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THE KEPT UNIVERSITY

Commercially sponsored research is putting at risk the paramount value of higher education -- disinterested inquiry. Even more alarming, the authors argue, universities themselves are behaving more and more like

for-profit companies

by [7]Eyal Press and Jennifer Washburn

IN the fall of 1964 a twenty-one-year-old Berkeley undergraduate named Mario Savio climbed the steps of Sproul Hall and denounced his university for bending over backwards to "serve the need of American industry." Savio, the leader of the Berkeley Free Speech Movement, accused the university of functioning as "a factory that turns out a certain product needed by industry" rather than serving as the conscience and a critic of society. To the modern ear this sixties rhetoric may sound outdated. To many people in the academic world, however, Savio's words ring truer today than ever. Although our national conversation about higher education remains focused on issues of diversity and affirmative action, nothing provoked more debate on many college campuses last year than the growing ties between universities and business -- and nowhere was the debate livelier than at Berkeley.

On the afternoon of April 13, a radiant day last spring, the Berkeley campus hardly looked like a site of protest. Students lay on green lawns, soaking in the sunshine. But inside Room 60 of Evans Hall, a concrete building on the northern edge of campus, the lights were dim and the atmosphere tense. There two dozen faculty members, many of them professors in the [19]College of Natural Resources, had gathered to present the disquieting results of a newly released faculty [20]survey.

The focus of the survey was a controversial agreement that Berkeley had signed in November of 1998 with [21]Novartis, a Swiss pharmaceutical giant and producer of genetically engineered crops. Under the terms of the agreement Novartis will give Berkeley \$25 million to fund basic research in the [22]Department of Plant and Microbial Biology, one of four departments within the CNR.

In exchange for the \$25 million, Berkeley grants Novartis first right to negotiate licenses on roughly a third of the department's discoveries -- including the results of research funded by state and federal sources as well as by Novartis. It also grants the company unprecedented representation -- two of five seats -- on the department's research committee, which determines how the money is spent.

That the university had the backing of a private company was hardly unusual. That a single corporation would be providing one third of the research budget of an entire department at a public university had sparked an uproar. Shortly after the agreement was signed, a newly formed graduate-student group, [23]Students for Responsible Research, circulated a petition blasting the Novartis deal for standing "in direct conflict with our mission as a public university." [24]The Daily Californian, Berkeley's student newspaper, published a five-part series on the growing privatization of the university, and a coalition of public-interest groups sent a letter to Berkeley's chancellor, Robert Berdahl, charging that the alliance "would disqualify a leading intellectual center from the ranks of institutions able to provide the kind of research -- free from vested

interest" that is the hallmark of academic life. Meanwhile, the College of Natural Resources, headed by Dean Gordon Rausser, sent a message to all professors urging them not to speak to the press and to direct any questions to the university's public-relations office. Many viewed this as a hush order.

"We are here to discuss the position of the faculty," Ignacio Chapela, a professor of microbial ecology, announced as the April 13 meeting began. Chapela, who was then the chairman of the college's executive committee, a faculty governing body, snapped on an overhead projector to display the results of the survey, and declared that the Novartis deal had left the CNR "deeply divided." While 41 percent of the faculty respondents supported the Novartis agreement as signed, more than 50 percent believed that it would have a "negative" or "strongly negative" effect on academic freedom. Roughly half believed that the agreement would erode Berkeley's commitment to "public good research," and 60 percent feared that it would impede the free exchange of ideas among scientists within the college -- one of Chapela's chief concerns.

"When I came to Berkeley," Chapela explained to us after the meeting, "the people who brought me here and who were my closest colleagues were largely in the Department of Plant and Microbial Biology. Now I know that anything I say to these people can be turned around and handed over to Novartis. So I just can't talk to them anymore. If I have a good idea, I'm not going to just give it away." Chapela, like many critics of the deal, is hardly a confirmed opponent of university-industry relations. Before coming to Berkeley, he told us, he spent three years in Switzerland working for none other than Novartis -- then named Sandoz -- and he continues to have a relationship with the company. "I'm not opposed to individual professors' serving as consultants to industry," he said. "If something goes wrong, it's their reputation that's at stake. But this is different. This deal institutionalizes the university's relationship with one company, whose interest is profit. Our role should be to serve the public good."

The Academic-Industrial Complex

GORDON Rausser, the chief architect of the Novartis deal, believes that faculty concerns about the alliance reflect ignorance about both the Novartis deal and the changing economic realities of higher education. When we met with Rausser last year, in his spacious office in the ornate neoclassical Giannini Hall, he insisted that the deal, far from violating Berkeley's public mission, would help to perpetuate the university's status as a top-flight research institution. An economist who served on the President's Council of Economic Advisors in the 1980s and now operates a sideline consulting business, Rausser contends that Berkeley's value is "enhanced, not diminished, when we work creatively in collaboration with other institutions, including private companies." In a recent article in the Berkeley alumni magazine Rausser argues, "Without modern laboratory facilities and access to commercially developed proprietary databases ... we can neither provide first-rate graduate education nor perform the fundamental research that is part of the University's mission."

Rausser's view is more and more the norm, as academic administrators throughout the country turn to the private sector for an increasing percentage of their research dollars, in part because public support for education has been dropping. Although the federal government still supplies most of the funding for academic research (it provided \$14.3 billion, or 60 percent, in 1997, the latest year for which figures are available), the rate of growth in federal support has fallen steadily over the past twelve years, as the cost of doing research, particularly in the cutting-edge fields of computer engineering and molecular biology, has risen sharply. State spending has also declined. Berkeley Chancellor Robert Berdahl says that California now supplies just 34 percent of Berkeley's overall budget, as compared with 50 percent twelve years ago, and he claims that other

state universities have suffered similar cuts.

Meanwhile, corporate giving is on the rise, growing from \$850 million in 1985 to \$4.25 billion less than a decade later -- and increasingly the money comes with strings attached. One marked trend is a boom in industry-endowed chairs. Kmart has endowed a chair in the management school at West Virginia University which requires its holder to spend up to thirty days a year training assistant store managers. Freeport McMoRan, a mining company embroiled in allegations of environmental misconduct in Indonesia, has created a chair in environmental studies at Tulane. In its series on privatization at Berkeley, *The Daily Californian* noted that buildings throughout the Haas School of Business were "plastered with corporate logos." One major contributor to the school is Don Fisher, the owner of The Gap, whose company also happens to be featured as a case study in an introductory business-administration course. Laura D'Andrea Tyson, formerly one of President Clinton's top economic advisers, is now officially known as the BankAmerica Dean of Haas.

In rushing to forge alliances with industry, universities are not just responding to economic necessity -- they are also capitalizing on a change in federal law, implemented nearly two decades ago, that laid the foundation for today's academic-industrial complex. In 1980 concerns about declining U.S. productivity and rising competition from Japan propelled Congress to pass the [25] Bayh-Dole Act, which for the first time allowed universities to patent the results of federally funded research. The goal of the legislation was to bring ideas out of the ivory tower and into the marketplace, by offering universities the opportunity to license campus-based inventions to U.S. companies, earning royalties in return. Both the government and the business world saw universities not merely as centers of learning and basic research but as sources of commercially valuable ideas, which is why the Business-Higher Education Forum, a coalition of corporate and academic leaders, and similar groups lobbied to tear down the walls separating universities from the marketplace. In the years since, Congress has passed numerous other laws to bolster university-industry ties, including generous tax breaks for corporations willing to invest in academic research.

The Bayh-Dole Act was from the beginning controversial. Some in Congress argued that granting private companies the rights to publicly funded research amounted to an enormous giveaway to corporations; others pronounced the act a visionary example of industrial policy that would help America compete in the fast-moving information age. What is undeniable is that Bayh-Dole has revolutionized university-industry relations. From 1980 to 1998 industry funding for academic research expanded at an annual rate of 8.1 percent, reaching \$1.9 billion in 1997 -- nearly eight times the level of twenty years ago. Before Bayh-Dole, universities produced roughly 250 patents a year (many of which were never commercialized); in fiscal year 1998, however, universities generated more than 4,800 patent applications. University-industry collaborations, Rausser argues, have brought important new products -- anti-AIDS treatments, cancer drugs -- to market, and have spurred America's booming biotech and computing industries. "The University of California alone has issued over five hundred patents since Bayh-Dole," Rausser says.

This is a powerful argument, but a troubling one. In an age when ideas are central to the economy, universities will inevitably play a role in fostering growth. But should we allow commercial forces to determine the university's educational mission and academic ideals? In higher education today corporations not only sponsor a growing amount of research -- they frequently dictate the terms under which it is conducted. Professors, their image as unbiased truth-seekers notwithstanding, often own stock in the companies that fund their work. And universities themselves are exhibiting a markedly more commercial bent. Most now operate technology-licensing offices to manage their patent portfolios, often guarding their intellectual property as aggressively as any business would.

Schools with limited budgets are pouring money into commercially oriented fields of research, while downsizing humanities departments and curbing expenditures on teaching. Occasional reports on these developments, including a recent 60 Minutes segment on corporate-sponsored research, have begun to surface beyond the university. But the larger picture has yet to be filled out. It is this: universities, once wary beneficiaries of corporate largesse, have become eager co-capitalists, embracing market values as never before.

Secrecy and Science

IN a classic paper published in 1942, the sociologist Robert K. Merton likened the culture of science more to the ideals of communism than to capitalism, because intellectual property was commonly shared and discoveries were freely exchanged. "The scientist's claim to 'his' intellectual 'property,'" Merton wrote, was "limited to that of recognition and esteem," and scientific knowledge was assumed to be a public good.

Today scientists who perform industry-sponsored research routinely sign agreements requiring them to keep both the methods and the results of their work secret for a certain period of time. From a company's point of view, confidentiality may be necessary to prevent potential competitors from pilfering ideas. But what constitutes a reasonable period of secrecy? The National Institutes of Health recommends that universities allow corporate sponsors to prohibit publication for no more than one or two months (the amount of time ordinarily necessary to apply for a patent), but lengthier delays are becoming standard. Berkeley's contract with Novartis, for example, allows the company to postpone publication for up to four months. A survey of 210 life-science companies, conducted in 1994 by researchers at Massachusetts General Hospital, found that 58 percent of those sponsoring academic research require delays of more than six months before publication.

"One of the most basic tenets of science is that we share information in an open way," says Steven Rosenberg, of the National Cancer Institute, who is among the country's leading cancer researchers. "As biotech and pharmaceutical companies have become more involved in funding research, there's been a shift toward confidentiality that is severely inhibiting the interchange of information." A few years ago Rosenberg confronted this problem firsthand when he tried to obtain information on safe-dosage levels for a reagent he sought to use in a clinical trial involving an experimental cancer treatment. The company asked Rosenberg to sign a confidentiality agreement, and when he refused, they withheld the information. Rosenberg has become so alarmed about secrecy that he now urges all scientists and research institutions to reject confidentiality restrictions on principle. Few have heeded his call. A 1997 survey of 2,167 university scientists, which appeared in the *Journal of the American Medical Association*, revealed that nearly one in five had delayed publication for more than six months to protect proprietary information -- and this was the number that admitted to delay. "The ethics of business and the ethics of science do not mix well," Rosenberg says. "This is the real dark side of science."

Nelson Kiang, a professor emeritus at the Massachusetts Institute of Technology and at Harvard, who recently organized an MIT conference on "Secrecy in Science," worries in particular that students, rather than learning proper scientific protocol, are being taught to accept the inhibiting power of money over science. "One hears of many students at MIT who complain about not being able to publish their theses in a timely fashion," Kiang says, "but when we tried to involve them in the conference, not a single one would come forward, and they actually asked us specifically not to be named. Of course, it's not surprising. They fear that if they come forward, they might get into trouble with their supervisors."

Worse than the problems of enforced secrecy and delay, however, is the possibility that behind closed doors some corporate sponsors are manipulating manuscripts before publication to serve their commercial interests. In the summer of 1996 four researchers working on a study of calcium channel blockers -- frequently prescribed for high blood pressure -- quit in protest after their sponsor, Sandoz, removed passages from a draft manuscript highlighting the drugs' potential dangers, which include stroke and heart failure. The researchers aired their concerns in a letter to the Journal of the American Medical Association: "We believed that the sponsor ... was attempting to wield undue influence on the nature of the final paper. This effort was so oppressive that we felt it inhibited academic freedom." Such meddling, though generally difficult to document, may well be common. A study of major research centers in the field of engineering found that 35 percent would allow corporate sponsors to delete information from papers prior to publication.

This past May, at a meeting of the American Association of University Professors, in Boston, a group of academics gathered to discuss the growing corporate threat to academic freedom -- and the apparent reluctance of universities to defend it. Among those present was David Kern, formerly the director of occupational medicine at Brown University's Memorial Hospital. In 1996, while serving as a consultant to Microfibres, a Rhode Island company that produces nylon flock, Kern discovered evidence of a serious new lung disease among the company's employees. Upon learning that he planned to publish his findings, the company threatened to sue, citing a confidentiality agreement that forbade Kern to expose "trade secrets." The information that Kern had gathered had come from tests on volunteers, and concerned not proprietary secrets but a serious threat to public health. Yet Brown University, too, tried to dissuade Kern from publishing, warning that the company might file suit. Outraged, Kern published anyway, and in 1997 the Centers for Disease Control officially recognized the new disease, flock worker's lung. Although Microfibres never did file suit, Kern's position at Brown was eliminated. "Universities should protect their faculty from any efforts to encroach on academic freedom," Kern says. "Unfortunately, with so much corporate money flooding into academia, that's not happening." At the AAUP conference several professors shared similar experiences, and these may only hint at the scope of the problem.

Mildred Cho, a senior research scholar at Stanford's Center for Biomedical Ethics, warns that for every David Kern who steps forward in such cases, an unknown number of researchers voluntarily toe the company line. "When you have so many scientists on boards of companies or doing sponsored research," Cho explains, "you start to wonder, How are these studies being designed? What kinds of research questions are being raised? What kinds aren't being raised?" In a 1996 study published in the Annals of Internal Medicine, Cho found that 98 percent of papers based on industry-sponsored research reflected favorably on the drugs being examined, as compared with 79 percent of papers based on research not funded by industry. More recently, an analysis published in the Journal of the American Medical Association found that studies of cancer drugs funded by pharmaceutical companies were roughly one eighth as likely to reach unfavorable conclusions as nonprofit-funded studies. Might the public begin to see academics less as stewards of truth than as hired hands?

Or worse than hired hands: interested parties. More and more, professors not only accept industry grants to perform research but also hold stock or have other financial ties to the companies funding them. In a study of 800 scientific papers published in a range of academic journals, Sheldon Krinsky, a professor of public policy at Tufts University and a leading authority on conflicts of interest, found that slightly more than a third of the authors had a significant financial interest in their reports. Michael McCarthy, an editor at the British medical journal The Lancet, says such links are now so common that he "often can't find anyone who

doesn't have a financial interest" in a drug or therapy the journal would like to review. Although Krimsky doesn't believe that the mere existence of such ties makes an academic study suspect, he advocates full disclosure. Yet in none of the nearly 300 studies in which Krimsky found a conflict of interest were readers informed about it.

The Securities and Exchange Commission has also detected this trend and is now investigating numerous academic researchers suspected of engaging in insider trading. In a case filed recently in Pennsylvania, the SEC charged Dale J. Lange, a Columbia University neurologist, with pocketing \$26,000 in profits after Lange bought stock in a company that was about to release promising new findings concerning a drug to treat Lou Gehrig's disease. Lange expected the stock to soar because he had conducted the confidential clinical trials.

The growing concern about potential conflicts of interest has prompted some universities to forbid professors to perform sponsored research for companies in which they hold equity. The federal government is also taking steps. In 1996 the Public Health Service issued guidelines that require all academic researchers to report it to their schools if they have received payments of more than \$10,000 from a company or if they hold at least five percent of its stock. At most universities, however, such information is kept private, which means that frequently neither journal editors nor academic peers know who has ties to industry and who hasn't.

More than a year before fen-phen, the appetite suppressant, was pulled off the market because it seemed to be implicated in a number of deaths, a group of researchers published a study in *The New England Journal of Medicine* warning that drugs like fen-phen could have potentially fatal side effects. But the same issue contained a commentary from two academic researchers that downplayed the health dangers of fen-phen. Both authors had served as paid consultants to the manufacturers and distributors of similar drugs -- connections that were not mentioned. "I was outraged when I saw that," Stuart Rich, a professor at Rush Medical College, told the *Chronicle of Higher Education* when the ties were exposed. "The study was the only scientific study that said these diet pills kill people." Like universities, some journals have begun requiring academic contributors to disclose corporate financial ties. But in a study released last year Sheldon Krimsky and another researcher examined 62,000 articles and found that these ties were disclosed in only 0.5 percent of them.

Correctional officials see danger in prison overcrowding. Others see opportunity. The nearly two million Americans behind bars -- the majority of them nonviolent offenders -- mean jobs for depressed regions and windfalls for profiteers.

Corporate underwriting of research is by no means confined to the medical sciences. In his book *The Heat Is On: The High Stakes Battle Over Earth's Threatened Climate* (1997), Ross Gelbspan documents how, over the past several years, fossil-fuel companies have bankrolled numerous academic studies that downplay the threat of global warming -- distorting, Gelbspan argues, the public-policy debate. And last June controversy erupted at the University of Florida following the disclosure that Charles Thomas, a criminologist at the school who advised the state on prison policy, had pocketed \$3 million in consulting fees from the private-prison industry, in which he also owned stock. (Thomas's views on private prisons are quoted frequently in *The Wall Street Journal* and *The New York Times*, and he has trumpeted the virtues of "full-scale privatization" in testimony before Congress.) "I'm really kind of astounded that the state university system would tolerate something like this," said a member of the state ethics commission, which slapped Thomas with a \$20,000 fine.

OME would argue that such relationships, far from being unseemly, are in keeping with the

utilitarian strain that runs through the history of American higher education. Certainly, in comparison with their European counterparts, U.S. universities have always displayed a pragmatic bent. Whereas in Europe universities took pride in pursuing knowledge for its own sake and in remaining aloof from the outside world, in America educators from Thomas Jefferson to John Dewey have argued that universities ought to be engaged in the world, and that knowledge exists to be put to use. When Congress passed the Morrill Act, in 1862 (which gave rise to America's public land-grant universities, including Berkeley), it specifically instructed the states to establish schools that would teach "agriculture and the mechanical arts ... in order to promote the liberal and practical education of the industrial classes," rather than the classical curriculum.

Thus it is hardly surprising that, as the historian David Noble documents in his book *America by Design* (1977), the rapid growth of the U.S. industrial economy at the turn of the century coincided with a surge in university-industry collaboration. Engineering and chemical giants underwrote research in exchange for the services of academic scientists; universities established industrial-research centers to furnish corporations with personnel; some schools even went into business themselves, with the University of Minnesota operating its own mine and New York University running a macaroni factory. Such entanglements inspired the radical economist Thorstein Veblen to comment acerbically in 1908 that "business principles" were transforming higher education into "a merchantable commodity, to be produced on a piece-rate plan, rated, bought, and sold by standard units, measured, counted and reduced to staple equivalence by impersonal, mechanical tests."

World War II, however, ushered in an era of public support for higher education. The role of university scientists in the Manhattan Project and other wartime initiatives -- such as the development of penicillin and streptomycin -- convinced public officials that academics were uniquely capable of undertaking crucial research initiatives. As corporations slowed their funding of academic research, public money filled the role: from 1953 to 1968 public support grew by 12 to 14 percent annually. Whereas funding for scientific research from all sources totaled \$31 million in 1940, federal funding alone reached \$3 billion in 1979, much of it dispensed by the National Institutes of Health and other new agencies. This influx of federal dollars reflected a growing appreciation for the basic, undirected research that universities perform. "New products and new processes do not appear full-grown," Vannevar Bush, President Franklin Roosevelt's chief science adviser, declared in 1944. "They are founded on new principles and new conceptions, which in turn are painstakingly developed by research in the purest realms of science."

The Bayh-Dole Act changed this, and not simply by creating incentives for corporations to invest in academic research. What is ultimately most striking about today's academic-industrial complex is not that large amounts of private capital are flowing into universities. It is that universities themselves are beginning to look and behave like for-profit companies.

The University as Business

THE Office of Technology Licensing at Stanford University occupies the third floor of a drab concrete building located just off the main loop that circles the palm-studded Palo Alto campus. This unprepossessing spot is the hub of a commercial enterprise that is the envy of universities across the country. The OTL's mission is to commercialize discoveries made by professors and to manage Stanford's growing patent portfolio. In the main lobby, encased in handsome wooden frames along the walls, are displays highlighting the various patents and products the office has recently helped bring to market. One describes a valve that creates high-resolution images on the surface of a silicon chip, another a new case-management system for heart failure that the university is hoping to license to the nation's hospitals.

"We're receiving about two hundred and fifty invention disclosures a year, roughly one in four of which is patented," says Jon Sandelin, a senior associate at the OTL. Sandelin says that Stanford earned \$61 million from its technology-transfer activity last year -- a success he credits to creating the right entrepreneurial environment. "You have to understand -- initially the department chairmen and school deans weren't thrilled by having this new activity that was diverting the attention of their faculty away from teaching and research," he explains. "So how do you offset that? You make them stakeholders -- you make them beneficiaries."

Once professors and their departments learned that they could earn a cut from inventions, Sandelin says, they became more enthusiastic about bringing their ideas to the OTL. To reinforce the message, the OTL conducts aggressive outreach, organizing lunches with department heads; publishing a newsletter, *Brainstorm*, that touts the latest faculty discoveries; and dangling incentives in front of would-be inventors. In 1990 Stanford established a Research Incentive Fund to help professors convert academic concepts into "prototype products." "Got an idea for the next great whatchamacallit but don't have the funds to move from hypothesis to thesis?" a recent issue of *Brainstorm* asks. "This fund might just be your answer."

Traditionally, universities regarded patents as being outside their orbit, generally believing that proprietary claims were fundamentally at odds with their obligation to disseminate knowledge as broadly as possible. Today nearly every research university in the country has a technology-licensing office, and some have gone further. Johns Hopkins Medical School, for example, has established an internal venture-capital fund to bankroll commercially promising lines of research. The University of Chicago, renowned for its classical tradition, has created an affiliated non-profit, the ARCH Development Corporation, whose mission, in part, is to launch start-up companies based on faculty innovations. The dean of Chicago's medical school, Glenn D. Steele Jr., recently removed many faculty department heads and bluntly told *Business Week* that he plans to begin "insinuating the place ... with entrepreneurial people" -- a clear statement that commercial acumen is becoming an important qualification for new faculty.

SURPRISINGLY, two decades after Bayh-Dole was passed, no independent assessments of its economic impact have been made. But the Association of University Technology Managers, a consortium of over 300 universities and research institutions that engage in technology transfer, does publish an annual statistical survey of its members. In 1998 alone, the AUTM reports, 364 start-up companies were formed on the basis of a license to an academic invention, bringing the total since 1980 to 2,578. The group estimates that overall, university technology-transfer activities generated \$34 billion that year, supporting 280,000 American jobs.

"There's clearly a kind of ferment going on at U.S. universities," says Lita Nelsen, the director of technology licensing at MIT. "When I went to MIT as an undergraduate, in 1964, the Kendall Square area was a bunch of vacant lots with a greasy old diner, and that was it. Now if you look out my window, it's brick high-rise buildings filled with little start-up companies -- everything from Lotus down the street, to Neurometrics across the alley, to Biogen and Sapient. The old mills with broken windows have been refurbished into high-tech incubators." The clustering of computer-engineering and biotech firms around academic-research centers in Silicon Valley; Austin, Texas; Route 128 in Massachusetts; and the Research Triangle, in North Carolina, derives in large measure from the synergy between universities and industry that Bayh-Dole has fostered.

No sector of the economy better illustrates the potential benefits of this synergy than biotechnology, a multibillion-dollar industry that grew out of university research labs. Garry Nolan, an assistant professor of molecular pharmacology at Stanford, epitomizes the new generation of professor-entrepreneurs. A few years ago Nolan founded Rigel, a biotech firm based

in San Francisco that has pioneered a promising new method for identifying the proteins involved in asthma, allergies, immune disorders, and other health problems. "We've already attracted a hundred and fifty million dollars in investment from various drug companies interested in our work," Nolan says. "There's almost no greater and more immediate feedback than when you find a commercial entity interested in what you're doing."

Walter Powell, a sociologist at the University of Arizona who has tracked the growth of the biotech industry worldwide, believes that the close links between universities and industry are a principal reason why U.S. firms now dominate the biotech market -- a lesson America's competitors are taking to heart. "You're seeing other countries moving in the same direction," Powell says, pointing out that the University of Munich has been involved in spinning off at least five private companies in Germany in the last two years alone. Lita Nelsen says her office at MIT has been overrun with visitors from other countries, including Japan, which recently passed its own version of the Bayh-Dole Act.

The surprising twist, however, is that although university licensing offices are churning out patents, most of these offices are themselves barely breaking even. "Everybody was waiting for a hundred million dollars a year out of their technology-transfer offices," Nelsen says. "The reality is that hardly any schools earn anywhere near that." Although some academic achievements -- such as the discovery of recombinant DNA and the development of the hepatitis B vaccine (developed jointly at the University of California and the University of Washington) -- have generated millions, most have not, and Nelsen says it is impossible to predict which will be lucrative.

Far from restraining universities, however, the difficulty of turning a profit seems to have made them more aggressive. A growing number of schools, for example, are buying equity stakes in the very companies that stand to profit from their faculties' research -- a practice that both raises the potential for conflict of interest and is financially risky. In the 1980s and early 1990s Boston University poured \$85 million (nearly a fifth of its endowment) into Seragen, a biotech firm specializing in cancer research, which several BU professors had founded. Convinced that the company would generate windfall profits, BU President John Silber also personally invested heavily in Seragen and persuaded numerous professors and trustees to do likewise. But from 1991 to 1997 Seragen lost almost \$150 million. The university, which at one point owned 91 percent of the company's stock, was accused of egregiously mismanaging the school's endowment to prop up the company and to protect the trustees' investments.

Might such a cautionary tale dissuade other universities from going down the same road? To the contrary: the University of California recently established a policy allowing it to acquire equity stakes in start-ups and now owns shares in thirty companies committed to developing UC technologies. Stanford took a similar step in 1994.

Meanwhile, universities are devising increasingly creative -- and controversial -- ways to raise their royalty earnings. Michigan State University, for example, recently took the unusual step of applying for a new, slightly altered patent on a widely prescribed cancer drug, cisplatin, that was patented by the university in 1979. Filing twice on the same invention is prohibited, but MSU's original patent, which along with its analog, carboplatin, generated \$160 million in royalties, was about to expire. Thus the slight alteration. The move may have been good for MSU's bottom line, but did it serve the public interest? MSU's action prevented four generic-drug manufacturers from marketing a cheaper version of cisplatin, and these companies are now suing MSU -- all of which prompted Barnett Rosenberg, the drug's developer and a now-retired professor, to complain that his work has "led to the creation of a lot of selfish, money-hungry university

personnel."

Stanford has advanced beyond mere patenting. The university recently invested more than \$1 million to develop its own brand-name product, Sondius-XG, a sound-synthesis technology that it will market in conjunction with Yamaha. Why? Because unlike patents, which expire after twenty years, brands generate revenue forever. Mary Watanabe, who works with Jon Sandelin at the Office of Technology Licensing, let slip during an interview that the university is also considering launching a "Stanford company." She declined to divulge details.

If these activities appear to be out of keeping with the university's nonprofit educational mission, that's because they are. In a provocative 1996 article in the *University of Pennsylvania Law Review*, Peter Blumberg, then a law student, argued that technology-transfer activity at universities is so far removed from the university's public mission that it "could be treated as unrelated business income for tax purposes." Universities, Blumberg writes, "enjoy their tax exemption because of a belief that they are producing research that no other market actor would produce absent a public subsidy; basic research, publishable research, research that educates students and ... is usable by the whole society."

In their zeal to maximize revenue, many schools are not only raising questions about their nonprofit status -- they are getting into some embarrassing skirmishes with their own students and professors over the rights to potentially lucrative ideas. In the most extraordinary case to date Peter Taborsky, a student at the University of South Florida, wound up on the chain gang of a maximum-security state prison after colliding with his university over the rights to a discovery he made as an undergraduate. Taborsky had been working as a research assistant on a project sponsored by the Florida Progress Corporation, a local holding company. At the end of the sponsored research period, Taborsky claims, he received permission from Robert Carnahan, a dean in the College of Engineering, to begin work on his own experiments, following a different approach, which he hoped to use as the basis for a master's thesis. But as soon as Taborsky made his research breakthrough, which had obvious commercial utility as a way to remove ammonia from wastewater, Florida Progress and USF both laid claim to his discovery. The university filed criminal charges against Taborsky and spent more than ten times the amount of the original research grant on outside legal counsel alone. In 1990 a jury found Taborsky guilty of stealing university property, and the State of Florida required him to begin serving his sentence on a chain gang in 1996. But the case became an embarrassing media spectacle, and Governor Lawton Chiles soon intervened to offer Taborsky clemency, which Taborsky, on principle, refused.

Why would a state university go to such lengths? To protect future investments, of course. As Seth Shulman argues in *Owning the Future*, a new book about intellectual property in the information age, the Taborsky case "underscores what can happen when universities, beholden to industry for an increasing share of research dollars, let financial concerns overshadow the notion of research as a shared intellectual pursuit."

Today it is common for universities to pay exorbitant legal fees to defend their intellectual property. According to the Association of University Technology Managers annual report, dozens of major universities -- Brandeis, West Virginia, Tufts, and Miami among them -- actually spent more on legal fees in fiscal year 1997 than they earned from all licensing and patenting activity that year. A growing number of disputes pit universities against their own faculty members. In 1996 a jury awarded \$2.3 million to two professors, Jerome Singer and Lawrence Crooks, who filed suit against the University of California for shortchanging them on royalties resulting from their pathbreaking research on magnetic resonance imaging, a widely utilized medical test known as the MRI. An appeals court found that the university improperly sheltered revenue by

dramatically discounting the patents it licensed to manufacturers in exchange for more than \$20 million in research funding.

IS this where the Bayh-Dole Act was supposed to lead? Two summers ago a working group at the National Institutes of Health issued a report to the NIH director, Harold Varmus, warning that changes in the way universities guard their intellectual property are endangering the free exchange of basic research tools -- such as gene sequences and reagents -- that are crucial to all research. The NIH found that the terms universities impose on their research tools, through their technology-licensing offices, "present just about every type of clause that universities cite as problematic in the [contracts] ... they receive from industry." These include requirements that universities be allowed to review manuscripts prior to publication and provisions extending their ownership claims to any future discoveries deriving from use of their research materials. Universities, the NIH charges, "have no duty to return value to shareholders, and their principal obligation under the Bayh-Dole Act is to promote utilization, not to maximize financial returns. It hardly seems consistent with the purposes of the Bayh-Dole Act to impose proprietary restrictions on research tools that would be widely utilized if freely disseminated. Technology transfer need not be a revenue source to be successful." Ironically, the proliferation of ownership claims threatens not only to stifle the free exchange of ideas but also to impede economic growth. James Boyle, an expert on intellectual-property law at American University, warns that if current trends continue, "creators will be prevented from creating," as the public domain is "converted into a fallow landscape of walled private plots."

Controlling the Research Agenda

IMMEDIATELY after the April faculty meeting at Berkeley several members of Students for Responsible Research gathered in an outdoor courtyard at La Burrita, a pub just off campus, to air their concerns about the Novartis deal -- and to let off steam. "This place has some of the cheapest pitchers around," said Jesse Reynolds, one of the group's leaders, as glasses were poured and beers were passed around a long picnic table.

Unlike the student radicals of the sixties, these students never intended to lock horns with the university establishment. Reynolds, who studies California water resources, says he's relatively new to student politics -- and to politics altogether. "I'm generally one of those people who gripe a lot and do nothing," he explained. "But when the best state agricultural college in the country makes this kind of leap, the world is bound to follow. I really fear that."

David Quist, a second-year graduate student in environmental science, laughed as he told a story illustrating the culture that now permeates the university. The previous October, Quist said, at a town-hall meeting where the Novartis deal was first made public, Dean Gordon Rausser invited concerned students to examine the contract for themselves. "So the next day I came to his office," Quist recalled. "I was given some materials and sat down to take notes. But as soon as an administrator saw me, she said, 'Oh, no, you can't do that.'" Quist's notes were confiscated and held at the dean's office for several months.

Wilhelm Gruissem, a professor in the Department of Plant and Microbial Biology who helped to negotiate the Novartis deal, insists that the negotiations were as open as possible without divulging the company's proprietary secrets. But even students within the department felt shut out. In December of 1998 twenty-three graduate students sent a letter to the faculty complaining that their views had never been solicited and that they had been "forced to rely on rumors and supposition throughout the negotiation process."

What most concerns the Students for Responsible Research is that as university-industry ties grow more intimate, less commercially oriented areas of science will languish. "Let's say you're a graduate student interested in sustainable agriculture or biological control or some other area that is not commercial," Reynolds explained. "My guess is you're not going to come to Berkeley, or you'll at least think twice about it."

Donald Dahlsten, the associate dean of the College of Natural Resources, shares this concern. "Molecular biology and genetic engineering have clearly risen as the preferred approach to solving our problems, and that's where the resources are going," Dahlsten says. "New buildings have gone up, and these departments are expanding, while the organismic areas of science -- which emphasize a more ecological approach -- are being downsized." Dahlsten once chaired Berkeley's world-renowned Division of Biological Control. Today that division, along with the Department of Plant Pathology and more than half of all faculty positions in entomology, are gone -- in part, many professors believe, because there are no profits in such work. "You can't patent the natural organisms and ecological understanding used in biological control," Andy Gutierrez, a Berkeley entomologist, explains. "However, if you look at public benefit, that division provided billions of dollars annually to the state of California and the world." In one project Gutierrez worked on, he helped to halt the spread of a pest that threatened to destroy the cassava crop, a food staple for 200 million people in West Africa.

Gordon Rausser counters that far from draining resources from other areas, the Novartis deal will benefit the college as a whole, because a quarter of the money will be spent outside the Department of Plant and Microbial Biology. "I'm sitting here with three science buildings that were built in the 1920s, thirties, and forties," Rausser says. "I can't get those buildings modernized for first-rate research without resources."

Chris Scott, who until recently oversaw industry collaborations at Stanford's medical school, describes another reason that working with the private sector is essential. Scott points out that for the past several years industry researchers have consistently been ranked among the most frequently cited scientific authors, making academic isolation intellectually deleterious. But Scott, too, recognizes the danger of allowing market criteria to dictate the paths of scientific inquiry. "Show me an industry-sponsored research project on schistosomiasis -- a liver parasite that afflicts people in the Third World -- or malaria or river blindness or dengue fever," Scott says. All these diseases primarily afflict people in developing nations who can't afford to pay high prices for medicine, he says, so all have been dropped from the pharmaceutical industry's docket. Mildred Cho, of Stanford's Center for Biomedical Ethics, agrees, pointing to vaccine research as another neglected area. "Public-health services simply can't afford to pay high prices," Cho says. "If research is market-driven, it raises potential problems not only for the research agenda but for public health."

As the research agendas of universities and corporations merge, there is one other danger: namely, that universities will cease to serve as places where independent critical thought is nurtured. Anne Kapuscinski, a visiting professor from the University of Minnesota who studies genetically engineered organisms, and other scholars we met with at Berkeley fear that raising questions about the safety of genetically altered crops -- a principal research focus of Novartis -- may prove difficult if more and more agricultural colleges turn to corporations to finance their research. Concerns about genetic engineering are mounting, Kapuscinski notes. A study published last May in *Nature* found that the toxins dispersed from the pollen of Bt (*Bacillus thuringiensis*) corn, a Novartis product, can kill nonpest insects, including the monarch butterfly -- a problem with potentially enormous ecological implications. Such dangers prompted the Food and Drug Administration to convene a series of public hearings last November on genetically altered crops,

whose use has provoked huge demonstrations in Europe and elsewhere. Ignacio Chapela, of the College of Natural Resources' executive committee, believes that the most important thing Novartis stands to gain from the alliance is legitimacy. "The sheer value of having the logo of the University of California next to the logo of Novartis is immensely valuable to the company right now," he says.

Maybe so -- but the plan may end up backfiring. At last year's graduation ceremony, in a graphic display of dissent, a student speaker placed the blue-and-orange Novartis logo directly above Berkeley's, while a hundred students in the audience mockingly donned graduation caps emblazoned with the Novartis logo -- hardly the public exposure the company sought.

Downsizing the Humanities

THE students at Berkeley were not the only ones protesting the growing corporate influence on university research last spring. In March of 1998 students at dozens of schools, including the University of Wisconsin, Harvard, and Cornell, held a series of teach-ins on the subject. At George Mason University, a state school in Fairfax County, Virginia, another graduation protest erupted as hundreds of students attached bright pink buttons bearing the slogan "Stop Dis-Engaging Our Future" to their caps and gowns. The buttons, which were distributed by Students for Quality Education, were a pointed reference to a recent George Mason mission statement, "Engaging the Future," which calls for increasing investment in information technology and tightening relations between the university and northern Virginia's booming technology industry.

In 1998 James S. Gilmore, the governor of Virginia, promised to increase state funds for GMU by as much as \$25 million a year provided that the university better serve the region's high-tech businesses. GMU's president, Alan G. Merten, a computer scientist and a former dean of the business school at Cornell, hardly needed urging. "We must accept that we have a new mandate, and a new reason for being in existence," he announced at the World Congress on Information Technology, a gathering of industry executives hosted by GMU in the summer of 1998. "The mandate is to be networked." By year's end Merten had added degree programs in information technology and computer science, poured money into the 125-acre Prince William campus, whose focus is biosciences, bioinformatics, biotechnology, and computer and information technology, and suggested that all students would be trained to pass a "technology literacy" test. Amid this whirlwind of change, however, other areas fared less well. Degree programs in classics, German, Russian, and several other humanities departments were eliminated.

In defending the changes, Merten speaks as a realist -- and, it's impossible not to notice, as someone versed in the language of the business world. "There was a time when universities weren't held accountable for much -- people just threw money at them," he says. Today "people with money are more likely to give you money if you have restructured and repositioned yourself, got rid of stuff that you don't need to have. They take a very dim view of giving you money to run an inefficient organization." The process of making GMU more efficient was, he concedes, "a little bloody at times," but there was a logic to it. "We have a commitment to produce people who are employable in today's technology work force," he says. Students at GMU are "good consumers" who want degrees in areas where there are robust job opportunities, and the university has an obligation to cater to that demand.

But should meeting the demand come at the expense of providing a well-rounded education? In response to GMU's cuts in the humanities 1,700 students signed a petition of protest. In addition, 180 professors in the College of Arts and Sciences sent a letter to President Merten arguing that although training students for the job market was a legitimate goal, "precisely in the face of such

an emphasis on jobs and technology, it is more necessary than ever to educate students beyond technological proficiency." Kevin Avruch, a GMU anthropologist who signed the letter, explains, "A university should teach people to read and write and think critically. And my guess is that, ironically, that's what corporations really want as well. If they need to teach them Lotus, they can do that after they graduate."

Perhaps -- but what happened at GMU is clearly part of a national trend. In 1995 the Board of Regents in Ohio assessed how the state's education dollars should be spent. The verdict? Eliminate funding for eight doctoral programs in history. James Engell, a professor at Harvard who has chaired that school's steering committees on degree programs in both history and literature, and Anthony Dangerfield, a former Dartmouth English professor, recently concluded a two-year national study of the state of the humanities. From 1970 to 1994, they found, the number of bachelor's degrees conferred in English, foreign languages, philosophy, and religion all declined, while there was a five- to ten-fold increase in degrees in computer and information sciences. The elite top quarter of Ph.D. programs in English have twenty-nine fewer students per program than they had in 1975. Meanwhile, humanities professors on average earn substantially less than their counterparts in other fields, and the gap has widened over the past twenty years.

"Test what you will -- majors, salaries, graduate programs ... the results come back the same," Engell and Dangerfield write in a lengthy recent article in the Harvard alumni magazine. "Since the late 1960s the humanities have been neglected, downgraded, and forced to retrench, all as other areas of higher education have grown in numbers, wealth, and influence." The authors trace this to what they call the new "Market-Model University," in which subjects that make money, study money, or attract money are given priority.

Even small liberal-arts colleges are responding to market demand. At the Claremont Colleges, in southern California, a cluster of schools that includes Pomona and Harvey Mudd, a new graduate institute has been launched that features "a curriculum focused on the needs of the industrial sector," a faculty without tenure, and an educational mandate to train students for "professional careers in emerging fields at the intersection of life sciences and engineering."

Surprisingly, such developments have received little attention. Since the early 1980s American culture has obsessively debated the content of the Western canon -- whether Shakespeare or Toni Morrison, European history or African history, should be taught to undergraduates. In the decades to come a more pressing question may be whether undergraduates are taught any meaningful literature or history at all. Kevin Avruch says that the recent restructuring at GMU brought home that lesson. "It actually united professors on the left and the right," he says. "This faculty is often characterized as overly liberal, but we discovered that in at least one sense most of us are tremendously conservative: we share a nineteenth-century view that our job is to educate well-rounded citizens."

TheHigherLearning.com

WHILE humanities professors at some schools are battling to save their departments from being eliminated, others are discovering, much to their surprise, that university administrators have taken a sudden interest in their course material because of its potential for being marketed online. Seemingly overnight the computer revolution has transformed "courseware" into a valuable piece of "content" that can be packaged and sold on the Internet, and online-education companies are racing to collaborate with academic institutions to exploit this burgeoning market.

Berkeley recently signed a deal with America Online, the University of Colorado has teamed up with Real Education, and the Western Governors' Association has founded a "virtual university" linking more than thirty schools in twenty-two states. Michael Milken, the convicted junk-bond trader, is investing heavily in an Internet education company known as UNext.com, which recently signed deals with Columbia University and the University of Chicago.

In a time of budget shortfalls and dwindling public support for education, university administrators and politicians see online education as a way to expand on the cheap. "Just building campuses is a very expensive proposition," says E. Jeffrey Livingston, the associate commissioner for the Utah System of Higher Education. "Governors see [the virtual university] as a way to not spend as much money in the future, to meet growth." "Distance learning" is also seen as a promising new teaching tool and as a way to reach nontraditional education markets, such as part-timers and foreign students.

Can the sum of our ideas be reduced to "intellectual property"? Or should all information, all knowledge, be set free? As we rethink our institutions governing copyright and intellectual property in the digital age, what touchstones, what principles, should we look to? What is at stake in the legislative battle over the ownership of culture?

A growing number of professors, however, fear that electronic education is destined to transform teaching into little more than a commodity. Before a university can sell courseware online, it must first control the rights, and that means, in essence, usurping copyright from the creators of the courses -- the faculty. "This is going to be one of the most important battlegrounds of the future," predicts Edward Condren, a professor of medieval literature at the University of California at Los Angeles. In June of 1994 UCLA's extension program -- the largest continuing-higher-education program in the country -- signed a deal granting exclusive control (including copyright) over the production and distribution of its electronic courses to OnlineLearning.net (then called The Home Education Network). Despite UCLA's much-vaunted faculty-governance structure, Condren says, there was no prior faculty consultation, and the academic senate had to wait until February of 1998 before it was permitted to see any version of the contract. "This is a public institution," Condren says angrily, "and a contract was entered into without any public announcement that bids were being sought."

In addition to being a renowned Chaucer scholar, Condren is an authority on intellectual-property law. For the past twenty-five years he has served as an expert witness in a number of high-profile court cases, and he testified for the winning side in *Falwell v. Flynt*. "In my opinion," he says, "the UCLA extension program in its electronic offerings is operating illegally. It does not have the copyright assignment from the faculty who own the rights to the courses." Indeed, professors have historically been considered the intellectual "authors," and thus the copyright holders, of their work, says David Noble, a historian at York University, in Toronto, where faculty members recently waged a successful battle to protect their copyrights from challenge. The Bayh-Dole Act allows universities to patent the intellectual discoveries of their faculty members and to share in the royalties, but controlling copyright is radically different, Condren says, because "it would undermine the legal protection that enables faculty to freely express their views without fear of censorship or appropriation of their ideas."

Professors also fear that universities will use distance learning not to enhance education but to eliminate teaching positions. It's a legitimate concern. The New School for Social Research, in New York City, now hires unemployed Ph.D.s to design online courses, pays them a flat fee, and then requires them to sign away copyright so that the school can assign the course as they see fit. Educause, a consortium of over 1,600 academic institutions and more than a hundred and fifty

corporations, in 1994 launched a National Learning Infrastructure Initiative that produced a detailed study of what professors do, breaking down which discrete teaching functions can be automated or outsourced for "productivity enhancement." William Massy and Robert Zemsky, education scholars based at Stanford and the University of Pennsylvania respectively, argue in a recent Educause paper that universities need information technology to control their budgets. "With labor accounting for seventy percent or more of current operating cost," they assert, "there is simply no other way."

The future the professors fear has already arrived. David Noble, citing figures from the U.S. National Center for Educational Statistics, notes that even before the computer revolution, while spending on instruction declined by 9.5 percent at public universities from 1976 to 1994, expenditures on research increased by 21 percent. The American Association of University Professors, examining changes in the academic work force, notes that from 1975 to 1995 the share of full-time faculty positions declined while the use of part-time faculty more than doubled. "In the end students were paying more for their classes and getting less," Noble argues in a recent paper, "Digital Diploma Mills," that links the growth in online learning to the increasingly commercial focus of universities. At least some students seem to agree. In May of 1996, at the University of Utah, Jeff Casper and Heather Fortuna were elected president and vice-president of the student body after running under the slogan "Get Real" and campaigning against the virtual university. "I took a class in one of my majors where the bulk of the instruction was done through computer," Fortuna explained, "and it was the most tedious thing that I ever had to deal with. I learned very little in comparison with the experiences I've had inside the classroom."

It has been the fate of American higher education to develop in a pre-eminently businesslike culture," the historian Richard Hofstadter wrote in 1952. Through the years, Hofstadter acknowledged, America's universities had fostered the nation's technological and economic development. But too often, he lamented, higher education in America was judged on purely pragmatic grounds. "Education is justified apologetically as a useful instrument in attaining other ends: it is good for business or professional careers," he wrote. "Rarely, however, does anyone presume to say that it is good for man."

Some would argue that Hofstadter's vision of higher education is an unaffordable luxury. In today's information age ideas have become prized commodities. Still, even on the utilitarian grounds that traditionalists like Hofstadter would scorn, preserving the distinction between higher education and business is vitally important.

For if commercial criteria are allowed to prevail, schools not only risk shrinking their educational mission -- they risk ceasing to be centers of technological innovation as well. Paul Berg, a Nobel Prize-winning biochemist we met with at Stanford, tells a story that dramatically illustrates why. Berg, seventy-three, is a seminal figure in the biotech revolution, having laid the groundwork for splicing DNA to make hybrid molecules. (Stanley Cohen and Herbert Boyer built on Berg's work to create the first recombinant DNA clone.) His discovery propelled the billion-dollar industry that is now hailed as a model of university-industry relations. But Berg points to an underlying irony. "The biotech revolution itself would not have happened had the whole thing been left up to industry," he says. "Venture-capital people steered clear of anything that didn't have obvious commercial value or short-term impact. They didn't fund the basic research that made biotechnology possible." Berg recalls that shortly after his own pathbreaking discovery he gave a seminar at the Merck pharmaceutical company, where he met a young scientist who had been pursuing the same idea. When this scientist encountered some obstacles after six or seven months, Merck prevented him from continuing to work on the project. "Even though Merck was widely championed for its support of research, they wouldn't let him go beyond a certain point," Berg

says, "and that is just one of the limitations of corporate research."

The freedom of universities from market constraints is precisely what allowed them in the past to nurture the kind of open-ended basic research that led to some of the most important (and least expected) discoveries in history. Today, as the line between basic and applied science dissolves, as professors are encouraged to think more and more like entrepreneurs, a question arises: Will the Paul Bergs of the future have the freedom to explore ideas that have no obvious and immediate commercial value? Only, it seems, if universities cling to their traditional ideals and maintain a degree of independence from the marketplace. This will not be easy in an age of dwindling public support for higher education. But the nation's top-flight universities can lead the way by collectively establishing new guidelines designed to preserve academic freedom in all their interactions with industry. These could include forbidding professors from having direct financial ties to the companies sponsoring their research; banning universities themselves from investing in these companies; prohibiting publication delays of more than thirty to sixty days and any other editorial constraints; and minimizing proprietary restrictions on basic research tools. In addition, universities could do more to make the case for preserving public support for higher education while refusing to tailor either the research agenda or the curriculum to the needs of industry. "The best reason for supporting the college and the university," Hofstadter wrote, "lies not in the services they can perform, vital though such services may be, but in the values they represent. The ultimate criterion of the place of higher learning in America will be the extent to which it is esteemed not as a necessary instrument of external ends, but as an end in itself." Copyright@The Atlantic Monthly