JOHN MOORE AND THE COMMERCIALIZATION
OF BIOTECHNOLOGY:
BOON AND/OR BANE FOR THE UNIVERSITY?

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Nancy B. Benjamin
UH Law Center, J.D. 1987
4800 Calhoun
Houston, TX 77004

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JOHN MOORE AND THE COMMERCIALIZATION OF BIOTECHNOLOGY:
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Free enterprise and unfettered inquiry and debate, embodied institutionally in the corporation and the university, are cherished, fundamental values of American democracy. Nevertheless, a tension inherent between the two has been exacerbated in recent years. The university has long enjoyed special status and protection because of its function as "the marketplace of ideas", fostering in an atmosphere of openness and free expression to discover truth and to develop the accessible and thoughtful leaders essential to the nation's well-being. In the last decade, however, the phrase has taken on an ironic connotation; universities, both by choice and by need, to an unprecedented extent have imitated or collaborated with big business in seeking to capitalize on the results of their scientific research, a further erosion of their ivory-tower image. In particular, developments in biotechnology, which evolved directly from basic research, entice individual faculty members and their institutions with extraordinarily lucrative potential that may be realized in a remarkably short time.

Connections with profit-oriented, private corporations can enrich academic offerings; however, because proprietary activities, by their nature, must be secretive and competitive, the new linkages between business and the university pose threats to higher education's traditional purposes of discovering and disseminating a wide spectrum of knowledge and to its values of
open communication, academic freedom, and pure and fundamental, as opposed to applied and practical, research. Furthermore, they foreshadow inevitable modifications and compromises in the role of the university in a rapidly changing, complex modern world, if the university is to continue to meet critical national needs.

Pinpointing many of these concerns, a novel case presently pending in a California appellate court is attracting considerable attention, in part because of the significant repercussions it has for institutions of higher education and for society at large. John Moore, a leukemia patient whose spleen was removed in the course of standard therapy at the research hospital of the University of California at Los Angeles (UCLA), is suing his physician and a university researcher for proprietary rights to a cell line developed from his excised spleen tissue and patented by his doctor, allegedly without Moore's knowledge and consent. While confronting what has rapidly become a customary practice by universities of cashing in on the fruits of their research, the case, when viewed from a broad perspective, illuminates the very complex network of interdependent and competing values and policies affecting higher education today.

This paper will not focus upon the particular validity of Moore's multiple claims or California state law. Rather, by examining only the property issue raised by Moore's case in as wide a context as possible, this essay will attempt to delineate the changing role of the university, caught in a tug-of-war among interrelated but divergent interests in today's world. An
appropriate analogy, which provides the underlying structure of this study, is a comparison of Moore's lawsuit to a pebble thrown into a body of water. The series of concentric circles rippling outward represent increasingly broader social concerns raised by and affecting Moore's claim. (See Figure 1.) Beginning with an analysis of Moore's contention that an individual owns rights to his excised body tissue, this paper will explore existing law and competing policy considerations arising from and impacting upon the relationship of an individual patient and a university physician-investigator. From a wider perspective, the essay will discuss the university's difficulties in maintaining a viable scientific research program and the accommodations such an effort appears to involve, despite financial and other support from the federal government. Next, the goals and achievements of university science programs will be measured against the purposes of the university as a whole. Subsequently, the university's necessary and at times conflicting relationships to both the federal government and private industry and their effects on higher education will be discussed. Finally, this essay will consider the role of the university in meeting the nation's needs in a competitive world market. Only by comprehending the whole economic, legal, and equitable pie can one begin to evaluate the relative significance and justice of Moore's claim to a slice.
Proprietary Rights and the "Marketplace of Ideas", the University: Policy Considerations
JOHN MOORE AND INDIVIDUAL PATIENT RIGHTS

A. Background of Moore v. Regents of UCLA

Diagnosed in September, 1976 as having a rare form of cancer known as "hairy-cell" leukemia, John Moore sought a second opinion the following month from specialist Dr. David Golde, head of the Hematology-Oncology Division of UCLA Medical Center. Golde confirmed the diagnosis and recommended removal of the cancerous spleen, the standard treatment for the disease, as essential for Moore's survival. After signing a routine surgical consent form, Moore underwent a splenectomy on October 20, 1976. Over the course of the next seven years, he returned periodically for check-ups, at each of which, he alleges, large quantities of blood were withdrawn from his body. When Moore's personal finances were depleted, Golde, presumably from NIH grant money, paid Moore's travel expenses.

On an April 11, 1983 visit, Moore alleges that the hospital for the first time requested that he sign a consent form authorizing research, apparently related to his leukemia virus, on his blood before it was withdrawn; he complied. On his next visit in September, 1983, he was presented with a similar form requesting consent for research. Moore claims that he asked if his blood had any commercial value but was told it did not and that the consent form was a procedural formality of the hospital. Moore nevertheless indicated on the form this time that he would not grant the university research rights to his
body products. After he left, the hospital personnel contacted him several times in an effort to convince him to change his form. Suspicious, Moore sought legal counsel from a firm specializing in medical litigation.\(^{11}\)

Moore also asserts that he assumed that the research authorized by his signed consent form was for his personal medical benefit, and perhaps that of humanity in general, but not for the defendants' personal gain from exploitation of his cells.\(^{12}\) Although the defendants filed only general demurrers to all of Moore's complaints in state district court, this past summer in a letter to the editor of *Genetic Engineering News*, Golde explained his perception of the events, involving no bodily harm to, but only benefit for, Moore:

> The research we do not only helps society, but was also of direct benefit to Mr. Moore. From the Mo cell line we were able to diagnose his type of leukemia and also to isolate, for the first time, a virus referred to as HTLV-II. We informed Mr. Moore of the presence of the virus and appropriate follow-up research studies were done by us and by scientists at the National Institutes of Health to determine the nature of this virus and how it might affect him and his family.\(^{13}\)

The epidemiological study referred to included studies on his blood serum, which carried antibodies to the virus.
Moore contends that, through his attorneys' efforts, he learned for the first time that Golde and his co-inventor Shirley Quan had developed and patented the "Mo-Cell Line" (derived from "Moore"), U.S. Patent No. 4,438,032, from the apparently unique cells of his removed spleen without his knowledge or consent. The patent application was filed on January 30, 1981, and the patent, entitled "Unique T-Lymphocite Line and Products Derived Therefrom", was issued on March 20, 1984, with the inventors partially assigning rights to the Regents of the University of California, presumably in accordance with the institution's regulations. For most of this period, Golde continued to act as Moore's physician but, according to Moore, Golde never revealed the existence of the cell line or of the patent. Moore filed suit on September 11, 1984.

Moore asserts that, during the legal process of discovery, his attorney uncovered evidence that Golde had made a formal agreement for financial gain with a biogenetics company, Genentech, for commercial development of biologically valuable substances produced by the cell line. In addition, Moore claims that the University and Genetics Institute in 1981 entered into a collaborative agreement; the University would grant an exclusive license to the cell line in return for $500,000.00 and other benefits for Golde and UCLA. Additionally, Sandoz, Inc., a pharmaceutical company, was to market world-wide products of the cell line. One reporter claimed that Genetics Institute funded $330,000.00 of research in Golde's laboratory during the period when it was attempting to acquire the license. Simultaneously,
Golde contracted with Genetics Institute for only $750.00 to receive approximately two million dollars' worth of stock options, which Moore alleges that he exercised, in return for exclusive use of the cell line.19 Furthermore, the University of California's policy permits Golde and Quan to receive fifty percent of the royalties collected from the licensing.20

Moore insists that Golde never informed him of the research on or value of his "blood and bodily substances"21 and he requests, inter alia, restitution for the value of his contribution to the patent and for the commercial use of his cells.

Given the facts of this case, under existing law Moore has no established legal claim to property rights in his excised spleen, in the patent, or in commercial profits made from exclusive licensing agreements under the patent. In light of developing technology, of novel changes in the use and exploitation of human tissue that was once justifiably viewed as waste, but that has suddenly assumed a potentially great value, and of the policies underlying the doctrine of informed consent, however, this case of first impression does raise valid questions as to whether the law should be reexamined and modified to reach and equitably respond to the concerns raised by this suit.

B. Federal Regulations for Human-Subject Research

In regard to Moore's rights as an alleged research subject, in his challenge of the ownership rights in the Mo-Cell line,
Moore relies heavily but improperly upon the doctrine of informed consent, which is designed to protect a patient's well-being and his right to make decisions concerning his medical treatment. This body of law imposes a duty on physicians to disclose to patients risks, benefits, and alternative kinds of therapy. The doctrine has evolved judicially over the past thirty years. Within the last ten, however, the federal government has striven to clarify its bounds as well as to establish and codify guidelines for its use in clinical research.22

In 1974, Congress passed the National Research Act establishing the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research and provided for the development and promulgation of appropriate and stringent regulations. The Commission worked from 1974-1978, covering the time when Golde initially treated Moore. The Commission issued various reports and recommendations dealing with Institutional Review Boards (IRBs), which include both professional and lay members, for internal institutional review of proposed and on-going research, protection for pregnant women, fetuses, and prisoners, and "The Belmont Report", formally entitled "Ethical Principles and Guidelines for the Protection of Human Subjects of Research."23 The Department of Health and Human Services promulgated regulations based upon the Commission's recommendations in 1981. The updated versions are codified at 45 C.F.R. sections 46.101 et seq. (1985) and entitled, "Protection of Human Research Subjects."
Section 46.101(a) and (b)(5) expressly states that research activities involving pathological or diagnostic specimens, no longer considered part of the human subject, are exempt from regulation, including the requirement of informed consent, when they are funded in whole or in part by a grant from the Department of Health and Human Services, which includes the National Institutes of Health (NIH). The only exception would be if the investigator does not properly protect the privacy and identity of the source of the tissue. Golde's research funds came from the NIH and UCLA. The spleen was clearly a pathological specimen, used after removal by Golde in research approved by his institution's review board, as required under sections 46.103-46.112. Golde protected Moore's identity in accordance with customary procedures; it was Moore, himself, who exposed his personal involvement by filing his suit.24 Furthermore, as others have noted, when a patient chooses treatment at a research university's medical center, as Moore did, there is a substantial likelihood that excised pathological material will be studied.25

Moreover, human-subject research, according to section 46.102(f), involves intervention "performed for research purposes." Because the primary purpose of the splenectomy was therapeutic and not investigatory, development of the Mo-Cell line does not fall within the purview of the regulation's definition of human-subject research, nor is Moore considered to be a research subject. Therefore, informed consent for the study of the discarded material is not required under section 46.116,
as it would be for a research purpose. If Golde in 1983 was drawing Moore's blood specifically for research purposes, informed consent would be required, thus explaining the presentation of the forms to Moore.

Moore's case highlights the dangerously large gray area involving a wide spectrum of combined therapeutic-investigative work not reached by current regulations, as well as arbitrarily drawn lines. An important point is that had Moore been primarily a research subject, the outcome of his claims under existing law could be very different. Since this case was filed, a number of institutions have added a general waiver of commercial rights to products of research on human tissue to their consent forms. While such a statement may provide a liability defense, it clearly is inadequate to address the growing importance of the ownership issue underlying Moore's claim, due in large part to the radically changed value of human tissue.

C. Recognized Proprietary Rights to the Human Body

In addition to federal regulations regarding study of pathological specimens, there is a strong public policy against the commercial transfer of human organs and tissue, expressed in both the 1968 model Uniform Anatomical Gift Act, adopted in some version by all states and the District of Columbia, and the 1984 National Organ Transplant Act, 42 U.S.C.S. section 274(e) (Supp. 1986), permitting only voluntary donations of organs and tissues from living or dead bodies and prohibiting sale of human
parts as commodities. Public policies here are based upon a moral repugnance toward the idea of desperate people bargaining to buy or sell scarce and invaluable human materials, with the poor and the powerless losing out to the wealthy.

Nevertheless, arbitrary exceptions, semantically obscured by being characterized not as commodities but as "services", have been recognized by many state statutes for replenishable tissue such as blood, plasma, sperm for artificial insemination, urine, and skin. As a result, a thriving market has developed for these biological products to the extent that the integrity of the policy prohibiting sale of body parts is questionable as a double standard.

A noteworthy example of unique human biological material and of a healthy balance of interests relevant to the issues raised in the Moore case was recently reported in the New England Journal of Medicine. Ted Slavin was a victim of hemophilia and subsequently, because of numerous transfusions, of hepatitis B. As a result of testing in 1970 by the Hemophilia Society of patients for hepatitis B viral markers and high concentrations of antibodies for the purpose of advancing scientific knowledge about the disease, Slavin discovered that his blood had great commercial value. He began selling it to private commercial firms for up to ten dollars a milliliter and later formed his own successful company for locating and providing rare blood types. Slavin, however, donated his serum freely for research to the Fox Chase Cancer Center in Philadelphia through the aid of the NIH. There the serum was utilized to develop the radioimmunoassay
test, tissue fluorescence techniques, a vaccine against hepatitis B virus, and a method of preventing primary liver cancer.

In contrast to the "gift acts", common law traditionally and presently does not recognize a property right in a corpse, although quasi-property rights have been granted to relatives to allow for possession and burial of the body.\textsuperscript{31} Although common law also did not acknowledge the right of testators to donate their bodies irrevocably to medical use, in response to the needs and progress of medical science and organ transplantation, the Uniform Anatomical Gift Act and its progeny permit individuals to will any parts of their bodies as gifts upon death. This right, if unexercised by testators during their lives, can pass to their next of kin after death.\textsuperscript{32}

D. Patent Law and Moore's Claim

Patent law similarly offers no legal foundation for Moore's ownership claims.\textsuperscript{33} In a significant 1980 decision, \textit{Diamond v. Chakrabarty},\textsuperscript{34} the United States Supreme Court held that living, human-made micro-organisms are patentable subject matter under the 1952 Patent Act, 35 U.S.C. section 101, even though Congress did not foresee the development of biotechnology when it enacted the statute. Golde's cell line is a "nonnaturally occurring manufacture or composition of matter--a product of human ingenuity" with "the potential for significant utility."\textsuperscript{35} The decision paved the way for Golde and Quan's co-inventor patent application in 1981.
Under 35 U.S.C. section 111, the individual claiming the patent must be the inventor of the subject matter. Once a patent issues, it carries a strong presumption of validity and the patentee has exclusive rights to make, use, or sell the invention for a period of seventeen years (35 U.S.C. section 135). The policies behind granting this monopoly are to encourage technological development and to provide the public with information by requiring that in the patenting process the inventor disclose in the specification of his application the best way he knows to reproduce his invention.

To have a valid patent, the applicant(s) must be the sole inventor(s) of the invention (35 U.S.C. section 102[f]). The inventor is permitted to utilize "the services, ideas, and aid of others in the process of perfecting his invention without losing his right to a patent", as long as he is the one who perfects it. Moore was not involved in either the conception of the research or the reduction to practice of the immortal cell line, as required by 35 U.S.C. section 102(g) for participation in the inventorship of patentable subject matter.

E. Ownership of Disease

An additional twist to an already complicated ownership problem was raised by Golde. Perhaps the most valuable aspect of Moore's cells is their disease, a rare, now dormant, human leukemia virus identified at HTLV-II, which prompted the NIH to do an epidemiological study on Moore and his family. His body
has produced antibodies to the virus, and they are found in his blood serum. If it is the virus that causes the cells to produce the potentially valuable interferon and interleukin 2 observed in the cell line, the issue becomes, as Golde phrased it, "Do you own your disease?" This author has been unable to find any case or statutory law to answer this novel question.

F. Policy Considerations, University Research, and Moore's Claim

How would the university be affected by legal recognition of Moore's claims to a share of the cell line's profits? There are important public policy arguments against and for such a result. In terms of feasibility, allowing patients such proprietary rights creates considerable impediments to already costly research in universities. Granting such rights would vastly complicate and thereby have a chilling effect upon the university's immediate research program. (Wider implications for university research will be discussed later.) The vast majority of investigation does not lead to a marketable product, and the likelihood of a researcher's being able to predict that he will find one is very small. If one assumes that adequate new rules and valid consent forms, containing other than general waiver-of-rights clauses, could be drawn up, there are still many substantial barriers. First of all, should informed consent be required from all individuals whose body tissue is utilized in a study? Frequently hundreds and even thousands of individuals contribute toward the results of involved and lengthy
investigations. How should the researcher determine what each individual's share should be? Should tissue donors be allowed to bargain for the size of their allocations? On what bases? What if, in the course of experimentation with various methods, the "lucky" donors are unidentifiable at the time of final discovery? How long must records be kept, given the fact that many projects extend for decades? Since scientific endeavors are founded on the work of predecessors, how far backward or forward should proprietary rights extend? Because investigators frequently distribute tissues among colleagues at other institutions, how can adequate documentation be accomplished to protect individual contributions? Should tissue contributors be permitted to influence the direction of the research? At what point in the study should the researcher disclose potential profits: when they are certain?; when they are likely?; and/or when they are possible? Is it also necessary to negotiate with family members and heirs?

While the task may be a formidable one, law traditionally has drawn bright lines in murky areas when the social need for guidance and for equity is great enough. Similarly, insurance companies have acceptably placed monetary values on injuries, lost body parts, and even lost lives.

Thomas H. Murray, Ph.D., associate professor of ethics and public policy at the University of Texas Medical Branch in Galveston, has been a frequent and outspoken proponent for the university's recognition of obligations to public good and of people's ethical rights in their body tissue, as well as a critic
of scientists who privately line their own pockets with profits ultimately dependent upon an individual's "gift of life." 42

Murray argues that the body and its components are intrinsic to our concept of human dignity and should be viewed not as property or as surplus, but as gifts donated for the common good and not for the undue monetary gain of investigators. Murray warns that the greatest danger threatened by both the commercialization of biotechnology and suits for individual rights in body parts and in profits derived from them is that the public trust in scientific research will be undermined by images of greedy scientists economically exploiting these bodily gifts to research as commodities. The result inevitably will be either prevalent expectations of restitution or an increasing refusal of people to contribute the money or body tissue that together are vital to all university, publicly-funded, research and training programs for future scientists, to everyone's health, and to the national economy. Altruism is a socially desirable virtue that should be encouraged. Additionally, in an atmosphere of distrust, litigation is likely to increase. The university will suffer the costs of maintaining suits or settling to avoid them, as well as of expensive insurance, while its endowment would be a deep-pocket target for plaintiffs. 43

In response to the issue of the feasibility of research-contributors' consent to and share in commercial benefits of biotechnological discoveries, Murray offers workable guidelines for determining when such rights might be recognized. He suggests weighing several factors: (1) were any terms of the
patient's "contribution" express or implied (e.g., expectations that the tissue would be used for his or the public's good and not for the personal gain of the investigator)?; (2) how similar is the "invention" to the original gift upon which it was based? and (3) was the gift unique, or could a similar contribution from anyone or from a large group of people have sufficed for the same purpose? 44

To preserve the dignity of the human body and to protect public generosity and gift-giving to science, Murray propounds ethical and prudent compromises. He suggests providing other-than-economic returns for public-spirited gifts of tissue donated for the public good and placing limitations on personal acquisitions by investigators and corporations. For example, he proposes that the biotechnology industry found an organization to which each of its companies would donate a small but equal percentage of their profits. These monies would then be used to subsidize publicly needed but commercially unprofitable research and development projects like orphan drugs or vaccines against uncommon but impairing diseases; to educate the public in the value of the new field of biogenetics; and to fund research in related social and ethical issues. 45 As Murray astutely observes, "At the heart of the matter is whether the gift relationship between science and the public can continue, or whether caveat donor becomes the new rule... If public trust, esteem, and generosity are important to [scientists], then a little generosity in turn is a small price to pay for sustaining a mutually satisfying relationship." 46
Finally, the wider implications of the already broad social policy underlying the report on informed consent of the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research that valid consent is "a process of shared decision making based upon mutual respect and participation" must be considered in drawing any conclusions and guidelines for this newly and, indeed, explosively developing area of concern in a democratic nation.47

Dr. Golde and Investigator Incentives and Rights

Today it appears that to remain a viable and effective force in society, the university must tender patenting and marketing profits to compete with industry for competent scientists. Through patenting, the university can provide research faculty with incentives to innovative work by protecting their results and therefore their academic credentials. By extending to faculty personal benefits from commercialization of scientific research, higher education entices creative individuals to remain within academia despite competing and far more lucrative offers for positions with private industry. In a society that more frequently than not measures success by the dollar, patenting and licensing of inventions provide benefits for both public and private institutions and for their investigators. However, they have reached such proportions in the field of biotechnology as to raise questions as to the point at which an investigator should be required to disclose to both his patient-source of biological
materials and to his university-employer the extent of his economic interests in his research.\textsuperscript{48}

In the 1960's the NIH did not permit investigators to patent the results of government-sponsored research.\textsuperscript{49} However, the government gradually realized that universities were far more effective in licensing the few patents permitted to them under waivers or under the Institutional Patent Agreement made with a few nonprofit grantees of funds from the Department of Health, Education, and Welfare and the National Science Foundation. Mainly through licensing, patented discoveries are efficiently transformed into useful products, thereby benefitting the consuming public.\textsuperscript{50} In 1979 the federal government had licensed fewer than four per cent of the approximately 30,000 patents in its files, as compared to a few universities' records of successful licensing of two-thirds of their patents.\textsuperscript{51} Furthermore, federal taxes on the sales of patented products provide revenue for funding new basic research at universities.\textsuperscript{52}

As a result, in 1980, Congress passed the Patent and Trademark Laws Amendments\textsuperscript{53}, which permit all universities and small businesses to patent the products of government-funded research, thus further explaining Golde's 1981 patent application. The government, which retains a no-royalty, nonexclusive license, reserved "march-in" rights to transfer patents to itself if licensing and marketing are proceeding too slowly and inserted a pay-back clause for reimbursement of its support money where anything from profits to a windfall resulted from the commercialization. In addition, repositories, such as
the American Type Culture Collection (ATCC) in Rockville, Maryland, were established; the NIH requires samples of all patented microorganisms and cell lines be kept in them to ensure that they will be accessible for education, research, and noncommercial uses, as well as to disclose the nature of the invention in a manner that the patent's written specification cannot achieve. Golde's Mo-Cell line is available for nonprofit research from the ATTC. Thus federal policy solidly supports a university's and academic inventor's patenting and profiting from publicly funded research activities.

While patent title to property can provide academic recognition for the inventor, it is mainly because of the potential wealth involved that these ownership rights have become the source of intense litigation in this very young field. Present hostilities may be a harbinger of increasing future discord that threatens the long-cherished free accessibility and exchange of academic discoveries, thus impeding the scientific progress of individual investigators as well as of academia and the public in general. In fact, Golde's alleged conduct in the Moore controversy may have been motivated by an earlier cell-line dispute in which he was involved.

Several years before patenting the Mo-Cell line, Golde and a colleague at UCLA, using NIH funds, successfully cultured a cell line from a patient with acute myelogenous leukemia. Golde sent the cell line to an NIH investigator, Robert Gallo, who realized that it was releasing interferon. Gallo sent some of the cells to Sidney Pestka's laboratory at the Roche Institute of Molecular
Biology, a subsidiary of a Swiss pharmaceutical company, Hoffman La-Roche. All were customary exchanges among members of the scientific research community. Pestka then manipulated the cell line to cause vastly increased production of interferon so that synthesis of large quantities of the natural anti-viral protein became possible. Hoffman La-Roche, collaborating with Genentech, immediately filed for a patent on the discoveries. Golde claimed unauthorized use of his cell line. The drug company filed suit, claiming that UCLA was interfering with its research; UCLA countersued over ownership rights and royalties. The case was settled out of court in 1983, with the agreement permitting the drug company the right to use the cell line in return for an undisclosed payment to UCLA. There have been similar problems and suits, with an overall obvious dampening effect upon the traditionally free communication and exchange of research materials among scientists.

In addition to proprietary rights through patents, universities provide investigators with remarkably open-ended opportunities for personal financial gain, only partially justifiable by the institutions' need to retain their services. Generally universities permit inventors to pocket from fifteen to fifty per cent of any earned royalties, although they may be required to assign the patent rights to their university. The decision depends upon each university's policy; at the University of California, inventors like Golde and Quan are generously permitted a fifty per cent share of the royalties. Normally a university reinvests its share in educational and research
programs, thereby benefitting the public. At Stanford University, for example, out-of-pocket costs are skimmed off the royalties first for maintaining its on-campus licensing program, attorneys' fees, and costs, and then one-third of the remaining money goes to the patentee, one-third to his school within the university (which is still of indirect benefit to the patentee, especially when he controls the account), and one-third to the university's general research and educational effort. Some investigators donate their personal shares to the university, but such an act of generosity is not required.

Another common method of industry's "compensating" the researcher not just for marketable results but even for ongoing efforts is by awarding him with stock or stock options in the biotechnology company given or seeking a future exclusive license, as in the case of Dr. Golde. Dr. George Rathmann, President and CEO of Amgen Corporation, estimated last year that eighty per cent of the biotechnological firms have provided university-affiliated investigators with equity interests in their companies. He explains that since many of these formed only recently with minimal cash, they must attract "world-class scientists" by stock transfers that provide opportunity for substantial benefits in the future. However, the greater the percentage of ownership an academic may acquire in such a company, the greater the potential for conflicts of interest if he is also directing research at a university.
The University and Scientific Research

Mere greed is not the reason why the university and its investigators have become entrepreneurs in applied research and its profits. While always valuing autonomy, in recent years because of changing circumstances, the university has had to compromise some of its goals and to learn to juggle its interests with those of industry and government in order to maintain a viable science program.

In the early years of the twentieth century, private wealthy individuals and foundations supported what was then fledgling scientific research in American universities. There were some financial links between institutions of higher education and industry in aeronautics, agriculture, and chemistry. However, World War II radically changed the relationship of university research to the outside community. Not only did the war effort result in collaborations among industry, government, and university scientists that produced discoveries like radar, penicillin, synthetic rubber, and nuclear energy, but it opened a big door to increasing federal funding of university science programs during the 1950's and '60's. Sputnik only spurred on federal commitment to the university as a foundation for the nation's progress in science and its position in the world. During these halcyon days, university-industry linkages deteriorated sharply, as did graduate students' attitudes toward career choices in business as opposed to academia.
In the 1970's, however, trouble from various sources pricked the bubble of university prosperity and threatened the survival of its rapidly developing, increasingly expensive and sophisticated science research. Inflation and recession, fueled by oil crises, declining productivity, and intensified competition from foreign nations, drastically diminished the real amount of government support. Furthermore, academia met with heightened rivalry for limited federal funds from other sectors of society. Contributing dramatically to the problem were declining student enrollment and therefore decreasing employment within the university and government settings for present faculty and future graduate students in fields of growing importance to the nation's economic security.

Meanwhile, industry appeared to offer another financial resource for funding basic research and for shoring up the increasingly shaky and vulnerable university. The quality of a university and of its research is directly related to the quality of its students, who in turn are attracted by and dependent upon the availability of scholarships and grant money. Industry offers not only money, but continuing education programs, future jobs for students, an expanded and enriched educational experience, the incentive of observing ideas being transformed into needed, practical products, and sophisticated technology and specialized facilities and equipment unavailable in the standard university setting. In contrast to the NIH and its uncertain, usually annual grants of funding, industry offers stable, long-term financing. While industry now supports about four per
cent of universities' scientific endeavors and is unlikely to increase that proportion significantly, it still provides a complementary resource important to the vitality of the research programs.63

Balancing the positive contributions are the risks of upsetting the university's broad-based balance among many departments, faculty, students, resources, and space; of losing the input and restraints of peer and public review; and of increased outside controls over the direction, nature, and extent of research.64

The Clash Between the Purposes and Values of the University and Of Industry

The goals and values of the university and of private industry collide in this area of vital interest to the United States and thus make compromise by both sides essential for the national welfare. Universities traditionally, or perhaps to be precise, ideally have provided a collegial sanctuary for free inquiry, open exchange of information and ideas, trust, honest peer review, academic freedom, and an intellectually independent, neutral vantage point from which to evaluate critically the rough and tumble world of commercial competition. The university's ultimate goals embrace expediting a broad pursuit of basic truth(s), often with no practical value, research, teaching, unimpeded dissemination of information among the public, and national service in a broad sense.
In contrast, industry is motivated by profit and competition. Corporations are responsible not to the public at large, although it benefits indirectly by increased numbers of consumer goods and services, but to their stockholders; the purpose of their existence is pecuniary gain through the provision of useful and continually improving products developed by means of narrowly targeted, applied research. To realize profits, however, industry has to protect its knowledge and products from the commercial competitors through secrecy and exclusive proprietary rights. Because it normally will not pay a company to invest in and develop marketable products from the results of a university's basic research without an exclusive license, big business has required of the academic investigator silence and patenting before disclosure, publication, and dissemination of his ideas, research, and results.

Relationships Among the University, the Federal Government, and Industry

Today, given the importance, requisite sophistication, and enormous expense of biotechnological research, which has already contributed significantly to health care with findings like insulin treatment for diabetics and Factor VIII therapy for hemophiliacs, the interdependence among universities, the federal government, and private industry is not going to disappear. The federal government has made clear not just by extensive financial support, but by its generous patent and licensing polices, now
embodied in law, and its refusal thus far to regulate
distribution of any profits of the university's scientific
innovations, that these mutual endeavors are vital to the
national welfare and must be encouraged, perhaps at the expense
of many John Moores as well as of average taxpayers, who receive
no monetary return for supporting university research. The
government has still not provided tax incentives for business
funding to academic research, although many are pressing for
them. Nevertheless, contributions from industry provide needed,
long-term, stable funding not subject to the vagaries of the
nation's shifting political priorities. Alternative sources of
funding also strengthen the foundation of university research,
making it less dependent on changing fortunes of any one entity.

While industry jeopardizes a number of traditional academic
values, it is obvious from the wide spectrum of varying kinds of
contacts, growing fuller daily, and from the increasing numbers
of institutions of higher education who have entered into major
commitments with industry, that such liaisons are not going to
cease within the foreseeable future.

Affiliations between university and industry in research
represent a continuum embracing a variety of relationships
between the two: gifts; licensing under patents\(^66\); equity
holdings by university personnel in private companies;
traditionally approved consulting by individual or groups of
faculty members\(^67\); capital contributions by corporations to
particular departments, divisions, or laboratories; provision of
fellowships; contract research; payment for the right to use
university resources; cooperative projects between scientists of both sectors without exchange of money; industry funding of specific university research when industry has a personal interest in the outcome; research consortia, in which a university joins with multiple companies to do fundamental research on problems common to a whole industry; and huge research partnerships with mutual commitment for mutual benefits from mutual concerns.68

In the last category are controversial arrangements that within the last decade have become fixtures on the scientific research landscape. For instance, Edwin C. Whitehead, a self-made millionaire businessman, established the allegedly nonprofit Whitehead Institute for Biomedical Research affiliated with the Massachusetts Institute of Technology (MIT) by contributing well over one hundred million dollars to the project.69 While the Whitehead Institute is a separate entity, it draws the majority of its investigators from full-time faculty members at MIT. At the same time, it hires additional researchers, paid exclusively by the Institute, but given positions on the MIT faculty and upsetting the political relationships and power structure within the biology department. The arrangement raises unsettling questions about the Institute's control of MIT's research program and its investigators. The Institute gains from association with prestigious MIT70 and from contributions of the outstanding scientists at the school, while MIT, without financial cost, increases its faculty and gains access to remarkable facilities that it could not afford, as well
as enrichment and stimulation through input from the pragmatic commercial world.

Similar partnerships include the earlier Monsanto's twenty-three-million-dollar cancer center project with the Harvard Medical School, begun in 1974 for a twelve-year period; Monsanto's biomedical research project with Washington University; the Hoechst Department of Molecular Biology at Massachusetts General Hospital; and the DuPont-funded Department of Genetics at Harvard Medical School. Clearly, precise ground rules and regulations for such enterprises need to be developed, either from within the university-industry community or imposed from without by the federal government to keep conflicts of interest and unethical conduct at a minimum, as well as to delineate protective limits for control of research and its products, accountability, and responsible use of generated income.71

In 1980, Harvard president Derek Bok introduced a proposal to his faculty that the University form its own commercial company; the uproar against the concept of a university as entrepreneur was tremendous both within and without the academic community, and the suggestion was dropped.72 On November 26, 1986, illustrating how rapidly the public has become adjusted to the commercial industrial connection, Texas A&M University announced with pride its establishment of its own biotechnological institute in the Texas Medical Center in Houston as a boon for the university, for science, and for Houston's as well as the state's economy.73
International Competition and the Nation's Economy

A central factor in pressing for increasing involvement of universities with industry is a profound concern with the United States' declining productivity, quality of output, and competitiveness in the world market. The federal government has purposefully adopted a strong policy of supporting not only patenting as an incentive, but also the interrelationships between the two sectors in an effort to stimulate innovation through interaction among people whose facilities and expertise can offer each other enhanced research opportunities and increased financial benefits. 74 From the examples cited earlier, it should be obvious that foreign enterprises are competing and making profits even in this nation's backyard, e.g., Hoffman La-Roche's exploitation of Golde's earlier cell line through the attempted patenting of interferon synthesis dependent upon it, or Hoechst's ten-year, fifty-million-dollar involvement with Massachusetts General Hospital's Department of Molecular Biology. To protect its interests, the United States must encourage individuals, including its John Moores, its universities with their broad educational commitments and long-term needs, and its practical and profit-oriented industries to form productive but respectful interrelationships in order to secure the nation's economic, intellectual, and psychological independence and welfare. Simultaneously, it must shield their separate identities, distinct roles, and individual priorities as essential elements in the nurture of a strong democracy.
Conclusion

Scientific research is a rapidly expanding, expensive field but one essential to our economy and security today. There is rarely a free ride or money without strings attached. At the same time, the university and its investigators are enjoying new opportunities for interchange and financial rewards and support through their relationship to industry and commerce. Institutions of higher education must accommodate the needs of the government, of industry, and of the nation if they are to continue to receive the sustenance necessary for them to produce theoretical concepts and transfer such technology into practical applications. A realistic approach must recognize the mutual dependence and mutual compromise necessary for successful preservation of the best of what each entity has to contribute without the university's complete sacrifice of control of its programs, of reasonable academic freedom, of general educational excellence, and of commitment to broadly based, long-term, basic research.

Revisions in the patent process requirements might aid in eliminating presently impairing restrictions on exchange and dissemination of ideas and research, while still protecting proprietary rights of industry. Within their universities, open disclosure by academics of their economic contacts and interests in their research is essential to preserve the relationship of trust and the peer review that have aided universities in avoiding conflicts of interest and unethical behavior in the past. The former president of Yale University, A. Bartlett
Giamatti, recommended the establishment of a special forum in each research institution to hear, discuss, and decide cases on an individual basis. These fora might also determine, in cases like Moore and Golde's, to what extent each contributor should be entitled to commercial returns, especially equity interests in collaborating companies which can be a more subtle danger to institutional autonomy. In turn, industry must commit itself to supporting extensive fundamental research from which future, unanticipated discoveries are likely to arise, and not merely the narrow and practical areas of its self interest.

If legal rules cause unfair results for an individual in a particular situation, it is necessary to determine whether a controlling social purpose is served that justifies the inequity. Even then, at times legislatures, courts, government agencies, private industry, and universities can make adjustments to accommodate at least some of the interests of other parties, and even thereby strengthen their own causes, without sacrificing major benefits of the existing scheme.

In John Moore's case, some kind of legal and monetary recognition of his interests within prudently drawn limits would serve to bolster the larger social goals involved, as would reasonable restrictions on undue monetary awards to university investigators and industry, especially where they result from publicly funded research. The system must inspire public trust and generosity, yet still provide incentives for individual contributors, universities, and industry to pull together for their mutual welfare in a highly competitive and complex world.
ENDNOTES

1 Keyishian v. Board of Regents, 385 U.S. 589, 603 (1967).

2 Moore v. Regents of the University of California, No. C 513755 (Superior Ct. L.A., Cal. filed Sept. 11, 1984) (Order of Dismissal). While this case was under the jurisdiction of the district court, in the course of three complaints and two amended complaints, Moore filed suit against the University of California, Dr. David W. Golde and his research technician, Shirley G. Quan, Genetics Institute (a biogenetic firm), and Sandoz, Inc. (an international pharmaceutical firm). UCLA responded to all complaints with general demurrers. The case was recently dismissed, and an appeal was immediately taken.

The suit was brought under multiple causes of action, the two most prominent being a tort in negligence and a property claim, alleging conversion and requesting a share in any profits arising from Golde's patented cell line derived from Moore's body tissue. According to Allen B. Wagner, attorney for UCLA, the plaintiff appears to be leaning increasingly upon his tort claim. The result may be that the property issue will not be decided, despite the great need for some judicial guidance in this novel and controversial area.

3 Most human cells will not continue to replicate themselves endlessly. To establish an "immortal" cell line involves a difficult process of discovering the right cell and the proper medium and successfully culturing the cell in it under laboratory conditions. Once a cell line like the Mo is established, it can be joined with another but different kind of cancerous cell line, a myeloma cell line, which in turn can then produce antibodies against the first. The product of the fusion of the two cell lines is called a hybridoma. The purpose of a hybridoma is the production of these monoclonal antibodies for potential diagnostic or therapeutic use in cancer treatment. Obviously, the Mo-Cel line is still a remote step and its value uncertain.

4 Except where indicated otherwise, the summary of facts relevant to the thesis of this paper was compiled from Moore's Third Amended Complaint, filed Oct. 24, 1985 (hereinafter cited as Third), and from his oral and written testimony in a Congressional hearing, The Use of Human Biological Materials in The Development of Biomedical Products: Hearing Before the Subcomm. on Investigations and Oversight of the House Comm. On Science and Technology, 99th Cong., 1st Sess. 240-78 (1985) (statement of John L. Moore, Leukemia Patient/Research Subject) (hereinafter cited as Hearing).


6 Third at 4-8; Hearing at 249.

7 Id. at 11-12; at 241, 250.
Hearing at 251.

Third at 25; Hearing at 241, 252.

Id. at 14, 26; at 242, 253.

Hearing at 242-43, 253-55.

Third at 10-13, 26.

GENETIC ENGINEERING NEWS 4 (July/Aug. 1986) (hereinafter cited as Golde).

Third at 29; Hearing at 243.

See, e.g., Hearing at 262.

The Mo-Cell Line releases immune interferon (Type II), macrophage-activating factor, and T-cell growth factor (interleukin 2), which have potential therapeutic value in diagnosing and treating a number of diseases including leukemia and other cancers, anemias, immune system deficiencies, hepatitis, growth problems, etc. Id.; B. Culliton, Mo Cell Has Its First Court Hearing, 226 SCIENCE 813 (Nov. 1984) (hereinafter cited as First).

Hearing at 243, 260.

Graf at 44.

Hearing at 243-44, 259.

Discussion of Symposium Papers, 33 CLINICAL RESEARCH 455, 457 (1985) (statement by Allen B. Wagner); Graf at 44. Such a procedure is common; see discussion infra in text.

Although Moore and seemingly his attorneys are uncertain about the differing uses of the spleen and the blood cells, the scientific literature indicates that the patented cell line was developed solely from the removed spleen. Golde was using blood not only from Moore, but also from his family, though Moore does not mention the fact, to study possible genetic factors. Golde at 4; Graf at 44.


See, e.g., Hearing at 156-57. The Belmont Report is included in the Hearing record at 184-91.
It is important to understand that the patient who has diseased tissue excised for therapeutic reasons is not considered by IRBs to be a "donor", nor his tissue a "gift", even though they may be so characterized by the law. Rather the material is seen as surplus, discard, or waste. Indeed, Golde's comments in GENETIC ENGINEERING NEWS reflect not only annoyance that Moore never indicated any intentions of donating his spleen as a gift, but also imply this investigatorial perspective; Golde insists that Moore is a patient who paid for services which he received. Moore signed a consent form allowing disposal of the excised tissue by the pathologist. Furthermore, Golde asserts, "Removal of the tumor saved John Moore's life. . . . Of almost 20 lbs. of tumor delivered to pathology, we took less than an ounce for scientific research. The remaining pounds (precious gift?) were thrown out and destroyed . . . . It seems to me that there was no generosity involved on the patient's part. On the contrary, he was given the gift of life which evolved from previous leukemia research. Mr. Moore was not a donor; he was a recipient." Golde at 4.

Hearing at 230 (statement of Dr. Charles McCarthy, NIH). See also Browning v. Norton-Children's Hospital, 504 S.W.2d 713 (Ky. 1974) (consent to an operation implies acceptance of hospital practices unless the patient expresses a contrary desire).

Leonard H. Glantz, J.D., in Property Rights and Excised Tissue, 1 IRB 5, 6 (Oct. 1979), notes that a patient may object to his tissue's being utilized for research purposes. While acknowledging that where research is risk-free to the contributor, consent is not required, Glantz comments,

It seems to me that once the criterion for obtaining consent moves away from the issue of risk, and toward the subject's unwillingness to allow a body part to be used for research because of its offensiveness to the subject, then the subject should be allowed to decide . . . . It would be enough, I believe, that as part of the informed consent transaction prior to the performance of the therapeutic procedure that patients be informed that the tissues to be removed might be used for teaching or research purposes. This gives a patient an opportunity to ask further questions about such use of the tissues, and to refuse to permit such use.

Moore echoes Glantz's argument in Hearing at 274. However, what Moore finds offensive is not the research on his tissue, but his physician's failure to inform him about it and the resulting latent, as well as the refusal to provide him with a share of the profits.

26 See also Hearing at 77-79, 83-84 (statement of Dr. David Blake, Associate Dean for Research, Johns Hopkins School of Medicine), 232.

Indeed, even if informed consent were required, given the state of the art of establishing immortal cell lines in 1977, Golde could not reasonably have anticipated success. See, e.g. J.E. Karp, The Immortality of a Cancer Victim Dead Since 1951,
SMITHSONIAN MAGAZINE (March 1976) for a discussion of Dr. George Gey's achievement in establishing the first cancerous cell line, the famous He-La cell line, an acronym for the unknown patient from whom the original cells came, variously identified as Helen Lane, Helen Larsen, or Henrietta Lacks.

27 Hearing at 228-29 (testimony by Dr. Charles McCarthy of the NIH and Dr. Robert Levine of Yale University).


33 Originally defendants contended that the case should be moved to federal court because it was predominantly a patent dispute. However, at an Oct. 29, 1984 hearing, the judge, apparently recognizing the wider implications of the suit, ruled that the allegations of conversion and lack of informed consent warranted a hearing in California state court. First at 814.

34 447 U.S. 303 (1980).

35 Id. at 309-10.

36 Under the United States Constitution, Art. 1, section 8, cl. 8, Congress is empowered "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."
Hobbs v. United States Atomic Energy Commission, 451 F.2d 849, 864 (5th Cir. 1971); Agawan Woolen Co. v. Jordan, 74 U.S. 583, 602-03 (1869). See also In re Hardee, 223 U.S.P.Q. 1122, 1123 (Ass't Comm'r Pat. 1984) ("Unless a person contributes to the conception of the invention, he is not a inventor").

Allen Wagner raises as possible property law theories for the suit the common law doctrines of accession and specification, recognized in only some jurisdictions, including California. The Legal Impact of Patient Materials Used for Product Development in the Biomedical Industry, 33 CLINICAL RESEARCH 444, 445 (1985); Proprietary Interest in Research Involving Human Tissue, 15-16 (May 1985) (unpublished manuscript) (available through A. Wagner at the University of California at Berkeley). Accession is the right of an owner of personal property to claim ownership to another's property that has been incorporated into his own so as to create a single, unseverable product, where his contribution was the principal one. In contrast, and perhaps more appropriate to the Mo-Cell line, the doctrine of specification permits ownership rights and title to be transferred to an individual who innocently uses and significantly transmutes another's personal property into a new and different product with different characteristics. 1 AM. JUR.2d Accession and Confusion Sections 1-2 (1964). The boundaries of the doctrines are fuzzy. For example, according to Am. Jur.2d, accession can include changing one individual's personal property into something different by a second party. Title passes to the transmuter, but he must make whole the earlier proprietor for the value of his contribution. However, as Wagner emphasizes, there is no established right to Moore's excised tissue to begin such an analysis. Even assuming that Moore's property right to his cells were established, these older, limited, and relatively obscure doctrines provide an uncertain foundation for law dealing with novel matters of such increasingly significant and controversial concern today.

Graf at 44.


A prominent example is Dr. Aaron Lerner's discovery of the structure of the growth hormone, ACTH, a prerequisite to producing a synthesized version, after studies on approximately 7,000 cadavers' pituitary glands. Id. at 814-15.

(hereinafter cited as Proposal); and Hearing at 99-146, 202-40 (statements and testimony by Dr. T. Murray).

For an interesting and provocative study, not directly on point for this essay, concerning the relationship among property, personhood, and existing schemes of property entitlement in justifying or criticizing current law, see M. Radin, Property and Personhood, 34 STANFORD L. REV. 957 (1982).

43 Hearing at 6, 36-37.
44 Who Owns the Body? at 4.
45 Proposal at 43, 56.
46 Ethics at 92.
48 Levine at 7; Hearing at 59.
49 Hearing at 59.

50 Until 1975, Harvard University had a long-standing policy of required dedication of discoveries in the health field to the public domain. However, because of economic pressures and the recognition that patenting promotes both creation and availability of useful products to the public, it reversed its policy and permitted patenting as well as a share of the royalties to the inventor. B. Davis, Profit Sharing Between Professors and the University?, 304 NEW ENG. J. MED. 1232 (May 14, 1981) (hereinafter cited as Sharing); W.F. Raub, NIH Policies on Hybridomas, 17 IN VITRO 1089 (Dec. 1981).


55 Graf at 44.
56 Id.; B. Culliton, Biomedical Research Enters the Marketplace, 304 NEW ENG. J. MED. 1195, 1200 (May 14, 1981) (hereinafter cited as Marketplace); D. Nelkin, SCIENCE AS
One case receiving wide publicity in recent years dealt with a dispute over the ownership of a hybridoma. A Japanese postdoctoral fellow, Hideaki Hagiwara, worked at the University of California at San Diego (UCSD) with oncologist Dr. Ivor Royston. They fused cancerous lymphocytes taken from Hagiwara's consenting mother with a patented cell line developed at UCSD to create a "human-human" hybridoma that, although untested, showed promise for cancer therapy. Royston believed that Hagiwara wanted to help his mother. However, without permission, Hagiwara took some of the cells back to Japan. While Hagiwara did unsuccesfully attempt to treat his mother with them, Royston discovered that Hagiwara's father was director of the Hagiwara Institute of Health and president of the Japanese Pharmaceutical Development Company; that his fellow had applied for a patent on the hybridoma in Japan; and that he had written a paper on the new discovery without crediting any of Royston's group as co-producers. Hagiwara claimed familial ownership on the basis of his mother's cells and his initiating proposal for the research, while Royston claimed that his group's expertise in creating hybridomas was largely responsible for their success. No suit was filed, possibly because both sides recognized the time and cost of litigation that would be required, but they reached a settlement assigning the patent rights to the University of California and granting Hagiwara's pharmaceutical firm the exclusive license for use of the hybridoma in Asia in return for any royalties to be paid to the University. Royston urges that all possible patent arrangements be negotiated between research collaborators before research is started, a striking change in relationships of the past. See I. Royston, Cell Lines from Human Patients: Who Owns Them?, 33 CLINICAL RESEARCH 442-32 (Oct. 1985); M. Sun, Scientists Settle Cell Line Dispute, 393-94 (Apr. 22, 1983).

Hearing at 26-27, 34 (statement of Niels Reimers, Director of the Office of Technology at Stanford University).

Hearing at 51, 148-49.

An example of the overnight successes possible in biotechnology is the rise of Genentech in San Francisco. It was founded by Herbert Boyer, a biologist at University of California at San Francisco. Initially it had no products for sale, yet when stock was publicly offered in October 1981, the price of a share jumped fifty-four dollars in twenty minutes. Boyer became a multimillionaire in a short time. Marketplace at 1196.

See, e.g., Hearing at 10-13 (statement of Niels Reimers); D. Praeger and G. Omenn, Research, Innovation and University-Industry Linkages, 207 SCIENCE 379-80 (Jan. 25, 1980) (hereinafter cited as Linkages); RESEARCH UNIVERSITIES AND THE
NATIONAL INTEREST:  A REPORT FROM FIFTEEN UNIVERSITY PRESIDENTS

62 See, e.g., Frank Press, Core Technologies and the National
Economy, in PARTNERS IN RESEARCH ENTERPRISE: UNIVERSITY-CORPORATE
RELATIONS IN SCIENCE AND TECHNOLOGY 42 (1983).

63 See generally George M. Low, The Organization of
Industrial Relationships, in PARTNERS IN RESEARCH ENTERPRISE 68-69
(1983); Linkages at 380; G. Omenn, University-Corporate Relations
in Science and Technology, in PARTNERS IN RESEARCH ENTERPRISE 21
(1983) (hereinafter cited as Omenn); Press at 43-46.

Interrupted funding in basic research is costly in many ways:
expensive equipment and facilities go unused, research groups
dissolve, student interest in careers in science is directed
elsewhere, etc. PRESIDENTS at 32. Furthermore, when basic
science research is deferred, it takes years after sudden need is
recognized to make up the loss of fundamental progress in
understanding the natural world. Moreover, many valuable
discoveries have been made accidentally in the course of
unhindered, seemingly impractical basic research.

64 Omenn at 21.

65 J. Fox, Can Academia Adapt to Biotechnology's Lure?,
CHEMICAL & ENGINEERING NEWS 39 (Oct. 12, 1981); A.B. Giamatti,
Free Market and Free Inquiry: The University Industry and
Cooperative Research, in PARTNERS IN RESEARCH 3 (1983); Linkages
at 380.

66 As noted, royalty income is split between
faculty-inventors and the university in various ways by different
institutions, at times determined partly on the amount of
university resources employed in the research.

67 Most institutions set the time allowed for consulting,
e.g., usually one day a week, so that the relationship does not
interfere with the faculty member's academic duties, yet still
brings the enrichment of understanding what is being developed in
industry and of new ideas gained from contacts with other
scientists.

68 See generally Omenn at 23-27; Linkages at 381; A. Gore,
Jr. (U.S. Congressman on the House Committee on Science and
Technology), Recombined Institutions: The Changing
University-Corporate Relationship, in PARTNERS IN THE RESEARCH
ENTERPRISE 121 (1983).

69 See generally MIT Agonizes over Links with Research Unit,

70 Two commentators cynically described the function of such
industrial connections as grooming academia "for the role of

71 See, e.g., Omenn at 35.
72 See, e.g., Marketplace at 1199; Linkages at 381-82.
73 A&M To Open Biotechnology Institute Here, HOUSTON CHRONICLE at 1, col. 3, sec. 1 (Nov. 25, 1986).
74 See, e.g., Low at 68.
75 Giamatti at 6.