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Opportunities Study 2004

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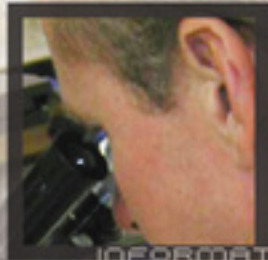
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Discover Biotechnology

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This project was proudly sponsored by the Department of Innovation, Industry and Regional Development

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Biotechnology, projecting Geelong into the future

In 2003 the five neighbouring Geelong Regional Councils of City of Greater Geelong, Surf Coast Shire, Colac Otway Shire, Borough of Queenscliffe and Golden Plains Shire worked together with community and business agencies to form the Geelong Region Strategic Alliance or G21, to plan for the economic, environmental and social challenges of the Region.

G21 released its Geelong Region Strategic Plan in November 2003 which highlights specific projects of regional interest across nine major “pillars” or themes including Arts, Culture and Heritage, Community Safety and Security, Economic Development, Environment, Health and Well Being, Lifelong Learning, Research,

Sport and Recreation, Telecommunications and Transportation.

Biotechnology was identified as a key pillar project for Economic Development given its potential as a source of jobs, income and export growth.

The biotechnology sector is expanding globally as its application is more widely used. Biotechnology can include a variety of activities but can be grouped into several broad categories including human healthcare and medical research, agriculture, environment and food.

The City of Greater Geelong with the support of the Victorian Government’s Department of Innovation, Industry and Regional Development commissioned the Geelong Biotechnology Opportunities Study in March

2004. The Study was prepared by Buchan Consulting and completed in June 2004.

The aim of the project is to establish Geelong as a major Victorian biotechnology precinct and to be a key player in the State Government’s Biotechnology Strategy that seeks to position Victoria as one of the top five Biotechnology locations in the world by 2010. The Geelong Region’s biotechnology sector is anchored by ChemGenex Pharmaceuticals, the CSIRO Australian Animal Health Laboratory and PIRVic Marine and Freshwater Institute with significant biotech focus occurring at Deakin University and Barwon Health. The majority of biotechnology activity that currently occurs in the Region is concentrated in the research and discovery phase.



Prospects Geelong

Australia is recognised internationally as a major centre of biotechnology with over 700 companies involved in various activities. In addition, there are a number of research institutes, cooperative research centres and universities.

Biotechnology is a major focus of Government policy at a national and state level. The key focus is on encouraging research, product and process development, commercialisation and the development of international partnerships.

In 2004 the Victorian State Government released its updated Biotechnology Strategic Development Plan for Victoria. The key outcome area for the Strategy is the development of Victoria as one of the world's top five global biotechnology hubs by 2010.

The Committee for Melbourne has recently established the BioMelbourne Network. The Network is an independent body that facilitates unique collaborations between the Victorian Government, business leaders and the biotechnology sector, to facilitate industry development and global connections to capitalise on international commercial opportunities.

Victoria accounts for over 35% of biotechnology organisations in Australia. The Victorian industry is made up of a diverse range of research areas with particular research strengths in medical (58% of organisations) and plant (35% of organisations) research.

There are six identified biotechnology precincts in Victoria, which have developed around universities and major research institutes. Their combined level of activity is substantial, employing 6,000 researchers and attracting research funding of around \$450 million per year.

The Parkville Precinct is Victoria's largest biotechnology precinct, and is the major focus for the \$400 million Bio21 development. The precinct comprises the University of Melbourne, the Walter and Eliza Hall Institute of Medical Research, the Howard Florey Institute of Experimental Physiology and Medicine, the Ludwig Institute for Cancer Research, and the Royal Melbourne Hospital.

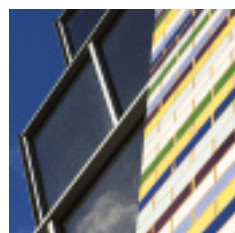
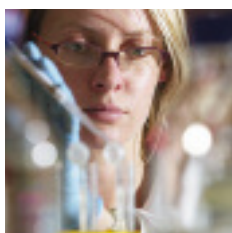
The Alfred Medical Research and Education Precinct combines the Alfred Hospital, the Baker Heart Research Institute, the MacFarlane Burnet Centre and Monash University School of Medicine. Key strengths of this

precinct are research into cardiovascular disease, viruses and HIV/AIDS.

The Monash Health Research Precinct is a biomedical cluster based around Monash University's Clayton Campus. It is linked to clinical research with a major focus on public health and health services. The precinct includes Monash Institute of Reproduction and Development, Monash Institute of Public Health, Prince Henry's Institute of Medical Research and the Southern Health Care Network. Biotechnology companies located within this precinct include Biota Holdings, Mimotopes and Monash IVF.

The Werribee Precinct is principally focused on animal and food research. Key institutions located on the site include the Victoria University of Technology, Food Science Australia, the Victorian Institute of Animal Science and the CSIRO Division of Livestock Industries.

The Bundoora Precinct is focused on plant bioscience. The precinct includes La Trobe University, La Trobe Research and Development Park and Royal Melbourne Institute of Technology Bundoora campus. Austin Biomedical Alliance Precinct is located in Heidelberg and is based at the Austin and Repatriation Medical Centre.



Biotechnology Industry Geelong

The Geelong Region has Victoria's largest biotechnology capability outside Melbourne.

There are some 300 researchers devoted to biotechnology and the industry attracts approximately \$18 million per year in external research funding. Employment in biotechnology alone contributes over \$15m in wages and salaries to the economy each year. An additional 120 staff are employed in biotechnology organisations in support roles. Geelong biotechnology activities occur across a number of organisations.

ChemGenex Pharmaceuticals

ChemGenex Pharmaceuticals (formerly AGT Biosciences Ltd) is a publicly listed biotechnology company focused on gene and protein discovery and validation. The recent merger of AGT Biosciences with USA firm ChemGenex Therapeutics Inc will maintain operations in California, Texas and Geelong. The new firm is focused on the development of novel small molecule therapeutics for the treatment of cancer and related conditions.

The company has a strong competitive advantage in metabolic diseases, diabetes and obesity, and now has cancer leads in Phase II clinical trials. Commercial arrangements have been set up with Merck-Sante, Sequenom and Kyokuto Pharmaceutical Industrial Co in relation to diabetes and obesity. The company's eXpress Technology Platform is an integrated suite of technologies leading from humans and animal models of disease through to validation of protein targets. It involves high technology in terms of equipment and incorporates considerable application of bioinformatics. The company generates some revenue from a contract service for validation of target genes.

Deakin University Research

Deakin University has a strong commitment to biotech research in a number of areas. Research features as a key element of its long-term strategic plan. The University has targeted its research priorities based on its capacity to compete successfully for national and international research funding, to produce high quality research output and to collaborate with other organisations.

The University's Waurn Ponds campus has a major focus on biosciences, with key activities grouped in four major areas.

Cellular Metabolism in Health and Disease

Deakin University is a leader in the field of biological sciences. It has a major focus on diabetes, obesity, anxiety and depression. The Metabolic Research Unit is a state-of-the-art facility for gene discovery and is researching new treatment for these diseases. More than 65 genes relating to diabetes and obesity have been identified. The research examines the molecular bases of these "lifestyle" diseases and the interactions between physical activity and nutrition that will impact on the management of these diseases and future therapeutics.

Deakin is also involved in the research of functional foods the development of novel foods and ingredients that produce health benefits, beyond the delivery of nutrients.

Chiral and Molecular Technologies

The free radical chiral technology being developed at Deakin enables the manufacture of new chemical compounds carrying the characteristics that are required for a specific pharmaceutical purpose, leaving out harmful, unwanted side effects. The process reduces waste produced in existing technologies and the outcome is a

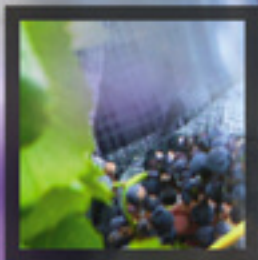
product with greater purity and effectiveness, yielding significant efficiencies and cost savings for industry.

Chiral chemicals are important in pharmaceutical manufacturing. About 80% of all new products in development, from anti-cancer drugs, through to antibiotics and cold and flu remedies, are chiral chemicals. Chirotechnology has applications in the development of drugs, insecticides and biodegradable plastics.

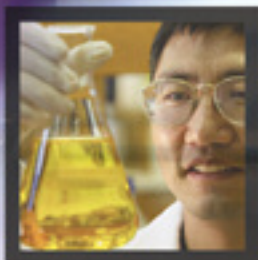
Research is funded by the Australian Research Council and by industry. International collaborations are in place with researchers at universities in Australia, England, Germany and the United States.



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Cell and Organism Bio-engineering

The Cell and Organism Bioengineering (COBE) group uses recombinant DNA methodology combined with advanced biochemical, cellular and genetic techniques to engineer cells and organisms. It is focused on major applications in agricultural and environmental technologies.

There are several internal and external collaborations. The Faculty of Science and Technology's biotechnological and molecular biological research is linked to work in chiral and molecular technologies and with aquaculture. There are links with nutrition and health researchers in the Faculty of Health and Behavioural Science. External collaborations exist with Botany and Genetics at the University of Melbourne, the Ludwig Institute for Cancer Research, and the Murdoch Children's Research Institute. Researchers also have national and international links. Industry links exist via research project funding.

Chronic Illness

Deakin University's Centre for Cellular and Molecular Biology (located at the Burwood Campus), is involved in research on the effects of heavy metals (copper, zinc, chromium and arsenic) on biological systems. The Centre is investigating copper-related diseases including Menkes disease and Wilson's disease. The research will also assist in the understanding the development of Alzheimer's disease and some motor neurone diseases. New cancer research is also being undertaken for leukaemia and breast cancer.

Geelong Technology Precinct

Deakin University has also committed to the development of the Geelong Technology Precinct at its Waurn Ponds Campus. The Precinct will focus on the University's core research capabilities in materials, biotechnology, chemicals and environmental engineering along with regional strengths in manufacturing and agri-processing.

The Precinct will integrate high-level research capabilities with specialised research equipment and industrial scale infrastructure. It will also offer tenancy for technology oriented businesses.

BioDeakin

During 2003, Deakin University established BioDeakin, a whole-of-university (Geelong, Warrnambool and Burwood campuses) vehicle for coordinating future biotechnology development including research linkages, research funding and commercialisation.

BioDeakin will drive future development and cooperation with other researchers in biomedical, biological sciences, plant and aquatic biology and bioprocessing.

Chirogen

A long-term research program in chirals between Deakin and Melbourne Universities led to the establishment of Chirogen. It is involved in commercialising technology for the synthesis of single enantiomer compounds for the pharmaceutical industry.

Chirogen now operates from Melbourne, but the capability that lead to establishment of the company still exists in Geelong through Deakin University's Centre of Chiral and Molecular Technologies.

Barwon Health

Barwon Health operates a range of hospitals (including Geelong Hospital), clinics and health centres in Geelong and South West Victoria. Geelong Hospital is a teaching hospital of the University of Melbourne (Chairs in Medicine and Surgery) and Deakin University (Chair of Nursing (Research)).

Barwon Health has research strengths in biotechnology, epidemiology and clinical trials, with most of this research based at Geelong Hospital. Key interests in laboratory research are the molecular and clinical aspects of bone resorption, markers of thyroid disease and stem cell growth, differentiation and gene expression.

Clinical Trials

Clinical trials are a major component of Barwon Health's research output. At any one time there are large numbers of trials being conducted. In recent years, the number of clinical trials has stabilised while the number of investigator-initiated projects is increasing. The major research areas are oncology, cardiology and clinical and biomedical sciences.

Osteoclast Cell Biology

The Geelong laboratory is one of the leaders in the world in the study of osteoclasts, the cells responsible for resorbing bone by demineralisation. The research ties in with the Geelong Osteoporosis Study, a major epidemiological study of 1,600 females (which is being extended to include 1,600 males), the results of which formed the basis of the Australian National Bone Density Range. Activities include basic research and projects in primary healthcare, such as the effect of Vitamin D treatment (by general practitioners) of older women on the prevention of falls and fractures.

Douglas Hocking Research Institute

A major research activity currently at the Douglas Hocking Research Institute is the study of conditions required for the growth and differentiation of stem cells derived from cord blood and the bone marrow of orthopaedic patients. The stem cell research includes application of a technique of re-programming cells by introducing the cytoplasm of other cells. Researchers have discovered novel genes expressed in stem cells.

CSIRO

Australian Animal Health Laboratory

CSIRO's Australian Animal Health Laboratory (AAHL) is located in Geelong. Research is driven by the need to safeguard Australia from exotic diseases and to maintain and grow markets for sheep, cattle, pig and poultry products.

Research activities target the development of new diagnostic tests, vaccines and therapeutics for exotic and endemic animal diseases of national importance. Three major programs are underway.

Diagnostic Sciences

Diagnostic Sciences involves the diagnosis of diseases of national significance to livestock, aquatic animals and fauna.

This includes development and application of diagnostic tests, the pathogenesis of diseases and the spread and management of diseases among populations. Research is supported by the extensive resources of the Tissue Culture Unit that maintains more than 120 animal cell lines in its collection. The program applies elements of virology and serology, pathology, epidemiology, electron microscopy.

AAHL's Diagnostic Sciences includes the Fish Diseases Laboratory that conducts research on finfish, crustaceans and molluscs of relevance to Australia's aquaculture industry. AAHL is considering the establishment of an Australian Centre for Aquatic Animal Health.

A series of feasibility studies on the Centre have been undertaken within CSIRO. Current and proposed capability covers the major known pathogens of salmon, carp, pilchards, prawns, oysters and tuna.

Infectious Diseases and Food Safety Program

Research is broadly directed toward increasing Australia's capacity for disease control by improving the understanding of viral and bacterial diseases and plant-associated toxins.



The five key projects of the program are:

- Avian virology, particularly the characterisation of infectious bursal disease virus that affects poultry and the development of vaccines and improved diagnostic tests.
- The development of more sensitive diagnostic tests for Johne's disease, a contagious disease of ruminants that causes intestinal inflammation.
- Protein chemistry and proteomics to identify, purify and characterise proteins of biological significance.
- Study of plant-associated toxins, from plants or bacteria and fungi that affect grazing animals.
- Application of molecular techniques to characterise emerging viruses.

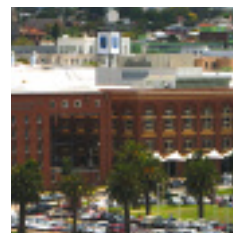
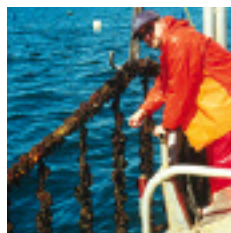
Vaccines and Therapeutics Program

Research aims at improving the health, welfare and production of Australian livestock by the development of vaccine-based products. The use of antibiotics and chemicals in controlling disease and promoting animal welfare is avoided whilst new approaches are employed in the design of vaccines. Much of the research relates to developing new molecular techniques for application in the livestock industry, including novel applications of RNA interference (RNAi) technology to silence specific genes and the development of recombinant vaccines.

Textile and Fibre Technology

Geelong is also the location of another CSIRO facility, the CSIRO Textile and Fibre Technology Division (T&FT). This Division is textile processing driven. There is capability through related research such as chemistry-based scouring technologies and environmental improvements to assist the Australian industry to reach the stringent wool-processing requirements to be applied in Europe from 2007. Also in pesticide residue – how and when to treat sheep to release the least residue to the environment (a project requiring skills in organic chemistry) and determining which compounds are most biodegradable.

The Division has significant capabilities (many of relevance to biotechnology), good industry links and a pragmatic approach to developing intellectual property with its commercial partners. Capabilities include light microscopy, SEN and TEM analytical microscopy, scanning probe microscopy, fibre chemistry and physics, chemical analysis and bonding of polymers to the surface of natural fibres. A contract project is currently under way that uses wool products for a human medical application. The Division can provide information about the chemical composition of amino acids, proteins and lipids and the nature of chemical bonds. It also has research and development capability that is applicable to the hair care industry.



Primary Industries Research (PIRVic) Marine and Freshwater Science

The Victorian Government's marine sciences research centre is located at Queenscliff.

The facility carries out research into marine life at Primary Industries Research Victoria's (PIRVic's) Marine and Freshwater Science program. The research has an environmental and ecological emphasis.

The research involves investigations of both aquaculture and the ecology of the marine and estuarine environment to identify factors necessary for the achievement of sustainable development of Victoria's commercial and recreational fishing and aquaculture industries.

Projects under way include Aquaculture Research and Development (investigations of aquaculture production systems), Marine and Estuarine Ecology (assessment, identification and monitoring of estuarine and marine environments), and Marine Fisheries Science (conduct of stock assessments and population modelling for bay and coastal marine fish resources).

Geelong Education and Training

Geelong is well served with education and training in biosciences.

Deakin University

Deakin offers a number of graduate and undergraduate courses in biotechnology and biological sciences. The School of Biological and Chemical Sciences is one of the five Schools in the Faculty of Science and Technology and is located at two campuses – Burwood and Waurm Ponds. Courses on offer include: Biological science - Bachelor of Science (Biological Science), Biotechnology - Bachelor of Science (Biotechnology), Chemical science - Bachelor of Science (Chemical Science) and Forensic science - Bachelor of Forensic Science. The combination of biology and chemistry has contributed significantly to success in attracting national competitive funding for both teaching and research activity.

In addition, the School of Ecology and Environment offers a Bachelor of Environmental Science (Environmental Management), Bachelor of Environmental Science (Conservation Ecology), Bachelor of Environmental Science (Fisheries Management and Aquaculture), Bachelor of Environmental Science (Marine and Freshwater Science) and Bachelor of Environmental Science (Integrated Catchment Management).

Gordon Institute of TAFE

The Gordon provides courses in biosciences through the School of Life Sciences and the Specialist Centre in Environmental Technologies. It plays a strong role in supporting the research sector and pathology services in the Region. Courses are delivered in Laboratory Technology, Pathology Testing and Biological and Environmental Testing.

Diploma courses include Diploma of Laboratory Technology (Biological and Environmental Testing), Diploma of Laboratory Technology (Pathology Testing), Diploma of Conservation and Land Management and Diploma of Environmental Management.

Certificate level courses are offered in Animal Sciences and include Certificate II in Animal Studies and Certificate III in Animal Studies.

Biotechnology Strengths Geelong

In order to grow the Geelong Region's biotechnology industry a clear understanding of the Region's strengths and challenges is crucial.

Competitive Strengths

A Strong Research Reputation

Geelong is home to several organisations with an international reputation for research such as ChemGenex Pharmaceuticals, CSIRO (AAHL) and Deakin University.

Existing Research Infrastructure

Existence of several major research centres with clusters of researchers and significant investment in equipment and buildings (Deakin University and Barwon Health). The development of Deakin University's Geelong Technology Precinct will be a major asset for the Region.

Commitment to Future Research

Existing organisations such as CSIRO, Barwon Health and Deakin University have a strong commitment to the future growth of biotechnology related capability.

Significant Growth Opportunities

Geelong's research focus has the potential for growth particularly in areas such as health-related research and pharmaceuticals (diseases and drug treatments) and animal health and aquaculture (diseases and vaccines).

Successful Commercial Ventures

The Region has been the birthplace of two successful commercial ventures in ChemGenex Pharmaceuticals and Chirogen that had their start from research undertaken at Deakin University.

Lifestyle factors

The Geelong Region offers unique lifestyle options to attract and retain researchers and related workers. The City has an envied education system and boasts some of Australia's finest schools.

Education and Training

Deakin University delivers supportive education through its Faculty of Science and Technology whilst the Gordon Institute of TAFE delivers courses in training, pathology and environmental science.

State Government Priority

The Victorian State Government is keen to develop biotechnology activities. The range of strategies, programs and financial resources directed at the industry demonstrates this support.

Regional Leadership

The Geelong Region has strong regional leadership in the biotech sector. Local companies are committed to Geelong and are prepared to help grow local biotech capability.

Cooperation

Researchers within the Region already have a number of informal networks and there is readiness to develop this further.

Access

The Geelong Region has easy access to Metropolitan Melbourne technology precincts, Avalon and Melbourne Airports and the Melbourne Central Business District. Travel times to Deakin University at Waurin Ponds will be reduced by the development of West Connect, (Geelong Ring Road).

Challenges to Growing Capability

Industry Size

In comparison to biotech precincts in other locations, the number of organisations and researchers in the Geelong Region is relatively modest. Critical mass is often an important investment attraction criteria.

Until the industry is more advanced there is a great reliance on a small number of key researchers who become crucial to the research being undertaken.

Diverse Research Focus

Geelong's current biotech resources are spread across a range of research areas and research locations.

Increase Research Funding

In order to scale up local research capability, the Geelong Region needs to be successful in attracting additional available Commonwealth research funding.

The Region needs to be aware of shifting Commonwealth funding priorities and the impact this may have on local industry.

Promote Geelong's Biotech Reputation

The Geelong Region needs to promote its biotech capability and improve recognition of its strengths within the industry and to investors.



Biotechnology Strategy Geelong

There is a strong foundation for further growth of biotechnology and related areas of biosciences in the Geelong Region. The scale of the Region's industry is relatively modest in comparison with major research precincts in Melbourne, however Geelong is specialising in areas that provide considerable future growth potential. In particular, human health and aquaculture.

The objective of the Geelong Region Biotechnology Growth Strategy is to consolidate the Region's research position and move the Geelong Region along the value chain so that by 2020 it will be in a position to attract a major manufacturing operation, having built substantial research infrastructure and commercialisation portfolio.

The underlying principle is one of "growing your own" with a scaling up in activity through an expansion of research funding and increased commercialisation.

A long-term approach to the development of the Region's biotechnology sector is essential for several key reasons.

- The long cycle in biotechnology to bring new discoveries to market.
- The lead-time required to build research capacity and research reputations in new and existing fields.
- The need for an increase in investment in research capacity and infrastructure.

The Geelong Region Biotechnology Growth Strategy has a 20 year perspective with 3 distinct phases.

Phase 1 ~ Building Research Scale

Phase One is earmarked as the first five years of the Strategy and involves concentrating on scaling up research activity through an expansion of research funding and increased commercialisation. Although it may take time to secure a result, the investment attraction needs to commence in Phase 1.

Phase 2 ~ From Research to Production

Phase two is earmarked to occur within the next decade and continues growth in research and development, whilst attracting related small to medium scale production facilities (scale up and bioprocessing). Deakin University's Geelong Technology Precinct will be an important location for these activities.

Phase 3 ~ A Regional Bioindustry Centre

This final phase covers the period 2010 to 2020. Geelong will have consolidated its position as a biotechnology hub, with a spectrum of activity from discovery to production, and developed to a position where it has the potential to attract a larger scale production facility (for example pharmaceuticals or vaccines).

Key elements for success of the Strategy include:

- Expanding the current research base
- Developing industry linkages
- Building research cooperation
- Major research centres continuing to pursue aggressive growth strategies to expand research and development activities.

- Development of Deakin University's Geelong Technology Precinct as a biotechnology location.
- Promotion of Geelong's biotechnology capability
- Regional Local Government to take an active role in facilitating the development of the sector
- Attracting a new research centre
- Increasing commercialisation of research
- Developing local skills
- Expanding infrastructure
- Manufacturing operation

Delivery of the Geelong Region Biotechnology Growth Strategy

Biotechnology Network

A biotechnology network (or similar structure) will need to be established to deliver the key objectives of the Strategy and facilitate regional cooperation on an ongoing basis. While there are already the foundations of a biotechnology cluster in Geelong, there is a need for a new structure with dedicated resources.

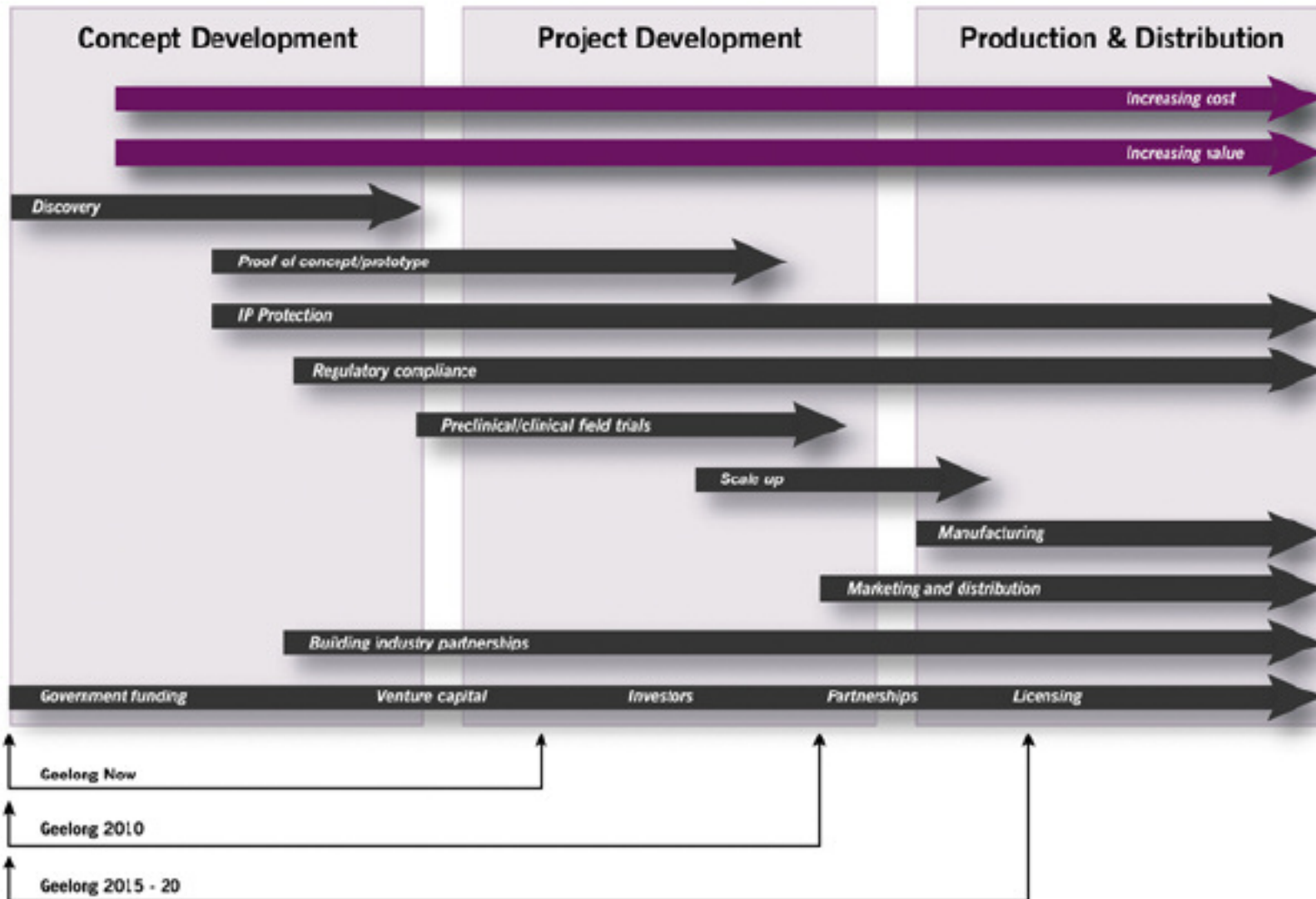
Biotechnology Funding

Funding will need to be secured from the State and Federal Government to deliver the Strategy.

Detailed Regional Action

Once a Network or structure has been established and funding has been secured, a detailed Action Plan will need to be developed to drive activities and initiatives and work on challenges that the Region faces in growing its biotechnology industry.

Geelong Region Biotechnology Growth Strategy



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