

United Kingdom Highlights Biomanufacturing Capabilities

The United Kingdom has the second largest biotechnology industry in the world, a leading position in Europe, an excellent science base, proven capability in the development of drug candidates, and a record of several firsts in technology development.

The United Kingdom's biotechnology community is concerned that the level of support and attention given to its highly regarded research and development (R&D) companies is not equalled for biomanufacturing — nor is the necessary link between the two properly appreciated. Steve Taylor, general manager of Avecia Biotechnology and chairman of the BioIndustry Association (BIA) biomanufacturing committee, underlined the United Kingdom's relatively small share of the global biomanufacturing market in a recent submission to a UK Department of Trade and Industry enquiry into biotechnology. Andrew Sinclair of Biopharm Services laments the fact that although monoclonal antibody (MAb) technology was pioneered in the United Kingdom, he estimates "that of the installed production capacity (2000–2001) of 400,000 L, there is less than 10% of that capacity in the UK." Liam Fennell of Scottish Enterprise feels that "the UK does not command its rightful attention" in this field.

The tide is set to turn. The UK government has been reviewing biomanufacturing needs, and a number of commercial successes and expansions, along with significant regional biomanufacturing programs, are poised to bring the UK biomanufacturing community to the forefront.

Reports and Recommendations

The UK government's Department of Trade and Industry started a "Manufacturing for Biotechnology" initiative some

years ago by commissioning a report to review the status of the industry (1). The report concluded that future growth predicted for biological products required UK contract manufacturers to address a number of manufacturing capacity issues for several types of production: preclinical and phase 1–2 materials; large-scale GMP microbial fermentation above 1000 L; mammalian cell culture for antibodies and recombinant proteins; and live vaccines. An earlier BIA study looked at wider issues and identified four important themes for development: partnership, education and training, local UK manufacturing, and facility clustering (2).

A more recent government report for the UK pharmaceutical industry identified a specific need to support biopharmaceutical manufacturing, including a Faraday project to promote work on biopharmaceutical technology developments (3). The UK government's Faraday program financially supports a number of projects focused on applied, precompetitive research to meet industry needs. Each Faraday project is based on joint industry–academia research and technology transfer over three-year periods.

A determination to support the biomanufacturing industry in 2001 was highlighted in a speech by Lord Sainsbury, minister for science, to the Royal Pharmaceutical Society. He announced a £25 million program with four main elements, one of which was developing UK biomanufacturing capability. A growing linkage and mutual recognition of the big pharma–

biotechnology manufacturing interface is a particularly important development for the UK industry. Fennell, with his experience in inward investment, also believes the country must sell its attractiveness to biotechnology investors "in conjunction with big pharma."

Two recent developments

highlight the industry's turnaround. PowderJect became the world's largest vaccines-only company by acquiring in 2000 Celltech Medeva's vaccine manufacture and marketing business (Evans Vaccines in Liverpool) and in 2001, SBL Vaccin (Sweden's leading vaccine company). Those strategic acquisitions transformed a business based on a proprietary delivery technology (a

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needleless injection device) into a fully integrated global vaccine company. It now ranks as the fourth largest biotechnology company in Europe, with 2000 sales of \$160 million and a strong pipeline (4).

Avecia recently announced a \$100 million investment into its Billingham site to create the largest purpose-built facility of its kind in the world. This will create 40,000 L of contract manufacturing capacity for microbially

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derived biologics in two stages for 2003 and 2005 (5).

Regionally Speaking

Scotland and North West England have made particular efforts to highlight biomanufacturing capability as part of their cluster development and inward investment programs. Both regions are undertaking specific projects. Although different in nature, both directly support the industry and emphasize the importance of biomanufacturing to cluster development as well as its intimate link with R&D. Sinclair has identified that the “main premise of UK biotech companies is of drug discovery and licensing deals or being integrated but virtual with regards to manufacturing, but there are signs that this is changing.”

Scotland has made major strides in raising its profile

SEVERAL eminent

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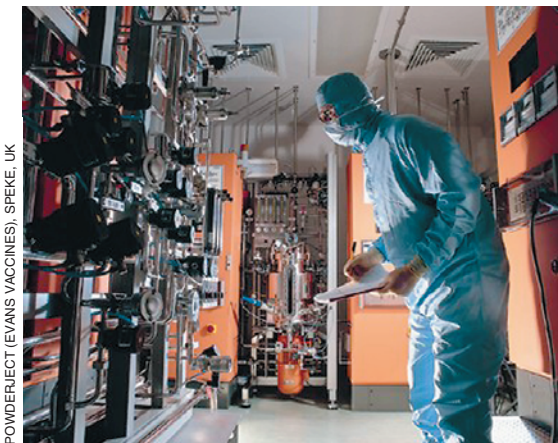
and has a burgeoning biotechnology community, with 93 biotech/pharma companies employing just over 11,000 people and 14 manufacturing companies (including Avecia, Excell, PPL, and Viragen) employing

4,500 more. Thirteen universities produce about 4,000 graduates per year, 11.2% of the United Kingdom's life science PhDs.

At a recent conference, Fennell presented a number of focused initiatives that Scottish Enterprise has undertaken to support biomanufacturing in both skills development and premises provision (6). Skills initiatives include PREBIO for biomanufacturing, the Scottish Colleges Biotech Consortium that provides technician training, and collaboration with University College London (UCL) for online training delivery. A biomanufacturing campus is in development just outside Edinburgh close to Roslin Biocentre (home of Dolly the sheep at PPL), with a £3.8 million, 2,500–m² advanced biomanufacturing unit to offer purpose-built space for biomanufacturing companies.

North West England, which borders Scotland and is represented by Bionow (the North West Development Agency's biotechnology group), also clearly focuses on support for the biomanufacturing industry. Similar to Scotland in size with a slightly larger population, the North West has a large and well-established pharmaceutical presence (including AstraZeneca's largest worldwide research center and a major manufacturing site) and a biotechnology cluster of about 120 companies, with 70 core biomedical biotech companies employing about 17,500 people.

The region is home to nine universities producing about



POWDERJECT (EVANS VACCINES). SPEKE, UK

Now owned by PowderJect, Evans Vaccines is one of several facilities for biomanufacturing in the United Kingdom (Table 1).

7,000 life science and medical graduates per year. Liverpool and Manchester dominate life sciences research with the University of Manchester's School of Biological Sciences being one of the largest of its kind in Europe. After Cambridge, it intakes the second largest number of Biotechnology and Biological Sciences Research Council (BBSRC) funded PhD students.

In Speke, just south of Liverpool, England's North West is home to a large concentration of in-market biomanufacturing capability (Evans Vaccines, Eli Lilly, Aviron, GlaxoSmithKline), and at that site the National Biomanufacturing Centre (NBC) is to be built (7). This £30 million project will provide process development and clinical grade biomanufacturing services to start-up and early-stage biotechnology companies. An important NBC activity will be training in conjunction with the Speke-based Partnership for Learning, a unique training establishment set up by Eli

Lilly, GlaxoSmithKline, and Evans with Jaguar Motors to deliver technical and operator training.

Academics

Several eminent UK academic institutions are involved in biomanufacturing. UCL's Department of Biochemical Engineering is headed by Professor Mike Hoare, who is also a member of the BIA biomanufacturing group. His department heads an interdisciplinary research collaboration within the Advanced Centre for Biochemical Engineering, which also runs a modular training course for a Masters in the BioIndustries (MBI) and is the Engineering and Physical Sciences Research Council's (EPSRC's) doctoral training center for bioprocess innovation. This academic center of excellence, among others, will participate in the BIA-led biomanufacturing Faraday funding currently under review alongside major biomanufacturing and biotechnology companies and the regional groups Scottish

Table 1. Biomanufacturing activity in the United Kingdom

Company	Location	Type	Products and Technologies
Accentus Biologics	Oxford	CMO	Microbial fermentation
Avecia	Billingham, Manchester	CMO	Microbial fermentation, peptides, DNA medicines
Aviron (MedImmune)	Liverpool	Sponsor	Vaccines
BioReliance	Stirling	CMO	Viral vaccines, viral vectors for gene therapy
BioSynergy	Cambridge	CMO	MAbs, viral particles, viral antigens
Blood Transfusion Service	Scotland, Liverpool, London	Public health organization	Blood products and factors, cell culture
CAMR	Porton Down	CMO	Vaccines, mammalian and microbial cell culture and fermentation
Celltech	Sough, Manchester	Sponsor	MAbs, recombinant proteins
Cobra Therapeutics	Keele	CMO	Microbial DNA vaccines, mammalian therapeutic proteins/adenovirus, gene therapy
Delta Biotechnology	Nottingham	Sponsor	MAbs
Diagnostics Scotland	Edinburgh	Sponsor, CMO	proteins, MAbs, mammalian cell culture
Eli Lilly	Liverpool	Sponsor	Animal health care, recombinant hormones (fermentation)
Evans Vaccines (PowderJect)	Liverpool	Sponsor, CMO	Vaccines (mammalian cell culture and microbial fermentation), live viral products
Excell Biotech	Edinburgh	CMO	Viral vectors, microbial fermentation
Genzyme	Haverhill	Sponsor	Proteins, microbial fermentation
GlaxoSmithKline	Scotland, Liverpool, Ulverston	Sponsor	Antibiotics (bacterial, fungal, yeast), inhaled medicines, HIV and hepatitis B treatments
Ipsen Biopharm	Wrexham	Sponsor	Botulinum based toxin product
Lonza	Slough	CMO	Mammalian cell culture products
Pfizer	Sandwich	Sponsor	Antibiotics
PPL Therapeutics	Edinburgh	Sponsor	Transgenic proteins/enzymes
Q-One Biotech	Glasgow	CMO	Gene therapies, vaccines
Serologicals	Livingstone	Sponsor	Blood products (fractionation)
Vericore	Braintree, Dundee	Sponsor	Bacterial and viral vaccines (animal health products)
Viragen	Edinburgh	Sponsor	Immunological products

Enterprise, Bionow, and Southern Bioscience.

The foundation for such formal process-related research activity is the general strength of the United Kingdom's science base in life sciences. As Fennell points out, the "UK government's supportive stance on stem cell research is a key opportunity for the UK to lead research in new expression systems." Regulations surrounding this area of research are permissive and science-

friendly, and the stable governing body builds on well established legislation.

Building a Network

The BIA has established a strong biomanufacturing committee under Taylor, with membership from contract and in-house manufacturers, biotechnology companies, suppliers, and regional groups that support biomanufacturing. This group takes the lead in lobbying government and surveying members on their needs. Taylor says,

"Although there are strong manufacturing centers in the USA and mainland Europe, there is still time for the UK to establish itself as a top tier player."

Some countries offer strong fiscal incentives (low corporation tax) to support inward investment, which is undoubtedly advantageous to profitable companies. It is less well known that the United Kingdom offers very generous capital allowances and R&D tax credits to both small biotechnology and large

pharmaceutical companies. The BIA is keen to raise general awareness that manufacturing of biotechnology products is a complex task requiring strong technology, major investment, and integration of process science and engineering. Taylor adds, "This is exactly the type of modern high-tech manufacturing the UK should be good at."

References

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