

# Biotechnology—a year of living prosperously

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The following pages highlight some of the stories we have covered and the research we have published in *Nature Biotechnology* over the past twelve months. Since *Bio/Technology* lost its slash and refound its *Nature*—a year ago with this issue—nothing has

changed our conviction that money and biological research, taken together, are a potent combination.

As you will note from the snapshots in our pullout section, research and development is valuable. The investment in biotechnology companies—a record \$7.6 billion in 1996—is devoted to securing ownership of research and developing it toward markets.

The market value of such investments in plant biotechnology, to give one example, became clear in 1996, as the “easy” projects—those involving single, available genes—began to generate significant revenues for those companies that had staked their claims early—nearly a decade before. Herbicide-tolerant soy and corn, and disease-resistant cotton and corn, developed by companies such as Monsanto, Mycogen, Calgene, and Ciba-Geigy, had their first significant commercial year in 1996. Landmark papers on the transformation of model and commercial varieties of these species were published in *Bio/Technology* between 1986 and 1988. That may say something about the prospects for the commercial production of transformed rice, the subject of a paper (p. 494) published last year (although it will almost certainly not take 10 years before the fruits of that research arrive). But it will probably take at least that long before the transformed cassava, reported in *Nature Biotechnology* in June, reaches its “markets” among subsistence farmers in developing countries.

Many collaborative arrangements in biotechnology arrived at in the past year are preemptive attempts to acquire ownership of research. When it is obvious that a technology is potentially valuable, large companies acquire rights to it. When it is certain it is valuable—perhaps because it has enabled the development of products—large companies buy the owner

outright. That is why Monsanto is buying Calgene, why AgrEvo bought Plant Genetic Systems, and why American Home Products bought Genetics Institute. When value is less certain, companies make deals, swapping rights for money, or rights for other rights. The formation of gene therapy consortia, such as Rhone Poulenc Rorer’s GenCell consortium, and the gene therapy grouping that Novartis has assembled through acquisition are, in essence, ways of brokering uncertainty. Which gene therapy methods will be important in providing solutions? In what combinations? And who actually owns those technologies?

Research actually fuels this uncertainty; a paper published here in January 1997 (p. 52), for example, suggests that adenoviruses reduced to not much more than their core proteins can nevertheless deliver DNA. What impact will such work have on gene therapy delivery systems? A different aspect of uncertainty applies in human genome research. In December 1996, *Nature Biotechnology* published a paper describing a technique developed by Affymetrix and Genetics Institute for parallel screening of gene expression. Technologies like this one, and others that gather or analyze genome data, increase the chances of successful drug or diagnostic development to such a great extent that many companies need to become involved in exploiting the results. In July of last year, Human Genome Science and SmithKline Beecham formed a new kind of consortium, extracting money from pharmaceutical companies worldwide to accelerate human genome studies now in exchange in exchange for exploitation rights in the future.

As we have pointed out previously, biotechnology is no longer the producer of “meta” goods: It has been amply demonstrated that biological products can be made like any others, be as effective as any others, and (in some places and for some products) be regulated like any others. Biotechnology has indeed become a broad, inclusive enterprise. What follows, then, tracks some of biotechnology’s recent research and business triumphs—and failures—as we at *Nature Biotechnology* have seen them unfold since our reincarnation in March of last year. ///

Pullout text by Philip Bernstein, Stephen Edgington, John Hodgson, Emma Johnson, and Andrew Marshall. Design by Renée Roberts.