BOOK REVIEWS

COMPUTER CULTURE: THE SCIENTIFIC, INTELLECTUAL, AND SOCIAL IMPACT OF THE COMPUTER
Edited by Heinz R. Pagels
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Reviewed By MICHAEL STERN †

If lawyers are the shock troops of advanced industrial society, artificial intelligence ("AI") experts are its fifth column, insinuating their reductive models of human nature and the cognitive process into both the marketplace of ideas and the marketplace itself. *Computer Culture,* a collection of the papers presented at an April 1983 symposium funded by IBM under the aegis of the New York Academy of Sciences, is a particularly striking example of technology assessment as resignation. It is, however unwittingly, a ratification of humans' status as the objects of social change rather than its subjects, the victims of history rather than its makers.

The symposium participants are a stellar bunch — academics, consultants, and researchers from IBM, Bell Labs, and Xerox — including household names in operations research, computer science, philosophy and the AI circles. Their papers are crisp and informative surveys of the leading edges in their respective fields. The transcripts of the discussions which followed each panel are more fun to read, capturing the Mad Hatter's Tea Party feel of experts, monologists all, riding their hobbyhorses past each other at a dizzying clip. For the lawyer, *Computer Culture* is a useful tool for exploring how to think, and not to think, about the technologization of legal practice.

The topics discussed in *Computer Culture* include technical reports on design constraints for CPU architectures, studies on image synthesis and modeling biological structures, an account of computer-assisted negotiations, and freewheeling speculation about the implications of AI research. In his introduction, symposium organizer Heinz Pagels, a distinguished physicist and historian of science, explains the eclectic range

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of panelists as the result of trying to select "the leaders of the computer revolution" when there is still little consensus about who they are or exactly what they are leading.[1] Nevertheless, there is an implicit consensus about the topic at hand.

This consensus is suggested in the subtitle of *Computer Culture*. The "computer" is defined as an autonomous source of change which will "impact" society, the standard cause-and-effect model of technological determinism. The alternative notion that "computer culture" is an aspect of technology as a way of life and a form of consciousness, a web of human practices and values which both constructs and is a construction of its members, is largely ignored. The panelists who do discuss technological innovation as the product of human choices are mostly shoved off into the same corner on the same panel.[2]

Most of the speculation about the role of computers in daily life has the same hyperbolic tone as the papers by Edward Feigenbaum, Stanford professor and AI entrepreneur, and his colleagues.[3] Feigenbaum sees himself as the Henry Ford of what he calls "knowledge engineering," or the attempt to mass produce canned domains of "expert" understanding for large corporate consumers of ideas. Just imagine the money to be saved if complex work experience no longer need be painstakingly acquired by individual human beings on the job, but could be modeled and stored for repeated use by those innocent of knowledge!

Feigenbaum's model for this process is MYCIN, a medical diagnosis program developed at Stanford, which uses if-then and weak/strong implication rules to generate diagnosis and recommend treatments for infectious diseases.[4] Feigenbaum acknowledges that this method of producing "expert" inferences from a database has limitations, but not inherent ones. Although what experts know is ordinarily not something they can express as a formal set of rules operating on a finite domain, Feigenbaum emphasizes that heuristic knowledge "can be extracted by a careful, painstaking analysis by . . . a knowledge engineer, operating in the context of a large number of highly specific performance problems."[5] From such software acorns will grow vast artificial intelligences. "I suspect that we will eventually stand before our intelligent machines the way our ancestors stood before the cereal crop: in awe, in pleasure, in reverence, and in a certain amount of fear,"[6] rhapsodizes Pamela

1. COMPUTER CULTURE: THE SCIENTIFIC, INTELLECTUAL, AND SOCIAL IMPACT OF THE COMPUTER ix (H. Pagels ed. 1984).
2. *See, e.g., id.* at 76-90 (Harley Shaiken and Seymour Melman discussing "Computers and the Shift in the Work Force").
3. *Id.* at 91-128.
4. *Id.* at 94-98.
5. *Id.* at 101.
6. *Id.* at 113.

McCorduck, a panelist and co-author with Feigenbaum of *The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World*.[7]

What is misleading about Feigenbaum's account of MYCIN and its progeny is his leap from the carefully-tailored microworlds in which these systems perform to the complex, unstructured world of human practice. Expert systems apply the logic of games to situations which are gamelike in only some respects, often respects which are not the most important. MYCIN deals with the quantitative results of blood tests, not with the qualitative reality of doctoring patients. Most activities of doctors cannot be reduced to a logically formalized domain of discrete facts manipulable only by predefined rules.

What AI systems lack, as Hubert Dreyfus and John McCarthy point out in their comments on the AI papers, is common sense: the ability to operate in the specific context envisioned by the actors who created them.[8] If you tell MYCIN that a patient's tests reveal the presence of cholera bacteria, it will recommend a two-week course of tetracycline for treatment. That's fine, but only as far as the program goes. The antibiotic will kill the bacteria, but it won't save the patient who will die shortly of untreated diarrhea and other symptoms.[9] Different users need to know different things for different purposes, which is precisely the context-dependent, non-rule bound reasoning AI by definition cannot perform.

Moreover, "knowledge engineering" in the forms envisioned by Feigenbaum & Company will reinforce rather than transform current modes of domination and alienation in the workplace. The forms they envision are a sort of "electronic Taylorism," segmenting intellectual production into optimized, automated modules executed by isolated workers whose output is planned and integrated at higher levels of management, just as current factory production systems use workers as robot operators of machine tools.[10]

Only two papers, by Harley Shaiken of MIT and Seymour Melman of Columbia University, explore the implications of automation in the office and factory with concrete examples of present practice instead of the usual AI rhetoric of future promise.[11] The two papers were given at a separate panel ("Computers and the Shift in the Work Force") consisting only of Shaiken and Melman, a classic example of preaching to the

7. P. McCORDUCK & E. FEIGENBAUM, THE FIFTH GENERATION: ARTIFICIAL INTELLIGENCE AND JAPAN'S COMPUTER CHALLENGE TO THE WORLD (1983).

8. COMPUTER CULTURE, *supra* note 1, at 129-160.

9. *Id.* at 131.

10. *Id.* at 79-82.

11. *Id.* at 76-90.

converted, and an ironic example of how the mainstream participants in the conference ignored conceptual alternatives to technological determinism.

Both Shaiken and Melman argue that the "de-skilling" of human workers through automation has led to complex top-down production processes increasingly vulnerable to failure. Computer-integrated manufacturing offers a series of choices — either creating more "idiot-proof" jobs for workers preconceived as idiots (in a workplace dedicated to producing not only specific goods but a specific form of social control), or of creating more opportunities for more rounded human productivity.

One example should suffice to illustrate this notion. A computer-aided design ("CAD") workstation can be linked to a machine tool in two ways. In the first, an engineer at a remote location can design a part on the workstation and download instructions to the programmable tool. The machinist's job is to watch the machine and stop it if it malfunctions. The results are that management control is maximized, worker's skill is minimized, and stress levels rise since high psychological demands, such as attentiveness to boring routine coupled with little decision-making authority, generate high levels of tension. In the second method, the machinist has access to the workstation from the factory floor, which connects her to the plant-wide production process and enables her to contribute to the design and making of the part based on her experiences. Results of this alternative, at least in theory, are more worker autonomy, higher productivity, and less stress.[12]

Neither of these approaches to automation is particularly revolutionary. The latter simply recognizes the choices embedded in technology as a way of life rather than covering them up. Melman's and Shaiken's ways of thinking about technological innovation are useful correctives whenever the purportedly "inevitable" consequences of computerizing the practice of law rear their undialectical heads, from blind dependence on the use of expert systems as drafting tools to the tracking of how much time associates spend in the washroom.

Computer Culture as a whole, however, is a good example of technological boosterism as a form of religious belief. As Langdon Winner suggests in *The Whale and the Reactor*,[13] technological romantics like the AI entrepreneurs are inheritors of the 19th century faith that material abundance through technology in itself guarantees freedom and democracy, with information and services simply replacing manufactured

12. *Id.* at 78-82.

13. L. WINNER, THE WHALE AND THE REACTOR: A SEARCH FOR LIMITS IN AN AGE OF HIGH TECHNOLOGY (1986).

goods in the cornucopia. But technology is not simply a means of human fulfillment: it is the very practice of being human. Technological change must be recognized as a means by which individuals can make choices that affect human culture and behavior, rather than a form of second nature to which we must submit. Unhappily, there is little in the work of current AI gurus to suggest that computers are the key to the iron cage of rationalization and bureaucratization in which we live rather than yet another set of bars.

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BROKEN CODE: THE EXPLOITATION OF DNA
By Marc Lappé
Published by Sierra Club Books, San Francisco, 1984
Pp. xiii, 354; $17.95.

Reviewed By KENNETH FINNEY †

INTRODUCTION

Set in a chemist's laboratory with pale liquids alive in Ehrlenmeyer flasks and a dog-eared copy of *Wealth and the Accumulation of Capital* on the lab bench, *Broken Code* seeks to clarify the maniacally complex business of genetic engineering. The title, *Broken Code,* is intended to introduce the two subjects of the book: the breaking of the genetic code which is the basis of the biotechnology industry, and the author's belief that the social code has also been broken by this new industry. Marc Lappé weaves these science and policy topics together to try to show that the social responsibilities of this new industry are defined by its unique nature.

The emphasis of *Broken Code* on the principles of genetic engineering as well as on the details of product development make the book an

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excellent primer for individuals curious about biotechnology. The author's goal, however, is to provoke thought about the future direction of biotechnology research and development. Lappé argues that the biotechnology industry's origin in public research institutions, its growth in a business environment unfettered by public control, and its phenomenal potential to serve human needs impose on it a high degree of social responsibility in choosing and developing new products. Lappé concludes that this responsibility is not being met. While the book is successful in raising questions about the products of biotechnology and whether the public is getting all that it should from this new source of goods, *Broken Code* is deficient in that it does not provide the basis for answering the questions it raises.

I. A "GOLDEN AGE" FOR BIOTECHNOLOGY

Broken Code contrasts the current marketing of the products of genetic engineering with the potential of what could be termed "appropriate biotechnology." Lappé begins by documenting the growth and the potential positive social impact of the biotechnology industry. His summary coverage of the industry tells us that more than one hundred of the Fortune 500 companies have made substantial investments in genetic engineering firms. Over 2500 companies world-wide are exploring genetic engineering techniques for the production of commercial products.[1] After describing the scientific basis of biotechnology, Lappé offers his assessment of the industry's promising capability to produce new products and to make organisms function in new and profitable ways.

What Lappé sees missing from this golden age of biotechnology is a sense of corporate responsibility. In one section of *Broken Code,* after describing the third world affliction with malaria, Lappé details Genentech's decision not to assist the World Health Organization in the development of a malaria vaccine. Genentech's Vice President for Research stated that "it seemed apparent that the development of a malaria vaccine would not be compatible with Genentech's business strategy."[2] Elsewhere, Lappé comments on the recent emergence of a "junk biotechnology" industry in which manufacturers of snacks, food additives and fragrances are using recombinant DNA products to facilitate production. "Nabisco and other major producers of bakery products see a particularly rich opportunity in using rDNA to make artificial fragrances that mimic the smell of fresh baked goods."[3] To Lappé, such product development decisions are examples of a good thing gone bad.

1. M. LAPPE, BROKEN CODE: THE EXPLOITATION OF DNA 6 (1984).
2. *Id.* at 250.
3. *Id.* at 245.

Where does the responsibility lie for the inappropriate product development strategies of the biotechnology industry? Lappé blames the influence of short-term investors and the concomitant short-term marketing strategies of businesses for driving investments away from those sectors that are "in the public interest."[4] To Lappé, the early days of biotechnology, characterized by considerable self-regulation and concern for social responsibility on the part of the technology's founders, have been followed by a period of intense profit-driven expansion. An observation by University of California, Berkeley microbiologist Leon Wofsy epitomizes Lappé's point of view: "The actual shaping of the 'biofuture' seems to be the exclusive province of the marketplace."[5]

The cost to the public of this state of affairs, Lappé argues, is the lost opportunity to use biotechnology for important long-term, low-profit product development. As an example, he cites the opportunity to use recombinant DNA technologies to vastly improve cholera vaccines. Commenting on the genetic engineering technique which could make the improved vaccine possible, the editor of the *British Journal of Hospital Medicine* stated that "the area concerned may not be the most glamorous but the repercussions [of development] could be of momentous importance."[6] Lappé concludes that the technique's non-glamorous and low-profit character is the reason only one commercial biotechnology company is conducting any substantial research on cholera vaccines despite their vast public health potential.[7]

II. AN INDUSTRY OBLIGATION TO THE PUBLIC WELFARE

In a round-about and deferential fashion, Lappé argues that companies and entrepreneurs that rely on recombinant DNA technology have a special obligation to develop products which provide the greatest good to the people of the world, not solely the greatest profit to investors. Lappé admits that the standard of product development that he is suggesting for the biotechnology industry is higher than for other industrial sectors of the economy. He acknowledges that Genentech and other biotechnology firms are simply responding to market forces and pursuing the widely accepted industry goal of obtaining the highest level of return on research investments. Nevertheless, Lappé presents three arguments in support of the view that the biotechnology industry should

4. *Id.* at 273.
5. *Id.* at 8 (quoting Wofsy, *The Life and Sciences of the Public: Is the New Biology Too Important to Be Left to the Entrepreneurs?*, POL. AND LIFE SCI., August 1984, at 65-68).
6. *Id.* at 86 (quoting *Gene Manipulation*, 29 BRIT. J. OF MED. 389 (1983)).
7. *Id.* at 87.

have a higher standard than other industries to promote the common good.[8]

First, Lappé argues that public monies funded the early research which formed the foundation of the biotechnology industry, and therefore the public is entitled to a just return on its investment. He states that the National Institutes of Health ("NIH") and others recognize that almost all the techniques for creating the first recombinant DNA were developed with unprecedented financial and technical support from public tax dollars and public institutions.[9] Basic discoveries, and in some cases prototypical cell cultures, were taken directly from public research laboratories to private commercial institutions.[10] This record of public support therefore entitles the public to benefit directly from the technology. The needs of the public deserve equal standing with the interests of current commercial investors.

Second, Lappé argues that the industry has formed a covenant with the public to use biotechnology in the public interest. Early advocates and later benefactors of biotechnology testified that their work was developed to serve the public good.[11] Some stated that this public benefit was facilitated by allowing the industry to grow unhampered by public control.[12] Progenitors of important techniques justified their freedom from governmental regulation on the promise that public benefits would accrue from their work.[13] By inducing the public to refrain from regulation, the industry has created for itself the obligation to serve the public good.

Finally, recombinant DNA technology presents an unprecedented opportunity to benefit humanity. The potential use of biotechnology to alleviate disease and hunger creates for the industry a moral obligation to provide such benefits. Lappé notes that unfortunately much of the research and product development currently proceeds without serious consideration of the social goals that could be served.[14] To deny these benefits to the public for the sole reason that greater returns on investment are possible from the development and production of "junk biotechnology" places the industry in a moral bind.[15] The solution, according to Lappé, is for the industry to give greater weight to the needs of the public in product research and development.

8. *Id.* at 265-72.
9. *Id.* at 269-70.
10. *Id.* at 8.
11. *Id.* at 270.
12. *Id.* at 271.
13. *Id.* at 8.
14. *Id.* at 270.
15. *Id.*

In making these three arguments, Lappé does not contend that they are sufficient to form a *legal* basis for imposing a higher standard of care on the biotechnology industry. He instead presents ethical rationales which he believes should be implemented by policymakers or to which the industry should voluntarily respond. Unfortunately, very little else is offered in *Broken Code* to substantiate these arguments. The debate Lappé hopes to foster over the direction of biotechnology therefore depends solely on the strength of his proposition that the industry has a higher social obligation. Lappé's decision not to present more information in this regard frustrates the effectiveness of his book. He appears to recognize the doubts his proposition leaves in the mind of the reader by rhetorically asking "[W]hy, you may properly inquire, should this industry be different from any other?"[16] Unfortunately, he does not adequately answer his own question.

Readers of *Broken Code* are left to consider for themselves the biotechnology industry's obligation to the public interest. In response to the proposition that the public funded the early recombinant DNA research and therefore should have some sort of ownership interest in the foundational patents of the technology, the reader is left asking, "Which patents? How much public money?" To the proposition that the industry made a promise to use the technology in the public interest, the reader is forced to ask, "Who promised what to whom?"

III. OPPORTUNITIES FOR "APPROPRIATE BIOTECHNOLOGY"

Rather than explaining why a higher obligation binds the biotechnology industry, Lappé relies on his presentation of the useful things biotechnology *could* do for the public to convince the reader of what the industry *should* do. Yet, it is difficult to distinguish the opportunities Lappé describes from similar opportunities available to many other types of industries, and thus it remains difficult to accept the premise that the biotechnology industry alone should be held to a higher standard. Despite this criticism of Lappé's approach, his discussion of the industry's opportunities for serving the public interest is the strongest part of the book.

Broken Code focuses on three areas in which the biotechnology industry could act to improve its contribution to the public. First, the industry could improve the choice of products it develops. Lappé's principal recommendation in this regard is that the health needs of developing countries deserve considerably greater attention than they currently

16. *Id.* at 8.

receive. Lappé also discusses appropriate safeguards for products intended for widespread environmental release, as well as the abstention from research on products which have weapons potential. Second, the industry should promote more effective scientific inquiry by limiting the impact of the commercialization of biotechnology on the free transfer of information among researchers. Third, Lappé discusses the need to address social problems, such as genetic discrimination, brought about by the technology itself.

A. Product Development

Lappé's most forceful argument is that the health objectives identified by international agencies such as the United Nations and the World Health Organization should, in large part, govern the agenda of biotechnology product development.[17] He charges that biotechnology firms choose geographically and socially limited health products such as insulin, interferon and human growth hormone rather than emphasizing the development and marketing of products which respond to long-term world health needs.[18] In the indirect fashion which is typical of his book, Lappé concludes that "in view of the tremendous health need . . . the absence of major investment capital in [the prevention of these third world diseases] is still difficult to justify."[19]

Once the disparity between the causes of disease worldwide and the development of biotechnology health products has been illustrated, it is difficult to challenge the good sense of Lappé's suggestion. But how is such a change in priority to be brought about? "In the absence of public input regarding the priorities that industry should follow," Lappé states, "it is highly likely that investments will continue to be made that are proportional to economic gains and not necessarily to public benefit."[20] While public input is his answer, this raises questions concerning exactly what public input consists of and what effects such input might have. Is malaria the choice the American public would make for the focus of biotechnology? Can investors in the relatively high risk area of biotechnology be convinced through public input to support malaria vaccine research and development when more profitable opportunities apparently exist elsewhere? Can the industry as a whole be convinced to

17. *Id.* at 78-83. The World Health Organization ("WHO") considers one category of disease, bacteria-caused enteric diseases such as dysenteries, cholera, typhoid fever, and amoebic dysentery, responsible for 80% of illness worldwide. WHO considers parasitic diseases such as malaria, leishmaniasis and river blindness to be the next greatest health priority. *Id.* at 80-81.

18. *Id.* at 83-84.

19. *Id.* at 83.

20. *Id.* at 253.

devote, for instance, five percent of its resources to combat malaria? Should the government compel industry by regulation to spend time and money on an improved vaccine?

To support his model of government as the source and instrument of public input, Lappé cites the comments of those who suggest that it is government's responsibility to guide the benefits of biotechnology so that they are shared equitably. For example, government could ensure that small farmers are not disadvantaged by being denied access to new strains of genetically engineered seed stocks.[21] The sanguine view Lappé holds of the potential impact of public participation on businesses' attention to the needs of developing countries may be accurate, but one suspects it is overstated. It is more probable that public oversight would only rarely ensure such altruistic behavior by profit-seeking firms. For instance, Lappé asserts that the harm caused to sugar-producing economies by the development of biotechnology-assisted production of sugar substitutes could be avoided by public scrutiny of product development.[22] This assertion is not particularly believable, however.

Closer to home, and therefore perhaps more likely to be influenced by public participation, are Lappé's suggestions regarding the development and regulation of new organisms for release into the environment. Lappé points out that many of the future applications of biotechnology involve the planned release of recombinant organisms. Such releases of new plants or bacteria will be used primarily to improve agricultural products as well as for pollution control.[23] These recombinant products pose unknown and potentially serious adverse environmental effects.

There has been considerable debate recently in the federal courts and in the Environmental Protection Agency over the adequacy of current environmental safeguards for the intentional release of recombinant organisms. Lappé points out that there are significant gaps in federal regulation of recombinant organisms.[24] The debate has been fostered by the proposed release of "ice-minus" bacteria in a test plot of strawberries by University of California researchers. Unlike naturally occurring bacteria, the shape of the ice-minus bacteria inhibits the

21. *Id.* at 256. If the government fails to ensure that small and medium sized farms have access to the benefits of biotechnology through a fundamental restructuring of the nation's farm policy, there is likely to be a drastic reduction in the number of these farms surviving by the year 2000. Schneider, *Report Says Biotechnology Is No Boon to Small Farms,* N.Y. Times, Mar. 18, 1986, at 1, 12, col. 1. (citing OFFICE OF TECHNOLOGY ASSESSMENT, TECHNOLOGY, PUBLIC POLICY AND THE CHANGING STRUCTURE OF AMERICAN AGRICULTURE (1986)).

22. *Id.* at 251.

23. *See id.* at chs. 6, 7.

24. *Id.* at 275.

formation of frost on strawberries. In a federal suit, release of bacteria was preliminarily enjoined because the NIH had failed to issue an environmental impact statement when its guidelines were revised to permit such releases.[25] Since that decision, the EPA has prepared an environmental assessment which provides a basis for such releases to go forward.

Lappé suggests two interesting measures for preventing harm from the environmental release of recombinant organisms. First, the biotechnology industry should require simulation tests of the harmfulness, spread, and niche occupancy of genetically engineered organisms before their release. Second, the industry should ensure that newly introduced species are genetically programmed for limited survival and with specific sensitivity to antibiotics or pesticides so that unanticipated spread can be contained, and contain genetic fingerprints that will permit monitoring of the spread of an organism or its genetic elements.[26] Beyond the development of products with inherent environmental safeguards, Lappé offers his assessments of which new organisms are most appropriate for product development. For example, the development of disease resistant plants "appears to be an area where the prospects for engineering will be less likely to have adverse impacts and more value."[27]

In his final major comment on the issue of product development, Lappé documents corporate and academic involvement in recombinant-DNA weapons research. Lappé believes that it is paradoxical "that critics have paid more attention to inadvertently produced biohazards than to intentionally generated ones."[28] He reports that since the 1982 relaxation of the NIH Guidelines prohibiting the isolation of gene sequences coding for extremely potent toxins, there has been a flood of research on such deadly substances.[29] Much of this research falls into a disturbing gray area of knowledge which is capable of leading to either the prevention *or* promotion of disease.[30] This dual aspect of some genetic engineering research carries over into the semantics of military operations. The United States Department of Defense ("DOD") insists that it engages in defensive, not offensive, biological warfare research.[31] To Lappé, such distinctions fall flat. He observes that DOD's interpretation of the international Biological Weapons Convention creates significant

25. Foundation on Economic Trends v. Heckler, 587 F. Supp. 753 (D.D.C. 1984), *aff'd in part and vacated in part*, 756 F.2d 143 (D.C. Cir. 1985).
26. M. LAPPE, *supra* note 1, at 180-81.
27. *Id.* at 146.
28. *Id.* at 203.
29. *Id.* at 207.
30. *Id.*
31. *Id.* at 218.

loopholes that encourage "defensive" research which may be rapidly or secretly translated into offensive weapons.[32]

Lappé again returns to his theme that it is the academic and corporate biotechnology communities which have the obligation to steer the technology away from weapons research. As spokespersons for a technology, corporate and academic leaders could effectively focus international attention on biological weapons proliferation. He specifically recommends that all investigators and their parent organizations decline any DOD contracts for recombinant DNA work that augment any military capability in violation of law or convention.[33] On a national level, he recommends that Congress withhold funds from any recombinant DNA study that is not directed to public health or peaceful purposes, in keeping with existing treaty commitments.[34]

These recommendations offer the reader a concrete response to the problem of international weapons proliferation, but Lappé presents the issue without considering why this industry alone has an obligation to restrain itself. Lappé misses an opportunity to address the larger issue of weapons proliferation by treating the biotechnology industry's contribution to weapons research in isolation.

B. Free Transfer of Information

Moving outside the realm of product development, *Broken Code* looks at the impact of economic ties between university researchers and biotechnology firms. Lappé sees the development of long-standing contractual relations between the two as having a distinct chilling effect on free scientific inquiry and publication. He cites thirty-two joint university/industrial research projects[35] and discusses the concomitant problems involved in getting researchers to publish their findings prior to patent approval.[36] He concludes that existing law encourages researchers not to disclose new information, but instead to treat it as a trade secret.[37] Lappé's solution to this tendency toward secret university research is to "[r]everse the decision to allow patenting of recombinant life forms and help make scientists aware of the potential conflicts they run when they contract with the private sector."[38]

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32. *Id.* at 222-23.
33. *Id.* at 237.
34. *Id.*
35. *Id.* at 300-04.
36. *Id.* at 279.
37. *Id.* at 279-80.
38. *Id.* at 281.

One wonders whether this brief treatment of the problems of preserving scientific freedom of inquiry is really very helpful. Reversing the decision to permit the patenting of recombinant life forms may do more to create an environment of secrecy than any other single act. As Lappé himself notes, the patent process serves to make knowledge available to the public while protecting the investments which motivated the discovery in the first place.[39] Without the protection offered by patents, inventors would be forced to rely on the trade secrecy of their work to protect investments. Such a situation would damage the free transfer of ideas more than the current pre-patent issuance delays now troubling investigators. There may be other good reasons for questioning the wisdom of permitting the patenting of life forms, but Lappé's reliance on a desire to preserve the freedom of scientific inquiry does not seem sound.

C. Biotechnology Induced Social Problems

Finally, Lappé seems to suggest that the biotechnology industry should anticipate and assume a major role in the resolution of social problems brought about by the technology itself. His primary examples are the new and difficult problems of discrimination and invasion of privacy created by biotechnologically based genetic testing to determine the likelihood of developing emphysema or heart disease.[40] In the hands of the government, employers or insurance companies, such information about the tendency to develop diseases could be abused. After raising this issue, Lappé suggests, "To prevent potential abuse of this provocative and potentially damaging information, further vigilance and perhaps regulation on the part of state and federal authorities appear essential."[41]

This advice confirms a comment made earlier about *Broken Code.* Lappé is apparently satisfied if his book succeeds in provoking questions about the products and the side effects of biotechnology. In this regard, he is eminently successful. However, in most instances he fails to make specific recommendations on how to address these problems. Such possibilities as government intervention in product development, voluntary industry screening of products, or the creation of socially responsible biotechnology investment funds are infrequently, if ever, discussed. The book leaves the reader feeling that just asking the questions was the easy part. The more difficult work has yet to be tackled.

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39. *Id.* at 279-80.
40. *Id.* at 113, 117-18.
41. *Id.* at 119.