligible to receive up to US\$335 million in milestone payments, plus royalties on global sales of Axiron.
- > Mesoblast announced an alliance with the global biopharmaceutical company, Cephalon, to develop and commercialise products for the treatment of degenerative conditions based on Mesoblast's adult stem cell technology. Under the terms of the alliance, Mesoblast will receive an upfront payment of US\$130 million and up to US\$1.7 billion in milestone payments and will retain its manufacturing rights.
- > Australia's largest biotechnology company, CSL, announced a \$230 million expansion of its Broadmeadows site. The project will create Victoria's first large scale biomanufacturing facility for the late stage development of new therapies for cancer, bleeding disorders, inflammation and infection. The expansion will create 333 highly skilled new jobs by 2016.
- > Invetech partnered with US company Organovo to develop the world's first production model 3D bio-printer, which will be used by researchers investigating human tissue repair and organ replacement. The bio-printer was named by *Time* magazine as one of the 50 best inventions for 2010.
- > Biota announced that its development partner, Daiichi Sankyo, had obtained approval to manufacture and market Inavir – an influenza drug delivered by a dry powder inhaler – in Japan. Biota will receive royalties on all Inavir sales in Japan.
- > Clinuvel Pharmaceuticals obtained approval in Italy to sell their drug, SCENESSE, which treats a rare condition where people have an absolute intolerance to sunlight. Clinuvel will next seek approval of the drug in Europe.

- > BioDiem was granted approval to market its intranasal influenza vaccine in India.
- > Universal Biosensors announced the launch in Australia and the Netherlands of the One Touch Verio blood glucose self-monitoring product for diabetics. The product, which is marketed by global company LifeScan, uses a disposable test strip developed by Universal Biosensors.
- > Starpharma announced an R&D agreement with Eli Lilly to collaborate on creating improved drugs using the company's dendrimer-based drug delivery technology.
- > Leading British retailer Marks & Spencer announced that its entire Swiss Chocolate Collection range will use trays made of plantic, a material made from starch that is completely compostable and that was developed by Victorian company Plantic Technologies.
- > Researchers at the Centre for Eye Research Australia in Melbourne commenced trials of a revolutionary new laser treatment for dry age-related macular degeneration, one of the leading causes of blindness in Australians over 50. The Retina Regeneration Therapy (Ellex 2RT) is being trialled on 50 patients, with promising results already emerging in slowing the progress of the disease.
- > Clinical trials of the milk compound RIPTAC (discovered by researchers from Victoria's Department of Primary Industries and the Murray Goulburn Cooperative Co Ltd) demonstrated that it can promote the growth and proliferation of primary human muscle cells, generating interest from around the world in its potential to reduce the incidence of cardiovascular disease and diabetes, and treat chronic muscular and bone diseases.

Research highlights

- > The results of two Victorian-led research projects that used the Australian Synchrotron to make breakthrough discoveries were published in the prestigious journal *Nature* in 2010. Researchers from Monash University, the Peter MacCallum Cancer Centre and Birkbeck College in London used the Australian Synchrotron's capabilities to show how an 'assassin' protein called perforin is capable of killing rogue cells in the human body that carry damaging viruses. A joint research team from Monash University and the University of Melbourne used the Australian Synchrotron to uncover the 'quality control' mechanism that must take place for the human immune system to effectively destroy harmful viruses and bacteria.
- > Bionic Vision Australia (BVA) unveiled a prototype bionic eye that promises to improve the quality of life for people suffering from degenerative vision loss caused by retinitis pigmentosa and age-related macular degeneration. The prototype will be implanted into Australia's first recipient in 2011, with BVA aiming to provide bionic vision within the next five years.
- > Scientists from the Walter and Eliza Hall Institute of Medical Research (WEHI) identified the three protein fragments that make gluten – the main protein in wheat, rye and barley – toxic to people with coeliac disease, opening the way for new diagnostic tools, prevention strategies, food tests and treatments for people with the disease.
- > Victoria celebrated an historic milestone in September when a three-year-old girl from Gippsland became the 2000th person to receive a cochlear implant at the Royal Victorian Eye and Ear Hospital. The bionic ear was invented by Professor Graeme Clark, who performed the first cochlear implant at the hospital in 1978. Since then, more than 150,000 people in over 140 countries have received a bionic ear.





Medical discoveries and breakthroughs reported by Victorian researchers in 2010 included:

- > *Stem cells* – A team at the Monash Institute of Medical Research used placental stem cells to treat lung cancer, showing for the first time that human placental cells could differentiate into functioning lung epithelial cells and offering hope for new lung disease therapies.
- > *Cancer* – The Ludwig Institute for Cancer Research commenced a clinical trial of a treatment for kidney cancer, using an antibody developed from its own research.
- > *Infectious disease* – Scientists at the Burnet Institute, Monash University and The Alfred identified the mechanism by which HIV enters resting cells and ‘goes to sleep’, reactivating after patients stop receiving anti-HIV treatment. Understanding this mechanism will assist in the development of new treatment options for HIV.
- > *Neuroscience* – Researchers at the Mental Health Research Institute discovered that the protein that forms the characteristic plaques found in the brains of Alzheimer’s sufferers transports iron out of neurons. When this function is impaired, the neurone accumulates iron and its oxidative (rusting) effects are toxic. This major advance in understanding the cause of Alzheimer’s disease will be the basis for a new class of drugs to treat the disease.

- > *Dairy innovation* – Researchers from Victoria’s Department of Primary Industries developed improved methods to discover the DNA in the genome of Holstein cows that controls the inheritance of complex traits. The innovation is part of the *10,000 Cow Genome Project* being undertaken by the Dairy Futures Cooperative Research Centre, which is building a comprehensive understanding of the genetic coding of cows with good fertility, high efficiency in converting feed into milk solids and disease resistance.

A number of large clinical studies commenced in Victoria in 2010, including:

- > The Australian Ovarian Cancer Study – a collaboration between the Peter MacCallum Cancer Centre and the Institute for Molecular Bioscience in Brisbane to sequence 150 ovarian cancer tumours to identify the genomic factors that confer resistance to treatment.
- > START – a new collaborative research group that will collect and analyse information from 200 stroke patients to reduce the incidence of stroke. The study is a collaboration between the CSIRO, the Florey Neuroscience Institutes, the University of Melbourne, the Royal Melbourne Hospital and Neurosciences Victoria.
- > Clinical trials for alternative medicine – a collaboration between RMIT University and Guangdong Provincial Hospital in China to conduct two multi-centre clinical trials in Victoria on Chinese herbal medicine for chronic obstructive pulmonary disease and the effects of acupuncture on hay fever.

Recognising and rewarding our research leaders

During 2010, a number of Victoria's leading researchers received awards for their outstanding achievements. These awards not only acknowledge the contribution of Victorian researchers, they also promote scientific research as an important and rewarding career, and help to keep the public informed about scientific discoveries, developments and breakthroughs.

Australian and Victorian awards

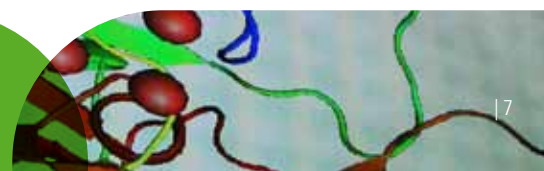
- > The **Prime Minister's Prize for Life Scientist of the Year** recognises researchers in the early stages of their careers who have recorded outstanding achievements in the life sciences. In 2010, the prize was awarded to Dr Benjamin Kile from WEHI for his work in unravelling the secrets of blood – research that will extend the life of blood transfusion products and help to explain how cells 'go bad' and cancer starts.
- > The **2010 Premier's Award for Health and Medical Research** was awarded to structural biologist Dr Julia Archbold of Monash University for her work in understanding why organs are rejected following transplants. Dr Archbold's discoveries are providing new insights into ways to improve organ donation strategies and prevent organ transplant rejection, and are likely to be highly beneficial for the 1700 Australians on waiting lists for life-saving organ transplants.
- > Dr Mark Shackleton of the Peter MacCallum Cancer Centre was awarded the **2011 Pfizer Australia Senior Research Fellowship** to continue his melanoma research. Dr Shackleton will use the \$1 million, five-year Fellowship to better understand how melanomas progress in patients, with a view to identifying new and more effective therapies for treating the disease.
- > The Royal Australian Chemical Institute awarded its prestigious **Green Chemistry Award** to Professor Milton Hearn and his team from Monash University's Centre for Green Chemistry for their work in exploring new technologies and processes to improve environmental management and prevent pollution.
- > Cancer researchers Dr Michelle Ma and Denise Miles were awarded **Victoria Fellowships** to travel overseas to further their research.

- > A new cancer research fellowship to honour skin cancer campaigner Clare Oliver was announced in September. The **Clare Oliver Memorial Fellowship** will provide \$400,000 over two years for a Victorian cancer researcher to strengthen the fight against skin cancer and represent the Victorian public's tribute to Ms Oliver who died at 26 from an aggressive melanoma after using solariums frequently.

International awards

- > WEHI researcher Dr Ross Dickins received a \$1 million **Viertel Foundation Fellowship** to investigate the genes involved in the development of cancer, particularly leukaemia, with the aim of accelerating cancer drug discovery.
- > Dr Michael Danquah of Monash University received highly commended status in the international **iChemE Bioprocessing Award** for his work in reducing the production times and increasing the yields of DNA vaccines. Dr Danquah's research will enable DNA vaccines to be produced rapidly in the event of a pandemic outbreak.
- > Victoria's bionic ear pioneer, Professor Graeme Clark, was awarded the **Lister Medal** – the most celebrated international award in surgery – in recognition of his work in developing the cochlear implant, becoming only the third Australian recipient of the medal.
- > Professor Alan Cowman from WEHI was awarded the **2010 Howard Taylor Ricketts Award** by the University of Chicago for his accomplishments in malaria research.

In May 2010, one of Victoria's most distinguished scientists, Professor Suzanne Cory, became the **first female president of the Australian Academy of Science**. Professor Cory was the Director of WEHI for 13 years, is the winner of numerous Australian and international awards for her research on the genomics of cancer and the immune system, and was named a Knight of the Legion of Honour (France's highest honour) in 2009.



Working with the biotechnology sector

Established in 2007, four industry working groups have advised government on relevant issues, explored new ideas for action, responded to developments in biotechnology more broadly and worked with the government to address issues of concern to the sector. The working groups were chaired by recognised industry leaders and coordinated by the Department of Business and Innovation, AusBiotech and the BioMelbourne Network.

Working Group	Membership
Competitive Business Environment Working Group for investment, industry development and regulation	Dr Leigh Farrell (Industry) <i>Chair</i> Dr James Campbell (Industry) <i>Deputy Chair</i> Dr Andrew Baker (Venture Capital) Dr Julian Chick (Industry) Dr Charlie Day (Venture Capital) Dr Michael Panaccio (Venture Capital) Dr Graeme Wald (Finance) Dr Anna Lavelle (Industry Association) Ms Michelle Gallaher (Industry Association)
Building a Bioeconomy Working Group for the integration of biotechnologies into the broader economy	Dr Elane Zelcer (Industry) <i>Chair</i> Dr Paul Donnelly (Research) <i>Deputy Chair</i> Professor Tony Bacic (Research) Dr David Barr (Industry) Mr Clive Davenport (CSIRO) Dr Mikael Hirsch (CSIRO) Dr Gillian Sparkes (Industry) Dr Anna Lavelle (Industry Association) Ms Michelle Gallaher (Industry Association)
Skills and Public Support Working Group for making Victoria a preferred place to live, work and learn	Mr Ken Windle (Industry) <i>Chair</i> Mr Jeremy Wurm (Services) <i>Deputy Chair</i> Mr Andrew Macdonald (Industry) Mr John Maddock (TAFE) Dr Jeanette Pritchard (Venture Capital) Dr Adam Watkinson (Industry) Ms Michelle Gallaher (Industry Association) Mr Scott Carpenter (Industry Association)
Infrastructure Working Group for building critical mass in key biotechnology areas and ensuring access to state-of-the-art technologies making Victoria a preferred place to live, work and learn	Dr Graeme Woodrow (CSIRO) <i>Chair</i> Professor Ian Smith (Research) <i>Deputy Chair</i> Dr Stella Clark (Research) Dr Susan Forrest (Research) Dr David Gearing (Industry/Research) Professor Nick Hoogenraad (Research) Professor Andrew Parratt (Research) Professor German Spangenberg (Government) Professor Andrew Wilks (Industry) Ms Michelle Gallaher (Industry Association) Mr Glenn Cross (Industry Association)

ACTION AREA

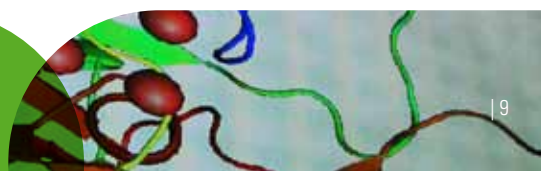
Creating a competitive business environment

Increased investor interest in biotechnology opportunities in Victoria reflects the growing maturity and sophistication of the biotechnology sector, backed by a competitive regulatory environment and strong government support for attracting international investors and building global alliances and partnerships.

Appropriate regulatory frameworks

Victoria continues to provide a highly competitive, supportive regulatory environment for biotechnology researchers, firms and investors, and to push for appropriate regulatory reform at the national level.

- > November 2010 marked the first year of operation of Victoria's **new streamlined system for the ethical review of multi-site clinical trials**. The new system has resulted in a substantial reduction in timelines for the ethical approval of multi-site trials, giving patients faster access to new treatments and increasing Victoria's attractiveness as a location for clinical trials. Victoria, NSW and Queensland have signed a Memorandum of Understanding for the mutual acceptance of ethical and scientific review of multi-centre clinical trials, commencing in 2011.
- > Victoria continues to advocate for a national taxation regime that encourages research and development activities by businesses. During 2010, the Department of Business and Innovation commissioned KPMG to conduct a study of the impacts on Victoria of the Australian Government's **New Tax Credit for R&D**. The study found that the proposed tax credit will provide significant benefits to Victorian biotechnology. Of particular relevance to the sector is an easing of the rules governing overseas R&D activities, which will allow biotechnology companies to claim a tax concession for conducting overseas clinical trials. Further benefits include increases in the rate of the credit and the small business threshold. A 45 per cent refundable credit will be available for small companies (with a turnover of less than \$20 million), and a 40 per cent non-refundable credit for larger companies.



- > Victoria's submission to the **National Independent Review of Food Labelling Law and Policy** put forward the position that food labelling regulation and policy should not become a barrier to the adoption of Genetically Modified (GM) ingredients in food or a barrier to trade. With safety assessments of GM food conducted by Food Standards Australia New Zealand and overseen by the Office of the Gene Technology Regulator, and with GM food already subject to specific labelling requirements, Victoria's view is that GM food should not be subject to additional labelling requirements.
- > Victoria also made a submission to the **Senate inquiry into the granting of patents in Australia over human and microbial genetic material**, stressing the importance of patents in driving innovation and commercialisation, the contribution of Australia's biotechnology industry to new health diagnostics and therapeutics, and the need for any changes to the patenting system to take into account intellectual property conventions and international trade obligations. The Senate Community Affairs Committee's report on the inquiry makes a number of recommendations on gene patenting and the Australian patent system, which are being reviewed by the Department of Business and Innovation.

Improved access to investment capital

The growing maturity of Victoria's biotechnology sector is reflected in higher levels of interest in biotechnology opportunities in Victoria by national and international investors. The sector continues to be supported by the Department of Business and Innovation to gain access to investment capital, progress investment projects and showcase its potential to investors and business or research partners.

- > Victoria again sent a trade and investment mission to the world's largest biotechnology conference and exhibition, the **2010 BIO International Convention** – held this year in Chicago. Victoria's Governor, Professor David de Kretser, led a delegation of 80 Victorians from 35 organisations, including representatives from government, biotechnology companies, research institutes, universities, law firms and patent attorneys, and industry organisations. Highlights from Victoria's attendance at BIO 2010 included reported projected export sales of \$26 million over two years and a total value of business amounting to \$8.9 million; and an investment showcase where seven companies presented to international investors.
- > A Victorian delegation also attended Shanghai World Expo as part of a **Biotechnology Trade Mission to China**. The mission's program, coordinated by the Victorian Government and Austrade, aimed to facilitate new investment in Victorian biotechnology products and services, and increase awareness in China of Victoria as a leading biotechnology location. The mission conducted around 100 meetings with leading Chinese biotechnology companies, toured biotechnology facilities and attended networking events.
- > The **Biotechnology International Partnering Program (BIPP)** pilot concluded in late 2010. BIPP provided financial assistance to Victorian companies to attend overseas biotechnology conferences and trade events. A Report Card on the program showed it had generated a significant return on investment, including projected export sales of around \$110 million over two years. Participants in the program also reported substantial benefits, including the identification of potential new collaborators and investors, increased market intelligence and improved knowledge of worldwide trends in the global biotechnology market. Around 70 per cent of participants expected an increase in capital investment as a result of using BIPP.

- > The **Smart SMEs Innovation Commercialisation Program (ICP)** and **Market Validation Program (MVP)** continue to support small to medium-sized biotechnology firms to progress products along the commercialisation pathway, attract investors and enter new markets. In 2010, the ICP engaged five new program partners that will help firms to develop and execute market entry strategies for China and the US, assist regional start-up and early-stage growth companies, establish stronger links with the global water industry and provide project management skills to develop new pharmaceutical products.

In Round 1 of the MVP, Victorian public agencies identified a range of challenges requiring new technology solutions. From the 19 technology requirements put to the market, 20 SMEs were funded to undertake feasibility studies into their proposed solutions. Eight of the feasibility studies involved biotechnology solutions. In 2010, nine projects received further funding to progress to proof-of-concept stage, including six biotechnology-related projects.
- > The **Medical Research Commercialisation Fund (MRCF)** was successful in securing an additional \$20 million from the Australian Government's Innovation Investment Fund (IIF) program. This funding has been matched by \$20 million held in reserve in the existing \$30 million fund, with the combined funds being used to invest in early-stage life science opportunities from the 30 medical research institutes that are members of the fund, 11 of which are based in Victoria. In 2010, MRCF made three investments in technologies emerging from Victorian research institutes.
- > The **Victoria-California Stem Cell Alliance** awarded funding to two partnerships between Victorian and Californian researchers in the field of stem cell transplantation immunology in 2010, bringing to six the number of collaborative projects funded through the alliance. The latest projects aim to improve the potential of stem cell derived tissue transplants to combat conditions such as multiple sclerosis and spinal cord damage.

Showcasing Australian biotechnology to global investors

The *Australasian Life Sciences Investment Summit* was a key feature of the *AusBiotech 2010* conference held in Melbourne in October.

The invitation-only, one-day summit highlighted the growing reputation of Australian biotechnology on the world stage and showcased the investment potential of the sector to more than 150 investors, 50 of whom came from overseas. The strong interest shown by international investors in the summit reflects the maturity of the Australian biotechnology sector and its increasing capacity to extract commercial value from world class local research.

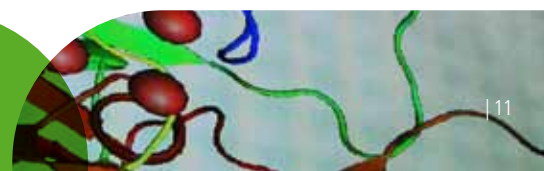
National and international investors attending the summit included angel investors, venture capitalists, fund managers, investment bankers and representatives of superannuation funds and major pharmaceutical companies. Australian firms invited to present at the summit included a mix of listed companies with

products in later stage development, private companies with identified investment opportunities, and early-stage commercialisation companies from research institutes and universities.

AusBiotech 2010 also featured a Business Matching Program, which facilitated around 1,000 one-on-one meetings between biotechnology companies with the aim of opening doors for new deals and alliances.

The Victorian Government was the major sponsor of *AusBiotech 2010* and also hosted a pavilion for small-to medium-sized biotechnology firms and research institutes.

The conference attracted 1,500 participants to Melbourne, with the largest overseas delegations coming from New Zealand, the United States, Canada, the United Kingdom and Singapore.



ACTION AREA

Building a bioeconomy

New discoveries, projects and alliances continue to advance Victoria's aim of facilitating biotechnology solutions to major health, agricultural, industry and environmental challenges.

Integrated industry sectors

Closer integration between the dairy, livestock and grain sectors has the potential to deliver significant economic and environmental benefits to Victoria, including a much-enhanced capacity to tackle common cross-sector problems and develop new processes, practices and products. Actions taken by government, researchers and industry during 2010 are helping to drive greater integration and collaboration across these sectors.

- > The **Dairy Futures Cooperative Research Centre (CRC)** opened in August 2010. Jointly funded by the Australian and Victorian Governments and industry, the CRC will bring dairy research across Australia under one roof, generating new opportunities for collaboration and driving greater innovation in the dairy industry. The CRC's three research streams will aim to advance the value of pasture, ensure the selection of better dairy cows and provide new science breakthroughs with a practical on-farm value. The CRC will also train 30 new scientists in dairy research.

The centre's location in Melbourne at the Victorian AgriBiosciences Centre acknowledges Victoria's strong record in dairy bioscience and innovation undertaken by the Department of Primary Industries, and will keep Victoria at the forefront of global dairy bioscience research.

- > In 2010, Murray Goulburn Cooperative Co Ltd progressed the nutraceutical and pharmaceutical commercialisation of the milk compound **RIPTAC** (Regeneration Inducing Peptide for Tissues and Cells). Discovered by Victorian researchers at the Department of Primary Industries, the compound has attracted global interest because it can reduce fat-to-muscle ratios. Clinical trials conducted in 2010 showed that RIPTAC can promote the growth and proliferation of primary human muscle cells, suggesting that it has significant potential to reduce the incidence of cardiovascular disease and diabetes, and relieve the symptoms of a number of age-related diseases such as osteoporosis.
- > The Department of Primary Industries (DPI) continues to assist food and fibre producers to tap into the results of cutting edge agricultural bioscience research and translate this research into practical processes and outcomes. A large scale genome **sequencing and computational biology** facility was established at the Victorian AgriBiosciences Centre in 2010 to underpin genetic innovation in crops and livestock for productivity and biosecurity outcomes in Victoria's agricultural industries.

- > During the year, scientists at the Department of Primary Industries became the first in the world to discover several new antimicrobials in proteins from platypus milk that are ten times more potent in killing bacteria than antiseptics commonly used with humans. This **research into platypus proteins** has the potential to create natural, highly effective new medicines and treat antibiotic-resistant bacterial infections in humans. It may also have potential to fight animal and plant diseases.
- > Following the expiration of the moratorium on **genetically modified (GM) canola** in 2008, commercial crops of GM canola can be grown in Victoria. In the 2010 cropping season, around 190 farmers planted more than 36,500 hectares of GM canola (compared to 27,500 hectares planted in 2009). A set of industry guidelines and standards now applies to the segregation of non-GM canola and GM canola in the grain supply chain, and there were no reports of canola from Victoria failing to meet either its GM or non-GM specifications in 2010.

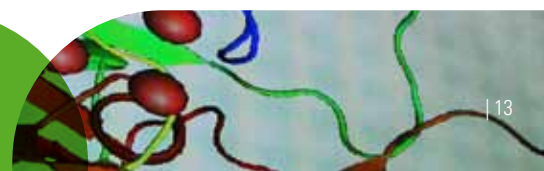
2010 also saw a stronger focus on promoting enabling technologies to improve industry integration and extend the benefits of biotechnology more broadly across the economy.

- > A new **Small Technologies Industry Uptake Program** was launched by the Department of Business and Innovation during the year. The program provides vouchers to Victorian businesses that can be exchanged for access to small technologies facilities, services, advice or expertise. Biotechnology firms can make use of the program to identify and scope the use of small technologies in developing new products and processes. Twelve companies were awarded vouchers in 2010.
- > Victoria's **Small Technologies Cluster** led a mission to the 2010 Techconnect World Expo in the United States, with the aim of assisting Australian companies to identify business opportunities, develop business networks and explore potential research partnerships. Companies attending the Expo included those involved in using small technologies to develop clean technology and biotechnology solutions.

Biotechnology solutions to environmental challenges

Biotechnology has enormous potential in helping to deliver solutions and responses to major environmental challenges. In particular, the biotechnology sector is contributing to the more efficient use of Victoria's energy resources and the development of new plant varieties, farming practices and water management technologies.

- > Victoria formally signed a **research agreement with Dow AgroSciences** (a subsidiary of the giant Dow Chemical Company) in February 2010, marking the start of the State's largest ever international agricultural biotechnology research partnership. The alliance between the Department of Primary Industries and Dow AgroSciences will expand the scale and scope of agricultural biotechnology research in Victoria, cement Victoria's reputation as a global leader in agricultural biotechnology and accelerate the development of new plant varieties, higher crop yields and improved farming practices.
- > Over the last two years, Victoria has been hosting the first Australian **field trials of high-energy pasture grasses** developed by scientists at the Department of Primary Industries within the Molecular Plant Breeding CRC and Dairy Futures CRC.
- > A new, **state-of-the-art mass spectrometry facility** has been established by the Department of Primary Industries at the Victorian AgriBiosciences Centre giving Victoria a much improved capability to analyse plant and animal proteomes and metabolomes. This capability, integrated in a systems biology context, is used to develop improved crops and livestock genetics to boost agricultural productivity by improving water and nutrient use efficiency in crops and pastures, enhancing quality of crops and pastures, and increasing feed conversion efficiency in livestock.



- > Scientists in the Department of Primary Industries and the Victorian company Procept IP commenced work on a **biophony pilot study** that will investigate how automated sensors can be used to monitor pests and insects in Victoria's orchards and vineyards. Biophony (the collective sound made by birds, insects, animals and other organisms in a particular environment) has great potential for measuring biodiversity and assessing environmental health, as well as assisting in reducing unnecessary chemical applications for pest control.
- > The **Victoria-Israel Science and Technology R&D Fund (VISTECH)** continues to support biotechnology-related projects including efforts to save energy and improve the management of water resources. The Sustainable Water Systems for Dairy Farms project was completed in late 2009 and products developed by the project are now on the market. In October 2010, VISTECH announced funding for a new joint R&D project between Victorian company o.d.t. engineering and Israel's Netanya Plasmatec to develop a new technology to reduce the energy intensity of the aluminium casting process.

Victorian research team helps to save Australia's abalone industry

In 2005, an unidentified disease began killing farmed abalone in Victoria. Within months, the disease had spread to wild populations, threatening Australia's \$200 million abalone industry.

The disease – known as Abalone Viral Ganglioneuritis – is caused by a herpes-like virus that inflames the abalone's nerves, impairing its ability to feed and move. The Abalone Virus Research Team (a partnership between the Victorian Department of Primary Industries and the CSIRO) identified that one of the challenges was diagnosing the virus in its early stages before the abalone showed clear signs of the disease. The team determined the genetic code of the virus, which has led to the development of two rapid detection tests which can detect and identify infection before and after signs appear.

The tests are now being used across Australia and New Zealand, increasing the speed of diagnosis and enabling infection control measures to be implemented at an early stage.

In 2010, the Abalone Virus Research Team won the Daniel McAlpine DPI Science Award for its outstanding research achievement and contribution to protecting a vital, multi-million dollar Victorian industry.

ACTION AREA

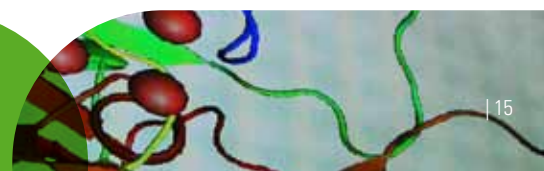
Making Victoria a preferred place to live, work and learn

New initiatives in 2010 aimed to further boost Victoria's attractiveness as a destination for leading researchers, skilled workers and biotechnology firms. Government and the biotechnology sector continue to work together to tackle skills shortages, encourage young Victorians to take up careers in biotechnology and build stronger public support for the sector.

A skilled workforce

Victoria continues to invest in building the highly skilled workforce needed to support the biotechnology sector and attract new firms and investors.

- > The **Biotechnology Skills and Workforce Review** was released in September 2010. Conducted by the Allen Consulting Group, the review identified that global demand for all biotechnology-related occupations is increasing; that there is particularly high demand for employees with skills in regulatory affairs, clinical strategy and project management; and that considerable potential exists for Victoria to attract and retain many more skilled and qualified biotechnology workers. The review's comprehensive analysis of the State's biotechnology workforce provides the basis for industry and government to target critical skills and occupations through education and training initiatives, skilled migration programs and other industry strategies.
- > The Victorian Government has engaged Medicines Development Limited (MDL) to deliver the **Practical Drug Development Program**, which will provide specialist expertise in project management for drug development to biotechnology companies. The program will place skilled, dedicated project managers in local companies to lead and manage drug development activities. Project managers will be supported by MDL's senior managers and a network of specialist advisers with extensive experience in international drug development. Over time, the program aims to accelerate the development of new pharmaceutical products in Victoria, strengthen project management skills across the biotechnology sector and improve the sector's global competitiveness.
- > The **Undergraduate Research Opportunities Program (UROP)** continued its contribution to Victoria's biomedical workforce by placing 18 science undergraduates with research or industry groups in 2010. Administered by the Bio21 Cluster, UROP aims to give high achieving undergraduates practical research experience, encouraging them to take up further study or employment in the sector. Since 2004, UROP has placed more than 300 undergraduates. In 2010, Davis McCarthy, a statistician at WEHI and a former UROP student, was awarded a Sir John Monash Foundation Scholarship to undertake a PhD at the University of California, Berkeley.



- > Alongside initiatives to build skills locally, Victoria also aims to attract skilled biotechnology workers to the State. To conform with reforms to Australia's Skilled Migration program, the new Victorian State **Migration Plan** came into effect in November 2010. The plan has a strong focus on addressing skills shortages in the biotechnology sector and targets a number of biotechnology- and science-related occupations for sponsorship, including life scientists, agricultural scientists, chemists, physicists and engineering technologists.
- > **Working in Victoria: A guide for biotechnology professionals** was released during the year. The guide provides useful information on how to go about finding a biotechnology job in Victoria, gives insights into Victoria's biotechnology sector and achievements, highlights the opportunities available for biotechnology professionals in Victoria and provides links to key employers.

Backing the next generation of innovators and scientists

Victoria continues to develop initiatives to encourage young Victorians to develop skills and knowledge in science and technology, and to take up careers in science.

- > The **Energising Science and Mathematics Education Strategy** includes the construction of three specialist science centres at Geelong, Ballarat and Heidelberg (to complement existing specialist centres in space, gene technology and environmental science); 200 new specialist mathematics and science coaches; university mentoring programs for primary and secondary students; and scholarships to attract new science and mathematics teachers.
- > Nine schools received **Victorian Science and Mathematics Education Excellence Awards** in 2010 for developing innovative programs that give students hands-on experiences in the contemporary use of science and mathematics. Laverton College P-12 won the statewide award for its LavNet program, which mentors a network of local primary schools in the use of innovative science kits, and the College's robotics room.
- > The **John Monash Science School** commenced operation in 2010, attracting 200 Year 10 students wanting to specialise in science, mathematics and technology studies. The school is integrated into Monash University's science and research precinct, giving students access to the university's resources and the chance to interact with leading Australian scientists. The school will eventually cater for up to 650 Year 10 to 12 students.
- > Following a highly successful pilot in Victoria, the **Science and Technology Education Learning Relevance (STELR) program** is being rolled out to more than 180 schools across Australia. STELR is a secondary school program that uses renewable energy technology to stimulate students' interest in science and technology, and to increase the number of students choosing science and engineering.



Public support

Public support is vital to the continuing success of the biotechnology sector in Victoria. During 2010, government and industry worked together to create opportunities to inform the public about developments in biotechnology and to engage Victorians in discussions about the best ways of translating scientific and medical research into practical benefits for the broader community.

- > Around 2,000 people attended the Melbourne Convention and Exhibition Centre in March to hear US genomics pioneer Dr J. Craig Venter deliver the Graeme Clark Oration, the premier event of the 2010 **ICT for Life Sciences Forum**. Coordinated by National ICT Australia, the forum also featured lectures by leading Australian and international researchers, and a *Meet the Founder Series* showcasing Australian entrepreneurs who have developed knowledge-based companies.
- > Other community engagement activities included the **Living science at the Queen Victoria Market** day as part of National Science Week (where shoppers were encouraged to explore the relationship between food, science, technology, innovation and the environment) and **Stem Cell Awareness Day** (an online initiative linking scientists, clinicians, patients and the public around the world to promote understanding about the potential of stem cells to treat a wide range of diseases).

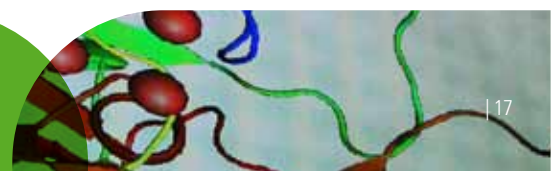
Industry and community input into the future of biotechnology

In August, representatives from the broader stakeholder cohort attended a forum hosted by the Department of Business and Innovation to guide Victoria's approach to biotechnology from 2011.

The forum included representatives from industry, research institutes, NGOs and government, and was run by an independent facilitator. The forum aimed to engage in constructive discussion with stakeholders holding diverse views about the benefits and risks of biotechnology to ensure that these views were taken into account in developing future biotechnology plans and strategies.

Participants discussed the importance of sustaining public support for biotechnology, the need to keep the community informed about biotechnology developments and the value of ongoing community engagement in government decisions about investment in the biotechnology sector.

Despite their differences, participants shared common objectives in relation to disease detection and prevention, and positive social and environmental outcomes.



ACTION AREA

Delivering access to high quality infrastructure

High levels of investment in world class infrastructure for biotechnology – including purpose-built cancer research and care facilities, powerful new computing platforms and state-of-the-art tools for closer collaboration between industry and researchers – continue to reinforce Victoria's global profile as a leading life sciences location.

Internationally competitive infrastructure

Innovations and improvements in cancer treatment require close collaboration between scientists and doctors. With support from both the Victorian and Australian Governments, new facilities will make Victoria a leading location for integrated cancer care, attracting the world's best researchers and resulting in earlier detection, new therapies, more holistic care and a better quality of life for the 500 Victorians diagnosed with cancer each week.

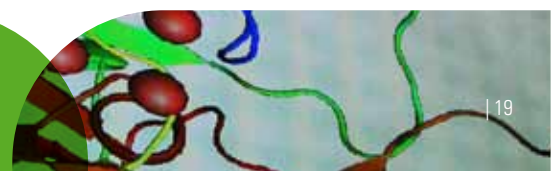
- > Progress continued during 2010 on the \$1 billion **Victorian Comprehensive Cancer Centre (VCCC)**. When completed, the Centre will be a world leader in cancer research, training and treatment, bringing together Australia's best cancer researchers, clinicians and educators in a specially designed facility. The Royal Children's Hospital has joined the VCCC as a partner, giving children treated at the hospital access to the best available cancer treatment and ensuring that Victorians benefit from world-class comprehensive cancer care from infancy through to adult life. The three companies shortlisted to build the centre were announced in March, with the successful consortium to be named in 2011.
- > Construction commenced on Stage 1 of the **Olivia Newton-John Cancer and Wellness Centre** at the Austin Hospital. Combining the Austin Hospital's cancer expertise with the globally renowned Ludwig Institute for Cancer Research, the Centre will integrate cancer research and treatment with the best model of holistic care and wellness for patients and their families.
- > Funding was announced for a new **Ballarat Regional Integrated Cancer Centre**, which will bring together cancer treatments with a wellness centre and clinical trial facilities.

Victoria continues to lead Australia in providing the state-of-the-art ICT infrastructure that is now essential for conducting groundbreaking research and participating in international research alliances.

- > The Victorian and Australian Governments combined to support the establishment of the world's first **IBM global information and communication technologies (ICT) research and development laboratory** at Melbourne University. The collaboratory will combine cutting edge R&D initiatives with advanced ICT infrastructure, enabling Victorian researchers to tackle challenges such as fighting disease, managing natural disasters and boosting agricultural yields. The new facility will open in 2011 and grow to around 150 researchers within five years.
- > IBM's investment in the laboratory follows its \$100 million collaboration with the University of Melbourne to build one of the world's most powerful supercomputers as part of the **Victorian Life Sciences Computation Initiative**. The supercomputer will be capable of making one trillion calculations per second, ranking it in the top six supercomputers worldwide and greatly enhancing the capacity of Victorian researchers to carry out world-class research in Melbourne. In 2010, researchers at the University of Melbourne started using the IBM Blue Gene supercomputer to develop faster, more accurate eye tests that will assist in detecting and monitoring glaucoma – the second leading cause of vision loss in older Australians.
- > Victoria's high tech research infrastructure base is being further enhanced through the development of the **MASSIVE high performance computing facility**, which brings together two high performance computers at the Australian Synchrotron. The Multimodal Australian Sciences Imaging and Visualisation Environment (MASSIVE) – a partnership between some of Australia's leading technology providers and research institutions – will give researchers from a range of fields the ability to create, view and analyse high resolution images and models that were previously too large to visualise.
- > Advanced computing tools will also be available to Victoria's agricultural scientists with the creation of a **new supercomputer at the Victorian AgriBiosciences Centre** in Melbourne and Bendigo. The new computer will be linked to Department of Primary Industries research centres in Horsham and Rutherglen, forming a virtual network of computer laboratories that will enable the rapid processing of data and analysis of research in areas such as climate change, water scarcity and biological threats.

The biotechnology sector continues to work with the Victorian and Australian Governments to deliver major medical research and science infrastructure.

- > The \$150 million **expansion of the Walter and Eliza Hall Institute (WEHI)** was completed in late 2010, giving WEHI the new facilities it needs to operate larger research teams, pursue new areas of research and collaborate with global partners.
- > New facilities were completed for the **Burnet Institute**, which is the largest infectious diseases institute in the southern hemisphere. Institute staff commenced research activities at the new Alfred Medical Research and Education Precinct in May and the Institute opened its Immunology Monitoring Facility in June.
- > The **Victorian Biomedical Imaging Capability project** was established, with the aim of improving access to biomedical imaging in Victoria and potentially leading to advances in the prevention and treatment of cancer, neurological conditions and heart disease. By bringing together an extensive network of capabilities and capacity in biomedical imaging, the project will pool and improve imaging resources and equipment across universities and research institutions, promote greater collaboration between biomedical imaging researchers and help to attract the world's best biomedical imaging researchers to Victoria.
- > Five Victorian education institutions received funding under the Education Investment Fund, including two biotechnology-related facilities. The **Green Chemical Futures facility** at Monash University will apply green chemistry research and innovation to develop sustainable manufacturing practices for industry and equip more Australians with green engineering skills. The **Australian Future Fibres Research and Innovation Centre** at Deakin University's Geelong campus will conduct research into innovative materials such as carbon fibre, nanomaterials and green natural fibres, with applications for the aerospace, automotive and textiles industries.
- > With nanotechnology and microtechnology predicted to have an escalating impact on industries and economies over the next decade, the opening of the **Melbourne Centre for Nanofabrication (MCN)** in July 2010 will ensure that Victoria is well-placed to benefit from this rapidly evolving science. The MCN is a purpose-built facility that combines instrumentation for micro- and nano-scale fabrication with special laboratories for making smaller devices – giving researchers and industry the tools to build miniature prototypes in a range of areas, including environmental management and health care.



Working together on infrastructure: BioSciences Victoria Collaborative

Established in 2010, the BioSciences Victoria Collaborative brings together Victoria's four major bioscience precincts to explore, plan, facilitate and coordinate projects that will contribute to Victoria's progress as a world leader in biosciences.

The Collaborative will play a leading role in improving access to biotechnology-related infrastructure by encouraging closer collaboration between the precincts, contributing to planning for major scientific projects and ensuring a coordinated approach to the development of bioscience infrastructure across Victoria. The Collaborative will also auspice collaborative projects and assist research institutions to develop business cases in support of funding requests for shared infrastructure.

The Collaborative has identified two particular areas where there is a strong interest from researchers and industry in exploring opportunities for greater collaboration and sharing of resources: systems biology and animal facilities.

The BioSciences Victoria Collaborative is independent of government and is supported by a secretariat housed at BioMelbourne Network. The forum is chaired by Emeritus Professor Richard Larkins AO.

Access to public infrastructure

While Victoria now has a breadth and depth of world-class, globally competitive infrastructure to support the biotechnology sector, greater collaboration and alliances between industry and researchers are essential for extracting the maximum benefits from this infrastructure. Several major initiatives to promote closer links and relationships between biotechnology firms, investors and researchers were completed or progressed in 2010.

- > Launched in March, the **Victorian BioPortal** – www.vicbiportal.org – is one of only two biotechnology portals in the world. Strongly supported by industry, the BioPortal is a 'one stop web shop' that provides a comprehensive directory of Victoria's biotechnology sector. The portal regularly updates industry news, links users with biotechnology firms, research institutes and universities, and provides access to relevant government programs, departments and agencies. Since its launch, the portal has attracted an average of more than 250 visits each week, of which about 20 per cent are from overseas.
- > The **Victorian Platform Technologies Network** – a joint initiative of the Bio21 Cluster, Monash University and the Victorian Government – facilitates access to infrastructure, services and expertise in platform technologies such as bioinformatics, genomics, microscopy, metabolomics and drug development. During 2010, the Network continued to expand and currently

includes more than 100 facilities across the State. The Network published Victoria's Capability Menu, which allows companies and researchers to identify platform technology capabilities that can support their particular projects. The menu is linked to a searchable directory of facilities on the Victorian BioPortal.

- > The **Biomarker Pilot Project** was established to test Victoria's capacity to translate basic research into clinical diagnostic use. Colorectal cancer was chosen as the test disease and basic research findings of protein biomarkers for colorectal cancer were selected for further development. The project was jointly funded by the Victorian Government and the Victorian Cancer Agency, and was a collaboration between Cancer Trials Australia, the Ludwig Institute for Cancer Research – Melbourne Centre, the Peter MacCallum Cancer Centre and the Victorian Cancer Biobank. The project has been successful in using facilities available within Victoria to develop clinical diagnostic tests for biomarkers, with basic research findings being converted to assays and tested in clinical samples. With proof of principle established, the assays developed will form the foundation for further work in producing diagnostic assays to use in screening and clinical applications. The pilot project's scientific outcomes show that Victoria can be a key player in biomarker discovery and validation.



Looking ahead

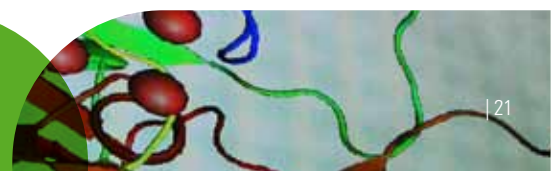
The Baillieu Government considers a strong and growing biotechnology sector to be vital to Victoria's future. The government is also committed to generating economic, health and environmental benefits from driving biotechnology-enabled innovation across other industry sectors and promoting the convergence of biotechnology with other technologies.

In 2011, the government will release Victoria's Technology Plan for the Future which will include a 'family' of three industry plans for biotechnology, ICT and small technologies. Victoria's Technology Plan for the Future will actively promote this trio of technologies with the aim of generating substantial benefits for Victorian industry, increasing innovation and productivity in our businesses and providing solutions to some of the challenges facing our state. The plan will adopt a strong, market-driven approach to supporting Victoria's innovators and technology leaders, and to facilitating the uptake of enabling technologies to promote innovation in other industries.

Victoria's Technology Plan for the Future – Biotechnology will consolidate Victoria's leadership in biotechnology and position the sector for the next stage of growth. While continuing to support activities identified by the sector as being critical to its future success, the plan will adopt a fresh focus on facilitating the convergence of biotechnology with ICT and small technologies and extending biotechnology's sphere of influence across Victorian industry and the economy.

The Baillieu Government is committed to improving collaboration between government and industry to better coordinate policies, actions and investment related to biotechnology. Victoria's Technology Plan for the Future – Biotechnology will meet the government's election commitment to establish a Victorian Biotechnology Advisory Council to provide a business and industry perspective on the development of Victorian biotechnology. The plan will also confirm the government's ongoing support for the BioSciences Victoria Collaborative and the important role it plays in bringing together Victoria's major research precincts to explore and facilitate collaborative projects.

In addition to new actions set out in Victoria's Technology Plan for the Future – Biotechnology, the Baillieu Government will continue to work with researchers and industry to build a strong and growing biotechnology sector, maintain an attractive and competitive business environment for the sector, and ensure that Victoria remains a leading location for biotechnology.



Australian Synchrotron drives international research excellence

As the largest stand-alone piece of scientific infrastructure in the southern hemisphere, the Australian Synchrotron in Melbourne is now in its fourth year of operation and is already building a strong international reputation for supporting high quality, groundbreaking research.

During 2010, one of the world's most prestigious and widely read scientific journals, *Nature*, published the findings of two research projects carried out at the Australian Synchrotron. In the first project, researchers from Monash University, the Peter MacCallum Cancer Centre and Birkbeck College in London used the synchrotron's capabilities to show how an 'assassin' protein called perforin is capable of killing rogue cells in the human body that carry damaging viruses.

The research team determined the molecular structure of the protein and the results of the study will support the next wave of immunology research, with the potential to be used in the fight against diseases such as cancer, malaria and diabetes. Joint project leader Professor James Whisstock from Monash University has observed that the study would not have succeeded without access to the Australian Synchrotron.

In another breakthrough, Victorian researchers used the Australian Synchrotron to uncover the quality control mechanism that must take place for the human immune system to effectively destroy harmful viruses and bacteria. The team, led by Professor Jamie Rossjohn from Monash University and Professor Jim McCluskey from the University of Melbourne, used the synchrotron to solve a 15-year puzzle by working out the structure and function of a protein called pre-T-alpha, which is vital to the function of human T-cells that fight viruses and infections.

The results of these studies will support future immunology research and the next wave of drugs to tackle immune-related diseases and disorders.

The winner of the 2010 Premier's Award, Dr Julia Archbold from Monash University, also used the Australian Synchrotron for her research into the reasons behind organ transplant rejection – work that is likely to lead to significant improvements in organ donation strategies and organ transplant practices.

The synchrotron is now starting to receive repeat requests from commercial users, indicating the usefulness of the facility for commercial applications and the benefits of initiatives designed to promote collaboration between industry and researchers in using the Australian Synchrotron.

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