

RAFI COMMUNIQUE

RURAL ADVANCEMENT FUND INTERNATIONAL

November, 1989

Biotechnology Industry Consolidation

ISSUE: Mergers, acquisitions and business failures in the biotech industry.

IMPACT: Major restructuring will shift increasing control to large transnational corporations--especially food, pharmaceutical and agri-chemical sector. Concentration of biosciences in the industrialized world threatens to further marginalize interests and needs of South as active participants in the bio-revolution.

WHEN: Now underway. Consolidation will halve the number of biotech companies worldwide by the year 2000.

FINANCIAL STAKES: By first quarter of next century, 40% of the world economy will be directly affected by new biotechnology products and processes.

The biotechnology industry has reached a critical juncture. A wave of recent mergers and acquisitions, coupled with numerous business failures, has set in motion the long-awaited "shakeout" in the biotech industry. Ominous headlines like these foreshadow a major restructuring in the fledgling biotech industry:

"Clouds Gather Over the Biotech Industry"--Wall St. Journal

"The Bust in Biotech"--Forbes Magazine

"Farm Gene Makers Money Woes"--New York Times

But despite hard times, no one is writing an obituary for commercial biotechnology. For the past decade, industry analysts have predicted a wave of consolidation in the biotech industry. Biotechnology is poised to emerge as a primary area of growth in the next century. Major restructuring throughout the 1990s will shift increasing control of the biosciences to large transnational corporations, a process which is well underway. (See appendix, "Who Owns Plant Biotechnology?").

This RAFI Communique examines biotech industry consolidation, and the outlook for the future. Given the global nature of the biotech industry, it is not really possible to provide an analysis by country or region. However, because of the large numbers of small biotech companies and the high level of consolidation now taking place in the United States, this

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Communique places particular emphasis on commercial biotechnology in the United States.

Background -- Industry Structure¹

Worldwide, the companies working with new biotechnologies can be divided into two distinct sectors: 1) Small biotechnology companies, and 2) large corporations.

The first sector includes the "pure" biotech companies. These are the small, entrepreneurial start-ups. According to a database on commercial biotechnology maintained by the North Carolina Biotechnology Center, there are approximately 750 "pure" biotechnology companies in the U.S. today.² These are companies whose primary activity is working with the new biotechnologies (including genetic engineering, monoclonal antibodies, large-scale tissue or cell culture, etc.). By contrast, there are approximately 115 major U.S. corporations that have significant in-house biotechnology programs.³

The explosive growth of the U.S. biotech industry over the past 10 years was made possible by an abundance of venture capital and public financing. But the predominance of small biotech firms is somewhat unique to the United States. Due mainly to the absence of venture capital, there are relatively few entrepreneurial biotech companies in Japan and Europe. Generally speaking, large corporations with considerable resources already dominate the biotechnology industry in both Japan and Europe.

The large number of "pure" biotech companies founded in the U.S. over the last decade gave the U.S. a competitive lead in the early stages of biotechnology's commercialization, and they also functioned as a litmus test for larger, corporate investors who were soon to follow. Most transnational enterprises in Europe, Japan and the United States did not begin significant in-house biotechnology research and development until after 1980.

Strategic Alliances

Strategic alliances..."corporate America's version of the singles' bar where the cash-rich meet the funding starved: in the end, only the strong and resilient survive."⁴

For most of the past decade transnational corporations (TNCs) have used "strategic alliances" with small biotech firms as a means of acquiring early access to biotech products or production technologies before developing their own in-house expertise. Whether as a licensing or marketing agreement, research contract or other joint activities, the partnership between TNCs and small biotech firms is mutually beneficial for both parties. The small biotech firm desperately needs capital to sustain their basic research and early-stage product

development. The corporate partner can provide capital, regulatory experience, and marketing knowledge. Corporate alliances also makes the smaller firm appear more investment worthy if it chooses to seek public financing.

Particularly noteworthy is the tremendous disparity between the two sectors--the small biotech companies with scarce resources and the transnational corporations with sizeable R & D budgets. According to Mark Dibner, Director of the North Carolina Biotechnology Center's Information Division, the large corporations have more than 500 times the revenue and 75 times the total research and development budgets of the "pure" biotech companies working exclusively with the new biosciences. The following chart, based on mean data from representative companies in each sector, provides a comparison of the two sectors:

	<u>Large Corporations</u>	<u>Biotech Co.</u>
Annual Sales	\$5.8 billion	\$11 million
Total R&D Budget	\$339 million	\$4.6 million
Total # Employees	33,908	90
Average Year Founded	1930	1981

After the U.S. stock market crash in October, 1987, venture capital dried up and the marginal biotech companies began to wither. The climate for biotech changed drastically. Some industry analysts now refer to the early biotech boom years as an "aberration". During this era, market potential for biotech products was greatly exaggerated, and the difficulties involved with product development were grossly underestimated. As one industry analyst told Bio/Technology Magazine:

I don't think you can point to a time when technology was funded at such an early stage by people who had no previous experience with it...There was a lot of hype...a lot of money poured in too early...and a lot of people will point to it and say it was wasted."

Early, inflated forecasts on the introduction of new biotech products missed the mark. After one decade, few products actually reached the market, and those that did were not overwhelming commercial successes. As of mid-1989, only seven products of genetic engineering (all human therapeutics) are available for commercial sale in the U.S. The list includes: human insulin, human growth hormones, alpha-interferons, OKT-3 (a monoclonal antibody that prevents kidney transplant rejection), hepatitis-B vaccines, tissue plasminogen activator (tPA), and erythropoietin. Projected U.S. sales for all of these products is expected to reach \$640 million in 1989.

Dozens of new products are on the horizon. Nearly 150 bio-drugs

and vaccines are now in human clinical trials, and scores of long-awaited biotechnology products for agriculture are expected to hit the market in the next 5-10 years.⁸ The question remains, who will reap the rewards of final commercialization?

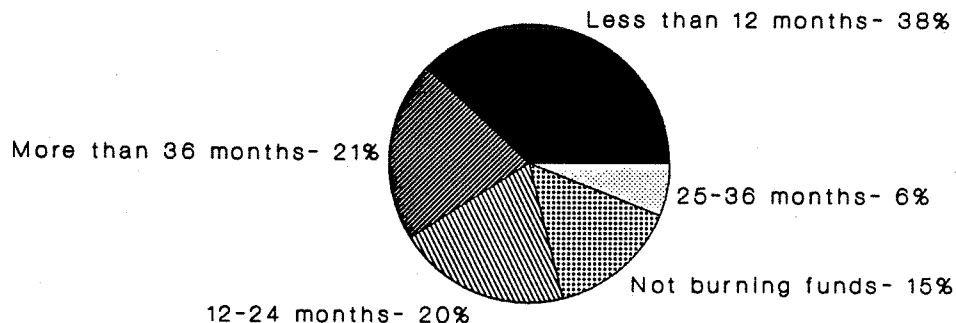
Biotech in the 1990s

Today small firms continue to predominate in the U.S. biotech industry. But the vast majority of these are under-financed, with limited resources for survival. According to industry analysts, the average biotech company will require \$55 million in external financing over the next decade.⁹ For all but the largest biotech companies, and the best-backed private ones, the likelihood of obtaining new capital in the future is poor. As a result, a large number of biotech companies are on the verge of bankruptcy. And for hundreds of others, life expectancy is very short, indeed.

Since the majority of biotech companies lack product revenues and earnings, industry analysts use the "burn rate" to assess the company's financial health.¹⁰ The "burn rate" for biotech companies is a measuring stick that estimates the rate at which these companies are "burning up" their cash. The survival rate shows how long a company can operate before checks start bouncing. Today, the average biotech company, if not yet profitable, can survive three and a half years operating at current loss rates.¹¹

A recent survey conducted by Ernst & Young reveals that nearly 40% of U.S. biotech companies will survive less than 12 months.¹² The following chart gives a more detailed breakdown:

Biotech "Burn Rate" Survival Index for Biotechnology Firms



Ernst & Young, 1989

As a whole, the biotech industry has a very short fuse. Consider the following "vital statistics" gleaned from Wall Street biotech analysts at PaineWebber:¹³

Biotech Industry-- "Vital Statistics"

- The average biotech company spends a high proportion on research and development, averaging 49% of total operating expenses.
- As a whole, the biotech industry is in "the red." Aggregate losses totaled \$177 million in 1988, compared to \$139 million in 1987.
- Direct biotech sales in the U.S. totaled \$650 million in 1988 of a total of \$1.1 billion in revenues. More than two-thirds of the industry revenues are generated by companies in the biopharmaceutical sector.
- Of \$1.1 billion in revenues, 60% is attributed to the introduction of a single product (Activase--brought to market by Genentech in late 1987).
- The vast majority of biotech companies operate at a loss. In 1988, only six companies (all biopharmaceuticals) reported operating income.

Faced with negative balances and few, if any, commercial products, the survival of literally hundreds of biotech companies depends on mergers, acquisitions or cost-sharing alliances. Those biotech companies with strong research and development, but weak finances, must seek a merger or acquisition to provide the necessary capital to stay alive. They cannot go it alone. As a result, many biotech companies will not have the luxury of deciding their own future on their own terms. With few exceptions, the rewards of commercial sales will go to large transnational corporations with strong market positions.

The present wave of consolidation will halve the number of biotechnology companies worldwide by the year 2000.

Industry analysts generally agree that the present wave of consolidation will halve the number of biotechnology companies worldwide by the year 2000.¹⁴ According to a recent survey conducted by biotech analysts Ernst & Young, approximately two-thirds of all biotech companies responding to their survey expect to be acquired at some point during the 1990s.¹⁵

The following list of biotech industry mergers/acquisitions, provides a sampling of recent activity:¹⁶

Genzyme (USA) acquired Integrated Genetcs (USA)
DNA Plant Technology (USA) merged with Advanced Genetic Sciences (USA)
Xoma Corp. (USA) merged with Ingene (USA)
Quidel (USA) acquired Cytotech Inc. (USA)
Bissendorf Biosciences (FRG and USA) acquired BIOTX (USA)
Enzo Biochem (USA) acquired Alphomeg Laboratories (USA)
Novo Industri (Denmark) merged with Nordisk Gentofte (Denmark)
Pharmacia (Sweden) acquired Electro-Nucleonics (USA)
Calgene Inc. (USA) acquired Plant Genetics Inc. (USA)
Intergen (USA) acquired Bio-Process Technologies (USA)
Biotechnica (USA) acquired Molecular Genetics' agricultural business (USA)
Animal Biotechnology (UK) merged with Ovamass (UK)
Liposome Co. (USA) merged with Liposome Technology Inc. (USA)
Transgenics Inc. (USA) merged with Embryogen Inc. (USA)

Transnational corporations are also making huge equity investments in biotechnology companies. The following is a sampling of recent activity:¹⁷

Kubota Ltd. (Japan) makes equity investment of \$10 million in Mycogen (USA)
DuPont (USA) buys 1.5 million shares (\$6.75 million investment) of DNA Plant Technology Inc. (USA)
Ciba Geigy (Switzerland) makes \$20 million equity investment in Chiron (USA)
Proctor & Gamble (USA) makes \$5 million equity investment in Calgene (USA)

Conclusion -- Lessons to be Learned?

There is little doubt that biotechnology represents a major growth industry, and it is increasingly clear that major transnational enterprises will control the industry as it enters the 21st century.

At a recent conference on "Biotechnology in a Global Economy", experts from 16 nations described their national biotech activities. One participant from the United Kingdom concluded with this candid assessment: "The important thing is what the multinational companies are doing. What nation states are doing is becoming irrelevant."¹⁸

Yet, particularly in the United States, any obstacles to the development of commercial biotechnology or efforts to regulate the biosciences are often challenged as a serious threat to

national competitiveness. One U.S. industry spokesman bemoaned the fact in a recent Wall St. Journal article, warning that the Japanese "can buy the whole U.S. industry for \$6 billion."¹⁹ In fact, allegiances of transnational corporations are not tied to geographic borders.

"The important thing is what the multinational companies are doing. What nation states are doing is becoming irrelevant."

A recent study by the Organization for Economic Co-operation and Development finds that national governments may play a limited or perhaps irrelevant role in the development of new biotechnologies. In reviewing implications for trade and competitiveness, the OECD study finds that, "large firms possessing an advantage in biotechnology may tend to establish their own competitive strategies without waiting for governments to act and without necessarily welcoming government plans."²⁰

With control of biotechnologies firmly in the hands of major TNCs, the science and technology are highly concentrated in the industrialized world. The OECD study concludes:

"Developing countries are only participating in the process marginally, even in cases where they have an indigenous capacity as in China, India or Brazil. As a result, at the moment, developing countries lie mainly on the receiving end of clearly perceptible trade impacts."²¹

Global Concentration

Consolidation in the biotechnology industry reflects what is happening, on a much grander scale, in virtually all industry sectors worldwide. Recent years have seen colossal, mega-mergers in the food, pharmaceutical and agricultural input industries.

As reported in other issues of RAFI Communique, eight corporations now control close to 71 percent of world trade in pesticides, while those same firms and a dozen more dominate the commercial seed business.

The food and beverage industry is still reeling from record-breaking "acquisition binges"--and the end is not in sight. There were 652 food industry-related acquisitions and mergers in 1988--up 8.8 percent over the previous year.²² Most notable, Kohlberg Kravis Roberts acquired RJR Nabisco for a record \$24.8 billion, Philip Morris acquired Kraft for \$12.9 billion and Grand Metropolitan acquired Pillsbury for \$5.7 billion. In Europe, industry experts predict that 45 remaining

European food processors will merge into ten giant food companies within the next few years.²³

In health care, the top 12 world pharmaceutical houses command nearly 30 percent of the world's \$125 billion drug trade. In 1989, the mega-merger of SmithKline Beckman and Beecham Group PLC formed the world's second largest pharmaceutical. Close on its heels, Bristol-Myers and Squibb announced a merger that may de-throne rival SmithKline Beecham from the number two spot.

"Restructuring according to the laws of new technology will mark the 1990s." -- *Chemical Business, Feb., 1989*

Throughout the 1990s, biotechnologies will play an increasingly important role in the process of industry consolidation, particularly in food processing, agricultural inputs and pharmaceuticals. Application of new biosciences will enable corporations to diversify into every field or specialty that uses living organisms as a means of production. As a result, traditional industry sectors will become less distinct, and corporate boundaries virtually unlimited.

Biotechnology has been called the century's third great technological revolution after atomic fission and computers. With a wide variety of applications, biotechnology products will have broad impacts throughout many sectors--agriculture, food processing, chemical, energy, pharmaceutical, waste treatment, mining, and military. With the potential to affect all industry sectors based on biological products, an estimated 40 percent of the world economy will be directly affected by new biotechnology products and processes by the first quarter of the next century.

Once, "power" was land--controlling what grew on it and what came from it. Then "power" became manufacturing--the smokestack industries...Today "power" is life. And "life" is fast becoming the private preserve of transnationals and venture capitalists.²⁴

Appendix

Who Owns Plant Biotechnology? A Closer Look at the Top 15 Companies

In May, 1989, L. William Teweles & Co. (seed and biotech industry consultants) published a list of the world's leading plant biotechnology companies, based on R & D spending in millions of dollars (US):

1. DNA Plant Technology Corp. \$15.0
2. EniMont S.P.A. \$15.0
3. E.I. du Pont de Nemours & Co. \$15.0
4. Imperial Chemical Industries \$14.5
5. Agrigenetics Corp. \$12.8
6. Ciba-Geigy \$12.5
7. BioTechnica International, Inc. \$12.3
8. Monsanto Corp. \$12.0
9. Sanofi \$12.0
10. Sandoz \$11.0
11. Calgene, Inc. \$10.5
12. De Danske Sukkerfabrikker \$9.0
13. Plant Genetic Systems, N.V. \$7.5
14. Agracetus \$7.0
15. Agricultural Genetics Co., Ltd. \$6.1

A closer look at the world's leading plant biotech companies reveals that transnational food and agrichemical corporations already dominate in this sector, either through in-house R & D, equity investments or contracted research agreements.

Five of the top 15 plant biotech companies are major transnational corporations (TNCs), including:

E. I. du Pont de Nemours & Co. (USA) annual sales: \$33 billion
Imperial Chemical Industries (UK) annual sales: \$20 billion
Ciba-Geigy (Switzerland) annual sales: \$12 billion
Monsanto Corp. (USA) annual sales: \$8.3 billion
Sandoz (Switzerland) annual sales: \$7 billion

At least five of the top 15 are wholly-owned subsidiaries or joint ventures of TNCs', including:

Enimont, S.P.A. (Italy) - a joint venture of Ente Nazionale Idrocarburi (ENI) and ENI-Montedison, established January, 1989. ENI is a state-owned holding company with subsidiaries operating worldwide, and 1988 sales of \$25 billion. The agricultural division within Enimont employs 8000 people in 16 factories across Italy and the United States, with annual sales of approximately \$1.5 billion.

Agrigenetics Corp. (USA) - a subsidiary of Lubrizol Corp. since January, 1985. Lubrizol is a major chemical corp. with 1988 annual sales of \$1.1 billion.

De Danske Sukkerfabriker (Denmark) - a subsidiary of Danisko, a major food corporation formed by the merger of three Danish food companies, January, 1989. The new company has annual sales of approximately \$1.8 billion and a combined staff of 12,000.

Sanofi (France) - A subsidiary of Elf Aquitaine Group, a major state-owned corporation with annual sales of \$21 billion.

Agracetus (USA) - A joint venture between W.R. Grace and Cetus Corp. (Cetus-53% and W.R. Grace-47%) W.R. Grace is a major agrichemical corporation, with annual sales of \$6.2 billion.

The remaining five plant biotech companies are dependent on equity investments and research/partnering agreements with major TNCs to stay afloat. The following table provides a more detailed breakdown of the leading "independent" companies:

Who Owns Plant Biotechnology? The "Independents"

COMPANY/R&D	SAMPLE EQUITY INVESTORS	SAMPLE CORPORATE PARTNERS
DNA PLANT TECHNOLOGY (USA) \$15.0	DuPont - 9.7% Campbell Soup - 8.1%	Ciba-Geigy Brown & Williams Tobacco General Foods Hershey Foods Continental Grain
BIOTECHNICA INTERNATIONAL (USA) \$12.3	RTZ Chemicals - 15% Seagram - 11% State Farm Mutual Auto Ins. - 25% Vencap Equities Alberta, Ltd.	DuPont W.R. Grace H.K. Heinz F. Hoffman-La Roche Johnson & Johnson Monsanto Pioneer Hi-Bred RJR Nabisco Uniroyal/Eni Chem Upjohn
CALGENE (USA) \$10.5	Hambrecht & Quist Mitsui Rhone-Poulenc Agrochimie Citicorp	Campbell Soup Central Soya Ciba-Geigy Dekalb-Phizer Genetics Nippon Steel Proctor & Gamble Rhone - Poulenc Roussel Uclaf
PLANT GENETIC SYSTEM NV (BELGIUM) \$17.5	Japan Tobacco GIMV NV (Flemish Ind. Dev. Agency) Hilleshog AB Radar NV Tienen Sugar Refinery	Agrochemical Co. Clause SA Hilleshog & KWS Janssen Pharm. Radar NV Rohm & Haas Sapporo
AGRICULTURAL GENETICS CO., LTD. (UK) \$6.1	British Technology Group - 22% Ultramar - 26.2% Ciba Geigy - 5.1% Danish Sugar - 5.1% Eli Lilly - 4.4%	Pioneer Hi-Bred Biotechnica Ag. Calgene

FOOTNOTES

- ¹For a more complete analysis of the biotechnology industry and its origins, see "The Laws of Life" Development Dialogue, 1988: 1-2, published by the Dag Hammarskjold Foundation, authored by RAFI staff.
- ²N.C. Biotechnology Center, Research Triangle Park, North Carolina, USA. The center maintains a detailed database on commercial biotechnology. Statistics used here are current as of November 1, 1989.
- ³According to N.C. Biotechnology Center database, as of November 1, 1989
- ⁴Marcus, Joel S., "Strategic Alliances", Bio/Technology, Vol. 4, October, 1986, p. 861.
- ⁵Dibner, Mark D., and R.S. White, "Biotechnology in the United States and Japan: Who's on First?", BioPharm, February, 1989, p. 26.
- ⁶Information derived from table appearing in Dibner and White, cited above, p. 24. Figures are mean data based on representative samples, U.S. companies only.
- ⁷Ratner, Mark, "Ag Investors Growing Excited", Bio/Technology, May, 1989, p. 423.
- ⁸Gupta, Udayan, "Watching and Waiting", The Wall St. Journal (special section on technology), November 13, 1989.
- ⁹Burrill, G. Steven, "The Promise of the Next Decade", Bio/Technology, Vol. 7, Bio/Technology, October, 1989, p. 1023.
- ¹⁰Teitelman, Robert, "Burn Rate Used to Measure Depth of Company Solvency", Oncology Times, March 1, 1988, p.3.
- ¹¹PaineWebber, Biotechnology Monthly, May, 1989, p. 1.
- ¹²Burrill, G. Steven, "The Promise of the Next Decade", Bio/Technology, Vol. 7, October, 1989, p. 1024.
- ¹³PaineWebber, Biotechnology Monthly, July, 1989. In some cases, statements are based on sample group of biotechnology companies rather than entire industry.
- ¹⁴Shamel, R.E. and Chow J.J., "Biotechnology: On the Rebound and Headed for a Boom," Chemical Week, September 27, 1989, p. 32.
- ¹⁵Burrill, G. Steven, "The Promise of the Next Decade", Bio/Technology, Vol. 7, October, 1989, p. 1023.
- ¹⁶Mergers and acquisitions listed are only representative and do not constitute an exhaustive listing.
- ¹⁷Equity investments listed are only representative and do not represent an exhaustive listing.
- ¹⁸Anonymous, Biotechnology Newswatch, July 17, 1989. The comment was made by Marguaret Sharp, Science Policy Research Unit, University of Sussex.
- ¹⁹Naj, Amal Kumar, "Clouds Gather Over the Biotech Industry", Wall St. Journal, January 30, 1989, p. B1.
- ²⁰OECD, Biotechnology: Economic and Wider Impacts, Paris, 1989, p. 80.
- ²¹Ibid.
- ²²Smith, Rod, "Food Industry Restructuring Continues in High Gear", Feedstuffs, April 3, 1989, p. 6.
- ²³Therrien, Lois, "The Food Companies Haven't Finished Eating," Business Week, January 9, 1989, p. 70.
- ²⁴From "The Laws of Life", Development Dialogue, 1988: 1-2, p. 191.