BioSpectrum the business of Bio & Health Sciences

Global bio-clusters

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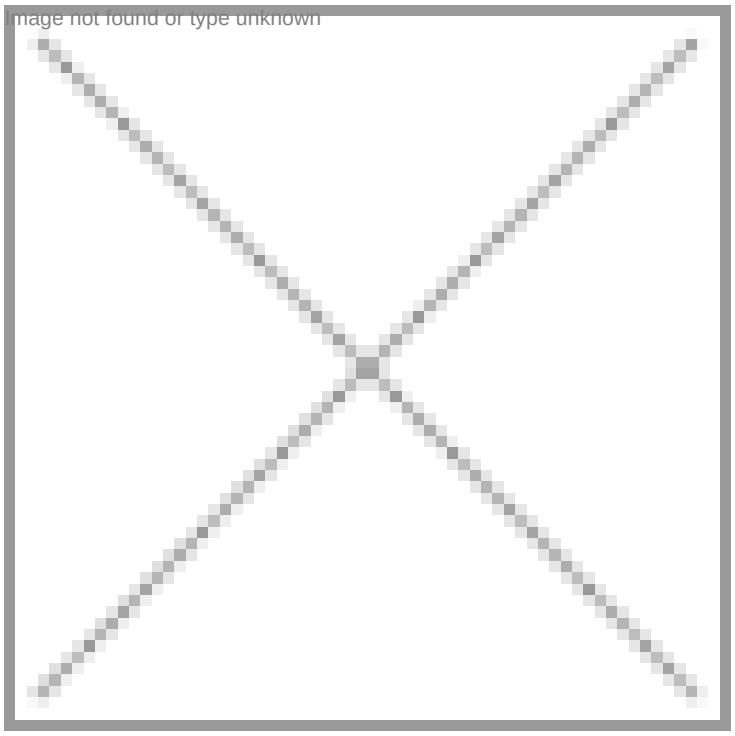

The purpose of this survey was to get a better understanding of the government initiatives, institutional research capacities and national focal points and strategies directed at the biotechnology sector. While other sources provide good information on the commercial, corporate and capital market ends of the biotechnology community, this survey aimed at recording and analyzing the sector's grassroots features of research, collaboration, infrastructure, technology transfer, and commercialization capabilities that serve as the underlying framework from which innovation and discovery grow. From this examination, several themes and insights emerge as to the strategies being employed by countries to domestically and globally position themselves in the biotechnology area.

Biotechnology is getting biggerâ€¦ and so is pharma

Asia-Pacific

Australia

No of biotech companies:190 (150 private, 40 public)

BioClusters: Sydney, Brisbane, Adelaide, Perth

Government Funds: $2.9 billion for research in 5 year

China

No of biotech companies: 50

BioClusters: Beijing, Shanghai

Government Funds: $740 million

Hong Kong

No of biotech companies: 3 (all public)

BioClusters: Hong Kong City

Government Funds: $65 million

Israel

No of biotech companies: 165 (160 private, 5 public)

BioClusters: Tel Aviv, Jerusalem

Government Funds: $100 million via Israel

Japan

No of biotech companies: 55 (40 private, 15 public)

BioClusters: Kanto, Kansai, Tokyo

Government Funds: $2.4 billion in 5 years

New Zealand

No of biotech companies: 30 (20 private, 5 public)

BioClusters: Auckland, Dunedin

Government Funds: $500 million

Singapore

No of biotech: 25

BioClusters: Singapore city

Government Funds: $1.5 billion plus $ 600 million in BioMedical Sciences Investment Fund

Taiwan

No of biotech: 50 (45 private)

BioClusters: Taipei, Hsinchu

Government Funds: $1.6 billion in 5 years

Americas

Canada

No of biotech: 415 (330 private, 85 public)

BioClusters: Montreal, Toronto, Vancouver, Alberta, Nova Scotia, Saskatchewan

Government Funds: $1.5 billion in 2002

Brazil

No of biotech: 300

BioClusters: Belo Horizante, Sao Paulo, Rio de Janeiro

Government Funds: $50 million

Europe

Belgium

No of biotech: 70 (65 private, 5 public)

BioClusters: Brussels, Wallonia, Liege, Flanders

Government Funds: $520 million

England

No of biotech: 310 (265 private, 45 public)

BioClusters: London, Cambridge, Oxford

Government Funds: $3 billion plus $1.5 billion in 2004

While the "average" biotechnology company in almost any locale could be described as small, private and unprofitable, several entities (namely in the US and a few in Europe) are large corporate structures with products in the market generating hundreds of millions in revenues and wielding the financial muscle (from R&D and acquisitions) to provide for pharmaceutical players. For the US-based firms, this means more financial flexibility, more investment opportunities and a more global outlook. For international biotech concerns, this means more chances for cross-border collaboration, a wider array of product development, financing options and greater market entry opportunities via partnerships.

At the same time, the pharmaceutical industry is evolving to be dominated by an ever-smaller number of giant, global corporations that continue to merge with and/or acquire one another in an ongoing consolidation effort to create critical mass, reach key markets, enhance product pipelines and deepen/broaden their in-house research capabilities. The significant growth in the size of participants in the closely-tied biotech and pharmaceutical segments is opening up new opportunities as outsourcing activities create demand for specialized laboratory and testing facilities, information technology providers and other customized services.

Nations investing billions in biotech infrastructures

In several countries, biotechnology has been anointed as one of the key priority areas on which a nation's future overall economic success depends. In order to develop and enhance the critical mass of infrastructure required, countries have announced initiatives specifically focused on their domestic biotech sectors in amounts denominated in billions of dollars. Specifically, these amounts are directed at research programs, construction of facilities and related equipment, seed capital funds, promotion of technology transfer and commercialization operations, regional clustering programs and related science and technology investments. Significant attention is being paid to ensure that invested funds are allocated in such a way as to promote R&D efforts related to specific products as well as enabling platform technologies and processes.

France

No of biotech: 240 (230 private, 10 public)

BioClusters: Paris, Strasbourg, Grenoble, Ferraud, Bordeaux, Toulouse, Montpellier, Marseilles, Lyon

Government Funds: $1.6 billion

Germany

No of biotech: 365 (340 private, 25 public)

BioClusters: Munich, Rhineland, Baden Wuerttenberg, Brandenburg

Government Funds: $2 billion

Ireland

No of biotech: 30 (27 private, 3 public)

BioClusters: Dublin, Cork, Galway, Maynooth, Tallght

Government Funds: $2.5 billion upto 2006

Scotland

No of biotech: 86

BioClusters: Glasgow, Edinburg, Aberdeen, Dundee

Government Funds: $60 million

Sweden

No of biotech: 190 (180 private, 10 public)

BioClusters: Stockholm/Uppsala, Medicon Valley, Goteborg

Government Funds: $ 425 million plus $ 2 billion in 15 years through Stockholm BioSciences Initiative

Collaboration, networks and clusters

Collaboration and the effective sharing of knowledge are key attributes of the biotechnology industry. The highly networked character of current activity coupled with the increased capability offered by information technology creates an ideal environment for a division of labor that spans worldwide to those researchers and facilities who best fit the needs of an individual project or program. Collaborations take on many different forms and range from the traditional multi-party efforts, to virtual networks of computer technologies linked together, to universities establishing joint venture research facilities, to university-industry partnerships, to exchange programs and sister city initiatives.

Regardless of form, they are essential due to the complexity, information technology requirements and geographic dispersion of expertise.

While technology and communications have allowed for truly global collaborations to take place, the more traditional networking platform based on physical proximityâ€”clusteringâ€”remains a key component of the development of biotechnology activity. The universe of these clusters is growing, with new areas approaching critical mass in several locales outside of the US, mostly centered in Europe.

Structural changes

Many of the countries are undergoing significant reforms in regulatory and structural areas that, heretofore, have acted as barriers to advanced development in their domestic biotech sectors. Recent legislative and policy changes in this area include the ability for researchers and innovators to retain some level of ownership in the intellectual property they create as well as allowing these same researchers to form and retain equity stakes in commercial endeavors deriving from their discoveries/innovations. Additional reforms facilitate university-industry collaborations and for-profit joint ventures. Further work needs to be done. While legally these activities are now permitted, a significant challenge remains in overcoming the traditional, cultural aspects of the academic and research communities that have long acted in a manner where research and commercialization are mutually exclusive endeavors. In the area of intellectual property rights, Europe is still trying to harmonize its patents system and in China, where intellectual property protection is provided for within the WTO framework, significant emphasis needs to be given to enforcement.

Upstarts and laggards

Outside of the US, several countries have developed a significant biotech presence within their national economies. Countries such as the United Kingdom, France, Sweden and even Germany have focused initiatives in place along with strong government financial support and rich research traditions. While these countries have historically occupied the leading

positions in international biotech, several countries have made surprising moves to get global attention. In the cases of Brazil and China, each country is home to institutions that played significant roles in mapping and publishing a draft sequence of a genome (Brazilian entities worked on sequencing the genome of a citrus canker bacteria and China worked on a rice genome).

Singapore is making headlines via the billions of dollars the government is offering to build its domestic infrastructure and position the country as the biotech hub of the Asia Pacific market. Ireland is investing over $500 million in biotech-specific research, infrastructure and programs throughout its university system. While these are examples of countries emerging on to the biotech scene, there are others who are doing relatively little or lack any kind of critical mass in institutional biotech capacity. At the same time Singapore is spending billions on biotech-related programs, the government of Hong Kong has only invested about $100 million in the past five years with recent initiatives amounting to little more than studies of the sector.

US Biotech Clusters	**International Biotech Clusters**
San Francisco Bay area	Brussels (Belgium)
San Diego	Montreal (Canada)
Research Triangle, NC	Toronto (Canada)
Boston	Paris (France)
Los Angeles	Strasbourg (France)
Seattle	Munich (Germany)
New York/New Jersey metro area	Dublin (Ireland)
Washington DC metro area	Stockholm (Sweden)
	Medicon Valley (Sweden/Denmark)
	Cambridge (England)
	Oxford (England)
	Edinburgh (Scotland)

Hot topics and issues

Almost every activity going on today with respect to biotechnology is in some way related to genomics and related fields (e.g. proteomics, gene therapy). Several genomes have now been successfully mapped including those of the human being, a

mouse, several types of bacteria, the mosquito responsible for spreading malaria in sub-Saharan Africa, the puffer fish and several plants. With this newfound information, novel therapeutic and diagnostic breakthroughs are emerging and almost every country involved with biotech has some level of research and infrastructure dedicated to the genomics field. The study of genomics is probably the premier example of the convergence between the biotech and infotech worlds as massive computing and processing power is required in the DNA sequencing process.

Not surprisingly, much of the efforts in the global biotechnology community are focused on treating, detecting and preventing human disease. Top research areas include cancer, AIDS, neurological disorders, heart disease and diabetes.

While the human disease and genomics areas of biotechnology get considerable headlines, it is surprising to many how advanced and how common, the field of agricultural biotech has become. Transgenic crops, resistant to environmental stresses such as weather and insects, have now existed for more than a decade. In fact, significant cropland in the US is farmed utilizing genetically engineered/modified plants, fertilizers and seeds. The widespread production and subsequent exporting of these crops has caused concern, particularly in Europe, regarding the safety of the food supply and long term ramifications of consuming genetically altered food products.

Another area of controversy and public debate surrounds the use of embryonic stem cells.

Currently, political, religious, and bioethics groups are trying to control what they see as harmful exploitation of stem cells which hold significant promise with respect to regenerative therapies and tissue engineering. The US President Bush recently announced limitations on stem cell research programs with only 78 stem cell lines worldwide meeting eligibility criteria for the US federal funding. Of those 78 lines, 51 were either developed by foreign institutions and/or foreign institutions retain the intellectual property rights associated with the lines.

Another area receiving significant attention from the international biotech community is the utilization and development of nanotechnology. Several applications are the focus of substantial research including drug delivery and diagnostic technologies.

Beginning of the biotech age

There is no question that nations and people around the world believe the biotechnology age is upon them. The great potential that life sciences breakthroughs promise is close enough and/or seemingly real enough for vast programs with billion dollar budgets to be put in place. While some countries such as the UK, France, Canada, Sweden and Germany enjoy financial resources and existing infrastructure that allow for broad-based strategies, others such as Brazil must find creative funding sources and make decisions about investing in technology vs. bricks and mortar. Approaches vary as well.

Ireland's biotechnology program is focused, in large part, on investing in the country's university research programs and infrastructure. New Zealand is relying more on developing niches in areas of strength such as agriculture, livestock and dairy. Research themes also illustrate differences in approaches. While Asian R&D looks for innovative uses of traditional medicines and studies the genome of the critical element in its food supplyâ€”rice, a large amount of European effort is targeted at development of biotechnology platforms as well as human therapeutics.

While the efforts being put forth are large in scale and underscore a legitimate commitment to the biotech sector, most national initiatives have been in place for less than five years with research programs only just beginning and facilities still under construction. Regulatory, structural and labor issues still exist in many locales that serve to impede the entrepreneurial and technology transfer efforts so crucial in bringing scientific research into the commercial marketplace. While headlines are made in announcing new national/regional biotech strategies, there is little comment (exceptions include Scotland and Canada) on performance measurement or the definition of success.

The world is still in the early days of the biotechnology revolution. The increasing size of biotech companies, the breadth and depth of current research efforts and the tremendous advances made in the field of genomics serve to tantalize and intrigue countries around the globe as they rush to gain a foothold and distinguish themselves in some manner. In examining these countries' approaches, one may not yet be able to judge results but one can now ask the questions which, when answered over the course of the next decade, may ultimately reveal the strategies and tactics required for successful national initiatives aimed at science's cutting edge.

- Can the United Kingdom retain its leading position in the face of intense competition from the likes of Germany and France?

- Will Sweden, Australia and Canada be able to leverage their ample biotech resources to occupy sustainable global leadership positions?
- Will Ireland's universities, now receiving hundreds of million of dollars, be able to produce scientific breakthroughs or will the country become simply a European manufacturing base?
- Can Singapore win its way (via enormous state funding) to a leadership position within the Asia/Pacific region?
- Will Belgium or Scotland rise to the top ranks of European biotechnology locales?
- Can the biotechnology sectors in China and Israel thrive in the midst of significant political issues?
- Can Brazil's research communities sustain itself within an uncertain macroeconomic climate? Will Germany's focus on developing biotech cluster regions within its borders serve as the key component to its ultimate success?
- Can New Zealand become a leader in niche areas?
- Does Hong Kong have a role to play?
- Will Japan's national economic situation holdback its biotech aspirations?
- When will patent harmonization be finally achieved?
- Can the EU's regional efforts work in parallel with individual European countries' biotech R&D programs?
- How will other countries react to life science developments in the United States?

These questions and many others currently linger. It is now up to the scientists, financiers and entrepreneurs of the world to take advantage of the largesse being offered to them from policy makers and state budgets and turn potential into reality.

(Extracts from the "World of Biotechnology", an international survey of biotechnology strategies, initiatives and institutional capacity, prepared by New Economy Strategies, Washington DC). The full report can be ordered from 1150,17th St. NW Suite 500 Washington, DC 20036 or info@new-econ.com