America Dominates in Biotechnology

OTA study highlights U.S. strengths but also notes potential vulnerability to foreign competitors—especially the Japanese

The United States has a commanding lead over its industrial competitors in the development and application of biotechnology, an exhaustive study by the Office of Technology Assessment (OTA) has concluded. American dominance of the fledgling industry is so extensive, according to OTA, that U.S. companies hold an edge in virtually every area, from basic research to the ability to attract high-risk capital.

Nevertheless, the report is quick to point out that the U.S. lead, though large, is not unassailable, and it dwells at length on some potential vulnerabilities. Given the high-decibel attention currently being paid to high-technology industry is the United States, the study is likely to spark a chorus of political rhetoric about the need to stave off yet another foreign technological challenge. Japan is reckoned to be the closest competitor, followed, in order, by West Germany, the United Kingdom, Switzerland, and France.

The strengths of the U.S. biotechnology enterprise are, however, more obvious than its weaknesses. Take, for example, funding. The OTA study indicates that the private sector in the United States invested more than $1 billion in 1983 to commercialize new biological techniques, which are defined as recombinant DNA, cell fusion, and novel bioprocessing technologies. Although some large chemical and pharmaceutical companies are putting money in biotechnology, a large fraction of U.S. investment has gone to start-up companies financed by venture capital. In contrast, in Europe and Japan, where tax laws do not favor the creation of venture capital funds, virtually all of the work is being done by large pharmaceutical companies. This difference alone has given the United States a comparative advantage in the ability to capitalize rapidly on the results of basic research, OTA says.

In research funding, too, the United States is miles ahead. OTA calculates that the U.S. government spends more than $500 million a year on biotechnology-related research and development, while the Japanese government spends only about $60 million. This provides a well-developed base on which the U.S. biotechnology industry has built. Moreover, the recently established links between university scientists and biotechnology companies—themselves partly a reflection of the booming venture capital markets—have moved the technology rapidly into the private sector. University-industry links have not flourished as vigorously in Europe and Japan.

If the U.S. industry does have an Achilles heel, however, it may be the relative lack of funding to develop new engineering technologies related to the production of biotechnology products. "In the next decade, competitive advantage in areas related to biotechnology may depend as much on developments in bioprocess engineering as on innovations in genetics, immunology, and other areas of basic science," OTA argues. And it points ominously to the fact that the federal government spends only about $6.5 million a year on developing such technologies.

> Limited partnerships alone invested $500 million in biotechnology in 1983.

Japan, in contrast, spends a relatively large fraction of its government funds for biotechnology on solving generic problems in bioengineering. "This strategy worked well in the semiconductor industry, and Japan may very well attain a larger market share for biotechnology products than the United States because of its ability to rapidly apply results of basic research available from other countries," OTA warns. What is needed to counter this approach? More federal funds for generic applied research, together with money for training grants is the stock answer.

Another potential vulnerability is the flip side of one of the strengths of the U.S. industry. All those new companies launched with venture capital will need major injections of new funds because they are likely to continue to report heavy losses in the next few years. Venture capital is good for starting up companies but not for keeping them going because the short-term returns are not so attractive. The staid, but wealthy pharmaceutical companies that are getting into biotechnology in Europe and Japan, in contrast, can use retained profits to underwrite their new ventures. OTA suggests a variety of creative tax measures to keep the money flowing into U.S. companies as they move from infancy into adolescence.

Some biotechnology companies are, however, already making good use of current tax laws to entice funds from wealthy investors. For example, limited partnerships and private stock placements are increasingly being used to fund such costly endeavors as clinical trials, scaling up processes for commercial production, and early product development. Limited partnerships alone are estimated to have channeled $500 million into biotechnology in 1983, and the figure could climb to a staggering $1.5 billion in 1984. U.S. tax laws provide much greater encouragement than those of other countries for the creation of such partnerships.

But it is clear from OTA's analysis of the products currently being pursued by the industry that an inevitable shakeout is in store. With perhaps 200 companies launched in the past few years and only about two dozen products nearing commercial introduction, there is unlikely to be room for everybody—no matter how attractive the federal government makes the tax environment.

Although the OTA report is extremely upbeat about the economic potential of biotechnology, one figure should give some pause. Only about 5000 jobs have so far been created in the industry, and the production phase is expected to be equally capital-intensive. Biotechnology companies will clearly provide few jobs for those communities that are assiduously wooing them.

What impact is the study likely to have on U.S. policy? Although it was commissioned by several congressional committees looking for ways to blunt a possible technological challenge from Japan, it is, ironically, likely to have more of an impact on the policies of the United States' competitors. Noting that the report concludes that U.S. biotechnology is, by and large, healthy, Nanette Newell, the project director, predicts that scientists and politicians in other countries may use it as ammunition to argue for domestic political and economic reforms.—**COLIN NORMAN**