

Canada's dynamic and outward looking biotechnology sector has strengths in both pharmaceuticals and agriculture. It includes a number of new, energetic, small biotechnology firms that are especially active in the areas of vaccines, insulin, and diagnostic kits. The recent competition for control of Connaught Bioscience between Institut Mérieux (Rhône-Poulence) on the one hand and Ciba-Geigy and Chiron on the other, attests to technical strengths in this area. In addition, Canada's strong resource industries give Canadian companies a head start in applying biotechnology in the resource-based industries.

There are about 220 organizations involved in biotechnology in Canada. Canadian biotech companies have an average of 6 products being manufactured and another 6 in development. In 1988, total sales for the Canadian biotechnology sector hit \$660 million. R&D accounted for aggregate spending of \$275 million.

## Structure

The biotechnology sector in the EC, like the North American and Japanese biotechnology sectors, is geared toward large firms that can bear the extremely high costs involved in R&D, testing and marketing. While smaller firms play key roles in the industry, they tend to concentrate their activities on research for the traditional pharmaceutical industry and larger biotech firms. The typical biotech firm has strategic alliances with about six other companies, forming a complex network which serves to spread costs and risks, while offering protection from takeover bids.

In addition to maintaining alliances with small innovative companies, large firms, such as ICI (Imperial Chemical) in the U.K., have begun to invest heavily in biotechnology R&D. ICI is developing a biodegradable plastic produced by naturally occurring bacteria through a fermentation process. Some big European companies involved in vaccines are Elf-Sanofi and Rhône-Poulenc-Merieux, the purchaser of Connaught Labs in Canada. In the enzymes market, the Danish firm Novo and the Dutch firm GIST-Brocades are two active European companies.

The quality of European R&D is widely recognized and Europeans can rely on the vitality of several medium-sized innovative firms backed by the funding capacities of the sector's major companies. Despite this, the European industry has been facing difficult problems which the EC is now trying to redress:

- Expansion into multiple EC national markets was difficult due to the large variety of regulatory regimes and patent law systems. This problem is being addressed through the development of predictable, pan-European standards. This will increase the pay-off from the pan-European program of biotechnology R&D subsidies the EC is conducting.
- The EC's income support program for agricultural producers made the costs of fermentation feedstocks (starch, sugar) prohibitively high for a number of companies. In one example, a major application of enzyme technology (liquid sweetener) was commercialized in the U.S. rather than in the EC even though many of the key developments that made it possible were European. This problem has been addressed through refunds, but it was a serious setback to the development of biotechnology in the EC.

## Nature of alliances with Canadian biotech firms

In 1989, 87% of Canadian biotech companies had formed strategic alliances:

- 47% of these alliances are in Canada
- 33% in the U.S.
- 13% in Europe
- 3% in Japan and
- 4% are elsewhere in the world

Canadian biotech companies reported that the most important factors they consider when looking for foreign partners were credibility, marketing expertise and access to technology.