The pure and the applied

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Biotechnology: The University-Industrial Complex. By Martin Kenney.
Yale University Press: 1986. Pp. 306. \$23.95, £22.50.

IN UNDER a decade, a whole new industry, capitalized with many billions of dollars, has come into being. Such is the rate of change in the late twentieth century. The product of 30 years of government support of basic biomedical research, biotechnology emerged from its incubator in the mid-1970s and quickly found its niche in the socio-economic structure of American and multi-national industry.

Mr Kenney chronicles, in intimate detail, the unfolding patterns of this development as determined by the extraordinary constraint that the basic knowledge — the blueprint for the industry — was almost exclusively to be found in the minds of university faculty. Industry had the production facilities and the marketing skills, but it was barren of the new expertise. The professorial start-up companies, the university-industry contracts, the limited partnerships in research and development, the equity purchases and licensing agreements by the multi-national corporations, all stemmed from this unprecedented circumstance.

Mr Kenney's book is repetitious and much of the material is redundant, but it does draw together a great deal of information about the establishment, financing and management of the new biotechnology companies. Also described are the subsequent contractual and fiscal interventions of the large chemical and pharmaceutical companies, as well as their successful efforts to purchase, in whole or in part, access to or even sole rights to the output of appropriate university departments, so as to acquire instant expertise and to ensure the economic future of the companies concerned.

Particular attention is paid to agricultural biotechnology, potentially the largest market. Organizational arrangements here were complicated because the land-grant universities, traditionally the source of agricultural research, have not been in the forefront of molecular biology, which is largely funded instead by the National Institutes of Health. Other universities, such as Harvard, MIT, Washington (St Louis) and Stanford, have consequently become the corporate partners for the development of plant molecular biology.

The effects on the academic world of these university-corporate relationships are examined, perhaps necessarily, in less satisfactory detail. Only sketchy anecdotal evidence is presented as to the impact

of corporate ties and proprietary information upon freedom of information in academia, upon the research and educational agendas, and upon the credibility of the universities as sources of disinterested judgement for society. In this regard, the author comments succinctly: "It is

Genentech makes splash on Wall Street

"One of the most spectacular market debuts in recent history." That was how the *Wall Street Journal* described the first day of public trading in shares in Genentech, the San Francisco company which has been among the leaders of those aggressively pursuing the commercial exploitation of recombinant DNA technology.

Initially the company had proposed to offer one million shares at between \$20 and \$30 each. But demand was so great that an initial price of \$35 was fixed for members of an underwriting syndicate through which the shares were made public last week. An extra 100,000 shares were made available, providing the company with an investment — once brokerage commissions had been deducted — of \$36 million.

During the day of frantic over-the-counter trading, in which more than half of the shares were resold by their original purchasers, the price rose at one point to \$89 a share, eventually dropping back to \$71. As the company has 7.5 million shares, this

Booming beginnings — a news story from Nature, October 1980.

quite remarkable how quickly doubts regarding safety receded once it appeared that profits could be made from this new technology". Similarly, Mr Kenney makes only limited reference to the questions of the propriety of the sequestration to private gain of knowledge gained at public expense, or the longer term consequences of "validating new areas of the natural world as private property" via the patent system.

The book is written from a capitalist-economic perspective, and does not cast a flattering light upon the molecular biology research community. Thus, on p.245 we find:

The biomedical funding system created an entire research structure based upon grantsmanship and the building of research empires... For the empires to keep functioning, products in the form of journal articles and prizes awarded are crucial. In this bitter competition research monies from any source are welcome because they could provide that competitive edge.

Mr Kenney is understanding, if not forgiving:

The professors who join companies have made rational choices, given the alternatives presented... Professors are also creatures of their social milieu. [This] is not to excuse the more egregious exploitation of students, the betrayal of the public trust, and even the theft that have occurred with creation of this industry.

He does not, however, relate these concerns to the responsibilities of universities to foster technology transfer — the transmission of the knowledge they have acquired with the aid of public funds to the industries wherein it may find useful application. Nor does he relate them to the increasing reliance, particularly in the United States, upon such high technology as the best means to maintain international competitiveness (which, in turn, affects the potential for university support). Such questions are particularly relevant to an industry by which, as the author states, "every production process that uses carbon-based materials" will be affected.

With the discovery that a previously arcane area of academic research suddenly had great market value, the traditional social relationships of the university became strained. Much of the recent development described here can be seen as an adaptation to that strain, but whether or not this is a transient adaptation remains to be seen.

It is only at the end of his book that Mr Kenney raises, suddenly and without answer, the most critical questions:

- The entire manner in which man conceptualizes interaction with the natural world will change as we begin to create new life forms — making "natural" selection a planned rather than a random process. Our world will be filled with genetically engineered organisms: if DNA is a "program" then these are "living robots". Ultimately we will need institutions to deal with the fact that we can engineer ourselves [p.246].

- Should the enormous power of transforming... life forms be transferred to groups merely seeking a return on investment [p.247]?

- To be fully serious, the debate must ask the questions of what can and cannot be privatized and done for profit. Industry cannot answer this question — the managers have a duty to maximize profit... This requirement for an unbiased debate raises the question of whether the universities and their professors are capable of carrying on this debate [p.246].

Biotechnology: The University-Industrial Complex bears upon questions of fundamental importance to science, academia and society, and provides valuable documentation of the magnitude of the actions already taken and the multitude of participants involved. But we must hope that someone will write the sequel, for which this is only the prologue. □

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