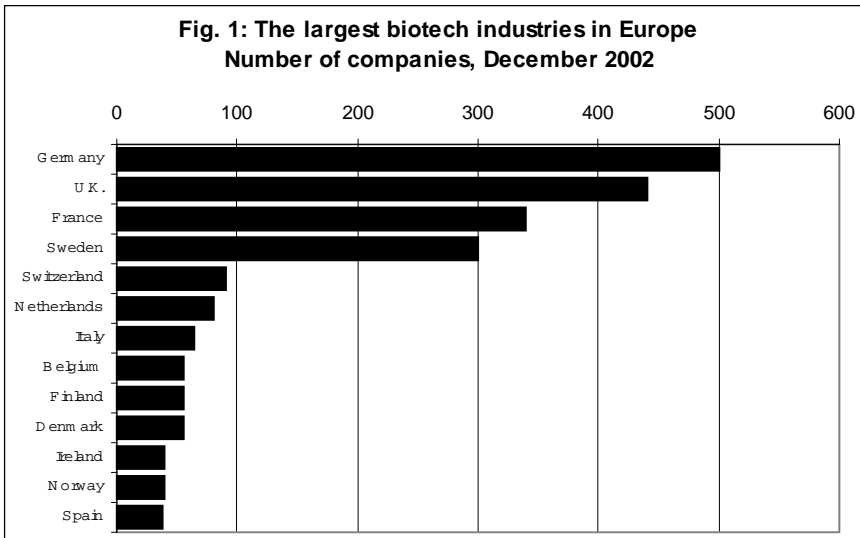


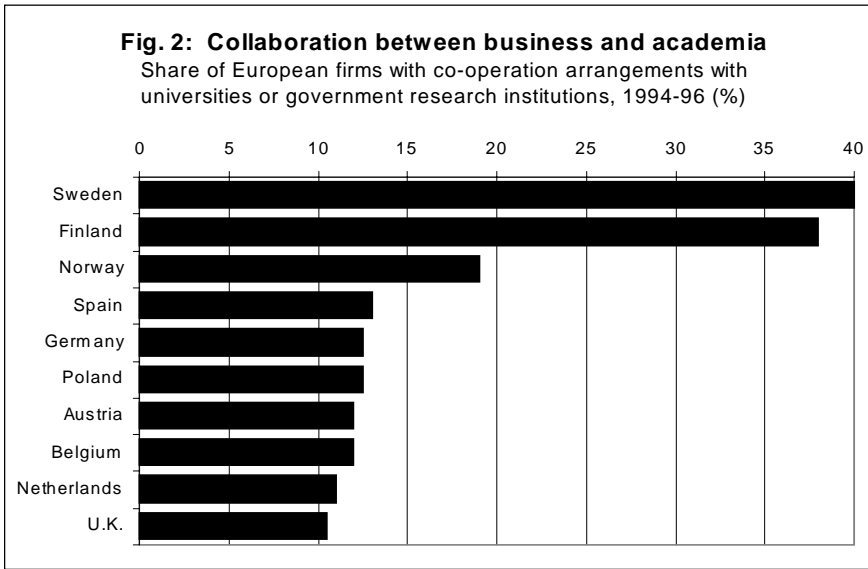
Biotechnology in Sweden*

After tremendous growth in recent years, the Swedish biotechnology industry today comprises more than 200 companies - Europe's fourth most numerous and the largest when measured in relation to both population and GDP. Sweden's success is the result of a strong biotechnology research tradition, big pharma consolidation, a boom in entrepreneurship and access to venture capital. Sweden's position builds on a long history of R&D achievements (Fig. 1). The presence of two of the world's largest



Source: European Commission, “*Innovation and Competitiveness in European Biotechnology*”, 2002.

* Based on *Scientific American*, May 2002 p 52/6.



Source: OECD, *Science, Technology and Industry Scoreboard*, 2001.

pharmaceutical companies, AstraZeneca and Pharmacia Corporation - with strong roots in Sweden and large investments in research and public health care - have also been important (Fig. 2).

Blood plasma substitutes and separation media based on polysaccharides were developed in Sweden in the 1940s and 1950s, and a range of equipment for use in research labs and later for the manufacturing of biotechnology drugs followed. Both the ultracentrifuge and the electrophoresis methods were early Swedish innovations in separation techniques.

In collaboration with Genentech, the Swedish pharmaceutical company Kabi Vitrum developed the world's first recombinant growth hormone, launched as Genotropin in 1987. Kabi later merged with Pharmacia, and Genotropin is now generating large revenues for Pharmacia Corporation. Functional genomics, proteomics, regenerative medicine, stem cell research and technology platform development are some examples of current Swedish research expertise.

Swedish research achievements have often been the result of successful cross-breeding among the fields of corporate and academic research, public health care and other institutions. An OECD study, covering business and academic research collaboration across industry sectors, showed this is more common in Sweden than anywhere else: 45 per cent of firms with more than 50 employees participate actively in joint R&D and other innovation projects with other organizations.

For biotech firms, this figure is even higher. A survey by the Swedish Agency for Innovation Systems (VINNOVA) showed that as many as 93 per cent of Swedish firms were involved in R&D collaboration with academic research groups. Collaboration is by no means restricted to domestic activities. Sweden has strong ties with the international scientific community through direct and active participation in global networks and collaborative relationships. A study of all life science-related articles published by Swedish authors between 1986 and 1997 showed that almost a third were co-authored by Swedes with collaborators from other countries. Ties were strongest with the US - 12 per cent of the articles were co-authored with US-based scientists.

Restructuring of the global pharmaceutical industry and increased entrepreneurial activity are key reasons for Sweden's rise as a biotech nation. Pharmacia, now Pharmacia Corporation, merged with Upjohn in 1995. The company, which prior to the merger was engaged in all aspects of drug discovery and development, went on to focus primarily on the later stages of the value chain. This change of focus has had a very productive effect on Sweden's biotech industry. In addition to spinning off biotech operations such as Amersham Biosciences, Biacore and Biovitrum (one of Europe's largest biotech firms), Pharmacia has supplied human resources to many start-ups. These are now staffed with board members, management and researchers who previously held senior positions at Pharmacia. Start-up activity has been significant in Uppsala, the former site of Pharmacia's headquarters.

Astra, which merged with Zeneca in 1998, has increased its R&D activities in Sweden, and even located its group R&D headquarters in Södertälje, south of Stockholm. Sweden has global R&D responsibility for four of AstraZeneca's seven therapeutic areas. Since the merger, the total number of employees in Sweden has increased by 2,000 people. Sweden is renowned for its ability to apply research progress in clinical practice, thereby stimulating the development of a large number of drugs and innovations. At an early stage, Sweden began building an advanced health care system, open to trying out new technology and techniques. A centralized public health care system also fostered the establishment of highly reliable systems of medical records. Common processes and working methods ensure the records' quality and reliability. Sweden has an outstanding collection of unique patient databases providing medical and genetic information. For example, Sweden has the most extensive twins register in the world, a unique tool in studying the relation between disease, genes and environment. Several databases include access to patients' medical history, as well as series of tissue and blood samples. UmanGenomics is a firm that offers gene analysis based on the unique biobanks available at the Umea University Hospital.