The Biotechnology Industry in Scotland*, United Kingdom

The Scottish biotechnology sector has a focus on biomedical, healthcare and diagnostics and is currently growing at 30 per cent per annum, which is double the European fighre.[1] There are 428 organisations employing more than 24,000 people, a presence which is significant in both the UK and international terms. Actually, Life Sciences in Scotland can be traced back to the 15th century, when the world's first department of medicine was created at the University of Aberdeen. Since then Scots have pioneered many of the major milestones in the history of biotech, as we know it today. Famous Scottish achievements have included those of John Hunter (1768) known as the Father of Modern Surgery; Sir William McEwan (1880) who conducted the first bone graft; john MacLeod (1920) who won the Noble prize for insulin; Sir Alexander Fleming (1929) who discovered Pencillin and Sir James Black (1992) Noble Prize winner for B-blockers and Cimetidine. That spirit of innovation is till thriving and growing today, with Professor David Lane's discovery of the p53 gene and more recently when Dr Ian Wilmut of the Roslin Institute gave us Dolly, the sheep.

Some of the key features are as follows:

- Key technological and scientific core competencies built on its world-wide reputation for groundbreaking research and development. Scotland has 51 research organizations working in life sciences, including 13 Universities. They are in such diverse areas of biomedical science such as genomics, bio-electronics, neurosciences, cardiovascular disease and cancer.

* Based on Report of Scottish Development International, Glasgow, UK.

- Scotland has strong support network for pharmaceutical product development. This includes clinical research, product development, pilot scale manufacture, clinical testing and clinical trials, formulation, products and process validation and pharmaco-economic evaluation. There are many support companies in Scotland offering contract manufacturing capability, drug delivery and formulation capability and expertise in diagnostic manufacturing, biosafety and clinical trials including Inveresk, Quintiles Transnational and Astra Zeneca Clinical Research.
- A significant presence of US organizations, many with European headquarters located here, such as Quintiles Transnational, Serologicals Inc, BioReliance and Viragen.
- An establishment presence of pharma multinationals with key players including Organon, who recently invested a further $ 10 million in a state of the art pharmacology research facility which employs more than 200 researchers, and Roche, who produce more than 30 per cent of the world's vitamin C at their facility in Ayrshire.
- A rapidly growing number of innovative biotech and medical device companies such as Axis Shield, who provide world class diagnostics for the diagnosis of cardiovascular disease; PPL Therapeutics, who produce therapeutic products for the treatment of pulmonary disease; and AorTech, who are developing a new range of heart valves.

The Scottish Enterprise Biotechnology Network Group

The Network Biotechnology Group is one of the specialized industry groups within the Scottish Enterprise Network and has a remit to develop the biotechnology sector in Scotland. The Group is made up of technologists with bio-industry experience and has representatives in many different areas of the network, including each of the 12 Local Enterprise Companies and the Inward Operations and Trade divisions within Scottish Development International. Its aim is to ensure that the potential of the Scottish industry is maximized through activities such as trade missions, exhibitions and seminars.

Biotechnology Cluster Strategy

In November 1999, Scottish Enterprise formally launched the "Framework for Action": a four year 40 million strategy to grow the biotechnology cluster in Scotland. Developed in close collaboration with the community, it set ambitious headline targets, laid out strategic goals and listed activities to enable the community to meet these targets by 2003.

The strategy is deliberately wide-ranging, encompassing not only those initiatives undertaken directly by Scottish Enterprise, but also those of partner organizations and the biotechnology community as a whole. This reflects the high degree of interaction in the cluster and underlines the value of working together to achieve maximum impact. Scotland is intending to double the number of biotech companies from 50 to 100 and also increase the number of support and supply organizations from 180 to 360. The idea is to raise the level of employment from current 12000 to at least 24000.

To assist the community achieve this growth, the strategy focuses on three key areas:

- Building critical mass, through new firm formation, foreign direct investment and engaging companies which are not currently in the cluster;
- Improving performance, to strengthen skills and compete internationally; and
- Strengthening local and international networks.

This "Framework for Action" details specific ways in which Scottish Enterprise and the community will drive the strategy forward to achieve our shared goals. These are activities in crucial areas such as:

- Commercialization of the research base;
- Accessing finance for start-up growth;
- Improving business support and infrastructure;
- Attracting inward investment;
- Building international connections and trade development;
- Improving skills and developing the labour pipeline; and
- Strengthening vital networks.

Scotland Research Strengths

Scotland is home to one of the most significant biotechnology clusters in Europe. It hosts a significant multinational presence in research and development and manufacturing, and has a wide range of product development support companies. These companies are supported by a powerful research and industrial technology base, and 13 universities – all with well developed links to industry – that produce 10.7 per cent of all biotechnology-related PhDs in the United Kingdom. There are 34 university departments and research institutes in Scotland conducting biotechnology related research. Collaborative research between the academic sector and industry has produced many successes, such as cloning adult mammals, keyhole surgery, imaging techniques, biosensors and materials, and modelling of human functions.

The strong medical and life sciences tradition in Scotland ensures a steady supply of people with appropriate qualifications and skills. The Scottish workforce has a wide range of biotechnology skills, in such disciplines as pharmaceuticals, environmental and agrochemical biotechnology, medical diagnostics and veterinary pharmaceuticals. Scotland's universities and research institutes have strong links with industry. For example, the University of Strathclyde discovered Atracurium, which was developed by Wellcome. In addition, the Fujisawa Institute of Neuroscience was set up as a collaborative venture between the University of Edinburgh and the Fujisawa Pharmaceutical Company of Japan.

University Research

The University of Glasgow houses one of Europe's leading medical schools and an Institute of Biomedical and Life Sciences (IBLS) with over 500 researchers covering all bioscience disciplines. Major areas of research focussing on the life sciences include oncology, cardiovascular medicine, neuroscience and molecular medicines. Life science research at the University of Strathclyde covers: immunology, physiology and pharmacology, pharmaceutical sciences, pure and applied chemistry, bioscience and biotechnology. The University of Dundee has an excellent record of collaboration with industry and its research strengths is areas like cancer,

cell biology, drug metabolism, immunology, neuropharmacology and neurosciences. The University of Edinburgh carries out a wide range of research in areas such as vaccine development, AIDS, gene targeting and neurodegenerative disease in collaboration with other universities, the Medical Research Council (MRC) and other hospital groups. The Department of Pharmacology also houses the MRC Brain Metabolism Unit, the Fujisawa Institute of Neuroscience and the New Inter-faculty Centre for Neuroscience. Within the departments of Physical Science, the Edinburgh Centre for Protein Technology offers the specialized production of glycoproteins, new therapeutic proteins, drug discovery and enzymes as catalysts. Areas of research interests at University of Aberdeen include: biotechnology, biological sciences, healthcare, engineering, physical sciences, computing, commercialisation of novel technology via patents, marketing and licensing to external bodies. The University of St Andrews has a department of Molecular Virology within the School of Biology. Research at the University is conducted into molecular pathology, the molecular biology of virus host interactions, viral proteases and their role in virus assembly, Paramyxoviruses and persistence, immunity to virus infections and vaccine design, molecular biological and biophysical analysis of virus polyprotein processing and molecular and antigenic studies on ureaplasma urealyticum. University of Abertay, Dundee is another major university. The University's general expertise covers plant, animal and microbial biotechnology. Particular interests include plant physiology, avian reproduction, molecular biotechnology, cryobiology, yeast biotechnology, genetic modification of plants, aging and stress in plants, fungi, bioethics, immunology, cell biology, and biocides. Environmentally related areas include wastewater treatment, wood technology, biohazards, bioremediation, monitoring/auditing and biopreservation. The University of Stirling has particular expertise in the field of natural sciences, specifically the Institutes of Aquaculture, Biological Sciences and the Department of Environmental Science, which house respected research groups. University of Paisley has education and research in plant and animal cell biotechnology; development of sensors with applications for industry and pollution; agrochemicals and pesticides; algal molecular biology; enzyme technology for recovery and stabilization of proteolytic enzymes; DNA fingerprinting and PCR analysis; cell proliferation markers; cell immortalisation; pilot scale fermentation.

High Quality Staff

Scotland has a tradition of education, with many young people continuing their education to achieve degrees and post graduate qualifications. Scotland, though having 9 per cent of the UK's population, produces 12 per cent of the UK's graduates in life sciences disciplines and 10.7 per cent of the PhDs. Scotland produces one quarter of all the UK's medical doctors. This means that research organisatoins and companies can easily recruit scientists. The strong medical and life sciences tradition in Scotland ensures a steady supply of people with appropriate qualifications and skills.

- There are currently in excess of 100 courses in biotechnology and related subjects running in Scotland.
- In the latest Research Assessment Exercise undertaken in 1996, both Glasgow and Edinburgh Universities achieved the top rating of "5" for research in Biological Sciences.
- In the same assessment exercise, the Universities of Dundee and Glasglow achieved "5" ratings for research in the field of Biochemistry.
- In the most recent quality assessment of teaching and learning in Scottish universities, carried out by the Scottish Higher Education Funding Council, biological sciences departments achieved very high results:

  In both Cellular and Molecular Biology and Organismal Biology, Aberdeen, Dundee, Edinburgh, Glasgow and St Andrews all received the top assessment of "Excellent".

Investor Support

Scotland has a tremendously strong commercial and industrial economy which already embraces hundreds of a overseas-owned companies. In both the manufacturing and service sectors, there has been dramatic growth over the years with more than 1,000 overseas-owned facilities now operating successfully in Scotland. For many years, Scotland's world class skills pool, extensive transport links and high quality of life have been key factors in attracting internationally renowned companies such as Motorola, NEC, Compaq, IBM, Quintiles, JVC & Elf Atochem.

These companies and many others have continually endorsed their original decision to come to Scotland by growing and diversifying their operations here. They have found Scottish Development International's one-door approach to providing assistance with location selection and operational start-up is a key contributory factor to their overall success in Scotland. And Scottish Development International also plays a vital role in assisting companies beyond the initial start-up phase. It provides on-going support through a fully comprehensive and integrated Investor Support service, drawing on the support of numerous partners in the private and public sectors. The Investor Support service offers a wide range of business support services designed to help newly located companies in Scotland to progress from the start-up phase into the next stage of their development.

From experience, we know the benefit of developing a good working relationship with new companies from a very early stage. That is why a member of the investor support service is designated by Scottish Development International and its partners to work with each company from the moment it arrives; co-ordinating and focusing all available practical and financial support to ensure continuing growth and success. This approach is designed to help Scottish plants to achieve their full potential and hopefully exceed the expectations of their parent company.

The Investor Support service helps companies in a wide range of key areas, including:

* ***Financial Assistance***

Scotland offers a range of public sector financial incentives to help offset the costs of expansion. We offer companies all the help and advice they need to obtain the available assistance.

* ***Training and Recruitment***

Companies are attracted to Scotland because it has a highly qualified and readily available skills pool. However, we recognize that the pace of technological change is continually increasing and some companies may need people with particularly specialized skills.

The Investor Support service can play a key role in helping companies to find the people they need, either by liasing with specialist recruitment agencies or helping companies to forge strong links with Scotland's universities and colleges.

In many cases, we have worked to set up customized training courses which have produced both the quality and quantity of staff needed to meet a company's exact requirement.

**** Business Development***

Companies are continually looking for ways to became more productive, competitive and profitable. One obvious way is to "locate in Scotland" and following this we can address "plant-level" issues such as up-skilling, product development and access to suppliers and markets.

To tackle key issues at national and international levels, companies can also draw on the specialist expertise of the Scottish Enterprise sectoral teams. Our key business strategy includes creating marketing groups and industry forums where members can exchange ideas and address important issues, and establishing stronger links between research establishments and commercial organizations.

We can also help companies identify and exploit additional international export markets by working closely with the Trade Division within Scottish Development International, the Scottish Executive and other partners.

**** Business Processes***

Finding new ways of refining business processes to retain a competitive advantage places a continuing demand on companies today. One of the ways companies can improve and develop their processes is by completing one or more of the nationally and internationally recognized development programmes available through Scottish Enterprise. The investor Support service can help companies towards business excellence through various routes such as the European Foundation of Quality Management (EQFM). Investors in people (IIP), Scotland the Brand, etc.

**** Property***

Extending facilities or relocating premises in a country far from the corporate HQ can be a daunting prospect. To help companies find and develop the sites they need, we maintain a comprehensive database of available commercial and industrial properties as well as potential sites throughout Scotland. In addition, our in-house Design Team can advise on the design of new-build facilities, extending or adapting existing premises and can even help co-ordinate any planning permission needed.

**** Setting In***

When a company sets up an overseas facility, it often relocates key members of staff to the new country. We put particular effort into helping expatriates find their feet while they and their families settle in. For example, we can provide information and advice on a wide range of issues such as housing, education, healthcare, leisure and culture pursuits, etc. Survey after survey confirms Scotland as offering one of the highest quality of life in Europe, and we want to help your company's employees experience it to the full. These services give just a taste of the wide range of Investor Support we are able to provide for overseas companies.

Further information is available at http://www.scottish-development-international.com.

Endnote

[1] Data collated by an independent consultant and interpreted by Scottish Enterprise Biotechnology Team, September 2001.