

The Republic of Ireland

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The Republic of Ireland. Brendan Finucane and Staff of BioResearch Ireland, Dublin. In SORJ, B., CANTLEY, M., and SIMPSON, K., eds. *Biotechnology in Europe and Latin America: prospects for co-operation* [online]. Rio de Janeiro: Centro Edelstein de Pesquisas Sociais, 2010. pp. 73-80. ISBN: 978-85-7582-036-6. Available from SciELO Books <<http://books.scielo.org>>.



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1.6. THE REPUBLIC OF IRELAND

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Prepared by the biotechnology group, National Board for Science and Technology (now replaced by BioResearch Ireland), presented by Brendan Finucane

Introduction

An Irish National Biotechnology Programme was initiated in 1983 by the National Board for Science and Technology, and the Industrial Development Authority. The programme's objective is to promote and assist the application of biotechnology in Irish industry, agriculture and other areas of social and economic development.

The major areas of application in Ireland are in agriculture/food, and in the healthcare and pharmaceutical industries. Agriculture occupies 15% of the Irish workforce directly, and the food and drink industry employs 26% of the industrial workforce. Exports in 1986 of food and drink were worth over US\$3.2 billion or 23% of total exports. It is thus a very important sector and one in which biotechnology can play an important role.

The healthcare and pharmaceutical sector is also important for Ireland and has undergone considerable growth in recent years. The Industrial Development Authority, IDA, has been very successful in its efforts to attract pharmaceutical and healthcare companies to Ireland. Over 100 overseas companies in this sector now have Ireland based production plants, including 10 of the world's top 15 pharmaceutical companies. Exports totalled IR£ 1.5 billion in 1985 and are growing at 40% per annum.

There has been a particularly encouraging growth in the Medical Diagnostics area of the healthcare industry. Among indigenous companies, Biocon, Bioprep and Noctech Ltd are manufacturing a range of products based on enzyme immunoassays, while Beckman, Technicon, Organon and Flemming GmbH are examples of transnational companies which produce diagnostic products in Ireland. The industrial strength of this sector and the fact that biotechnology has great immediate application made it an obvious area for national development.

There is also activity in other sectors, eg Biocon Ltd manufactures enzymes and other speciality chemicals for the food industry. Interbio Laboratories also manufacture microbial cultures for water and waste treatment and other purposes. A number of chemical and food firms are also using biotechnological processes in their manufacturing. These include Pfizer Chemical Corporation (Citric acid manufacture), Wheat Industries Ltd (Glucose/Dextrose Plant) and Carberry Milk Products (Alcohol production from by-product whey).

Biotechnology Research Centres

As in many countries, much of Ireland's expertise in biotechnology is located in universities and other higher level colleges.

Because almost half of the Irish population is under 25, Ireland has invested heavily in scientific and technical education. In line with our policy to develop Ireland as a centre for high technology industry, new colleges and new laboratories have been built to cater for technical education. Science, engineering and other technical graduates are an increasing proportion of the output of these colleges. They represent 41% of the primary degrees and 45% of higher degrees awarded by Irish colleges in 1985. The research facilities in biotechnology have also been improved and individual colleges have agreed on specific priority areas for biotechnology research.

Other centres of expertise include the following government funded agencies:

- Institute for Industrial Research and Standards, which performs research on fermentation process scale up, enzyme technology and monoclonal antibodies.
- The Agricultural Institute, which has a staff of 1300 in 7 major research centres throughout the country, is also involved in research and application of biotechnology in food and agriculture.

Areas of Biotechnology Expertise

The major areas of expertise in Ireland are:

- Genetic Engineering
- Diagnostic Technology

- Specialty Chemicals and Pharmaceuticals
- Biopharmacology
- Mammalian Reproductive Technology
- Plant Biotechnology

GENETIC ENGINEERING

Research is conducted in 6 of our 7 colleges; but particularly in Trinity College, Dublin and the University Colleges of Cork and Galway.

Microbial Genetics is the main area of interest at the Dept. of Genetics, Trinity College Dublin, where the research team of Prof. David McConnell have performed work for many companies, including Arthur Guinness and Co., Biocon Ltd., and ICI. This Group have recently signed a research agreement with the Agricultural University of Beijing to jointly done the gene for Porcine Growth Hormone. The research for Arthur Guinness was to done the gene for glucanase into brewing yeast strains. Guinness have recently located all their corporate research in a new centre in Dublin.

Another interesting area in Trinity College is in vaccine development at the department of microbiology. Among other projects is one with the objective of developing a vaccine for mastitis.

In animal genetics research is in progress at University College, Galway, in collaboration with the Agricultural Institute to develop transgenic animals including fish. This work is funded by the EEC in association with French researchers.

The Dairy Microbiology Dept., at University College Cork, and the Agricultural Institute at Fermoy, have developed considerable expertise in the genetics of dairy starter culture organisms: Strains of bacteriophage resistant bacteria developed by this group are now used to produce almost all of the 50.000 tonnes of cheddar cheese produced in Ireland. Further work on the genetic manipulation of other important dairy micro-organisms is under way.

DIAGNOSTIC TECHNOLOGY

Ireland has much expertise in this area. The dose contacts between the biological and clinical scientists in Ireland has been an important factor in the development of this area of technology.

The major centre for research on diagnostics is in University College Galway, where work is ongoing on solid phase immunodiagnostic technology, and on the development of kits for various human and animal hormone indicators.

Veterinary diagnostics is an area of particular interest because of our large livestock population. Work at University College Galway resulted in the development of the first animal progesterone assay to be put on the market. This was the progesterone measuring system from Noctech Ltd. This Irish company has produced Reprostrip, a rapid assay for progesterone.

Ireland also has a very important thoroughbred horse industry. Research on behalf of this sector is conducted by the Irish Equine Centre, a privately funded organisation, in association with university researchers. This centre is currently researching indicators of stress, eg travel stress, in performance horses with a view to developing diagnostic kits for equine health. Diagnostic kits are also in preparation in other centres for Epstein Barr Virus, Chlamydia and others.

BIOPHARMACOLOGY

Ireland has a large pharmaceutical and healthcare industry. To service the needs of this industry, both for technical services and for trained staff, Irish colleges have developed centres of expertise in several relevant areas.

Of particular interest are:

Development of in-vitro tests for pharmaceutical screening and for toxic effects. Among the projects in progress at the moment are in-vitro assays for detection of drug-related specific neural tube defects, eg spina bifida and also an assay for assessing efficiency and toxic effects of cancer chemotherapeutic drugs. Development of novel drug delivery methods.

MAMMALIAN REPRODUCTIVE PHYSIOLOGY

Ireland is one of the major milk and meat exporting countries in the world and breeding of sheep and cattle is therefore of great importance. Both the universities and the Agricultural Institute perform research on many topics of relevance to the breeding and production of cattle and other livestock. A topic which is of relevance to biotechnology is the area of mammalian reproductive physiology. The

research group of Prof. Ian Gordon at University College Dublin, was among the pioneers of Embryo transplantation.

Work by this group and the associated group of Dr J Sreenan at the Agricultural Institute at Beldare, Co Galway continues on areas such as immunological control of reproduction, embryo sex determination, oestrus control and *in-vitro* fertilisation.

PLANT BIOTECHNOLOGY

The major crops of interest to Irish biotechnologists are potato, cereals and ornamentals. Ireland has a large seed potato industry based on exports to Mediterranean and N African countries. The majority of these exports are two varieties which were bred at the Agricultural Institute, Oakpark.

Forestry research focuses on the use of mycorrhizae to assist the reafforestation of our marginal lands. Research on inoculation of seedlings with candidate strains of mycorrhizae is underway in the Forest and Wildlife Research Laboratory and at University College, Dublin.

Biotechnology Infrastructure

The major agencies responsible for the various elements of the Irish National Programme for biotechnology are contained in the table below.

Agency	Role
National Board for Science and Technology NBST, until late 1987	*National S & T policy and programme formulation: advice to government: promotion of specific technologies, including biotechnology and coordination of research Biotech activities of NBST have been privatized. BioResearch functions as a contract research and technology transfer organization. Staff and mandate similar to that of NBST.
From beginning of 1988 Bio research Ireland	Attraction of overseas investment, support for Irish enterprise
Industrial Development Authority, IDA The Agricultural Institute – An Foras Taluntais, AFT	Agriculture and agricultural product R&D
Institute for Industrial Research and Standard, IIRS	*Industrial Research and services; Establishment of national standards
*These two agencies were merged in January 1988 to form EOLAS, the Irish Science & Technology Agency.	

The Irish National Programme for Biotechnology was jointly developed by the NBST and the IDA.

The NBST's role within the Irish National programme was primarily to develop national biotechnology expertise and facilities and to maximise its application to Irish industrial and economic development.

The NBST achieved this end by:

- Funding basic and precompetitive research in universities.
- Promoting and assisting university-industry research co-operation.
- Promoting and assisting international research co-operation.

A very important part of the programme is the improvement of linkages between industry and researchers in Irish universities and the development of international linkages. Irish researchers are actively encouraged to perform research for industry in other countries, and also to form partnerships with other EEC researchers from participation in EEC research programmes.

The process of linking university researchers and industry has been one of the major activities of the NBST. To this end a newsletter, 'Irish Biotech News' was published and distributed widely in Ireland and abroad.

Mechanisms for Biotechnology Promotion

As mechanisms for co-operation are of specific interest to participants in SOBELA, it may be useful to point out some of those used in Ireland:

1. Publication of a newsletter – Irish Biotech News, which is distributed free of charge to both industry and researchers and highlights co-operative opportunities.
2. Running of seminars and workshops on topics of common interest. For each chosen topic both researchers and relevant industry representatives are specifically invited so as to encourage contacts.
3. Grants of up to 50% of the cost of university/industry co-operative research, are made available.
4. Funding assistance is given towards the employment of scientists and technologists by companies with a low level of technical employees.

NBST put a very high priority on international co-operation in research. Irish researchers have a particular problem in that our island position makes the travel necessary for co-operation more costly than on mainland Europe. To alleviate this, the NBST provide assistance towards visits by researchers to other research centres. This mechanism proved highly successful in developing collaborative research teams for applications to EEC research programmes. NBST also strongly promoted involvement in EEC and in other international programmes as a means of developing contacts and collaboration. We have also formed scientific and cultural exchange agreements with many countries.

Regulation of Biotechnology

A National Recombinant DNA Committee advises planning authorities and others on the safety of genetically engineered organisms used in the state. The committee is composed of experts, and representatives of the public, unions, industry and government. The guidelines of the National Institute of Health, NIH, in the USA have been adopted by the committee with some modification.

Recent Developments

In 1988 many of the activities of the NBST were merged with those of the IIRS to form EOLAS – the Irish Science and Technology Agency. EOLAS is geared to generating income for the state. BioResearch Ireland represents biotechnology activities within EOLAS, and is focused on three national centres:

- National Cell & Tissue Culture Centre
- National Food Biotechnology Centre
- National Diagnostics Centre

The National Cell and Tissue Culture Centre is located in the National Institute for Higher Education, Dublin, which was set up in 1980. The focus of work is monoclonal antibody production and all aspects of animal cell culture, including toxicity testing applications. Contract research is going on with a number of companies in Europe and elsewhere.

The National Food Biotechnology Centre is located in University College Cork. Genetically manipulated organisms are developed to enhance food bioprocessing and flavours. Cheese microbiology is a particular strength.

The National Diagnostics Centre, located at University College, Galway joins many skill bases to develop innovative diagnostics, including DNA probes. Custom synthesis of oligonucleotides is a feature of this facility's competence that could be of interest for outside clients.