

**External Review of the Collaborative Research Agreement
between
Novartis Agricultural Discovery Institute, Inc.
and
The Regents of the University of California**

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Today, the solitary inventor, tinkering in his shop, has been overshadowed by task forces of scientists in laboratories and testing fields. In the same fashion, the free university, historically the fountainhead of free ideas and scientific discovery, has experienced a revolution in the conduct of research. Partly because of the huge costs involved, a government contract becomes virtually a substitute for intellectual curiosity. For every old blackboard there are now hundreds of new electronic computers.

The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present and is gravely to be regarded.

Yet, in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite.

It is the task of statesmanship to mold, to balance, and to integrate these and other forces, new and old, within the principles of our democratic system – ever aiming toward the supreme goals of our free society.

Another factor in maintaining balance involves the element of time. As we peer into society's future, we – you and I, and our government – must avoid the impulse to live only for today, plundering, for our own ease and convenience, the precious resources of tomorrow. We cannot mortgage the material assets of our grandchildren without risking the loss also of their political and spiritual heritage. We want democracy to survive for all generations to come, not to become the insolvent phantom of tomorrow.

– President Dwight D. Eisenhower (1961)

Table of Contents

Acknowledgements	8
Glossary of Acronyms	9
Executive Summary	10
I. Introduction	15
Central Principles	16
Tests and Trials	19
II. Chronology of Events	22
Plant and Microbial Biology’s Strategies	22
Auction Process	24
Enter Novartis	25
Negotiations	28
Emerging Opposition	30
Involvement of the Academic Senate	32
Signing of the Agreement	33
Continued Questioning	34
External Study	35
Reconfiguration of Novartis Agricultural Discovery Institute, Inc.	38
University of California, Berkeley Internal Review	39
Implementation of the Agreement	40
Aftermath	41
III. Points of Contention	45
Process	46
Substantive Concerns	49
Local Conditions	52
Broader Issues	53
Conclusion	55
IV. Overview and Analysis of the Agreement	55
V. The Agreement and the Public Stage: The Role of the Media in Framing the University of California, Berkeley – Novartis Agreement	64
The Two Roles of the Media	64
The Public Relations Campaign	66
Newspaper Coverage	69
Comments on the Coverage	74
Conclusions	76

VI. The Effects of the University of California, Berkeley – Novartis Agreement on the Department Plant and Microbial Biology	77
Views on the Partner Selection Process	77
Justifications for Entering the Agreement	78
Reasons for Novartis’s Interests	79
Views on the Negotiation Process	82
Implementation of the Agreement	85
Benefits of the Agreement	90
Concerns Regarding the Agreement	94
Consequences of the Agreement	95
Intellectual Property Rights	105
Surrounding Controversy	116
Conclusions	117
VII. Impact and Significance of the University of California, Berkeley – Novartis Agreement on the College of Natural Resources and the University of California, Berkeley as an Institution of Higher Education, Research, and Outreach	118
The University of California and the College of Natural Resources at the University of California Berkeley	118
The Agricultural Sciences and the College of Natural Resources at UCB	121
Academic Freedom and Diversity	126
Collegiality	129
Reputation	130
Public Mission	131
Land Grant Mission	134
Conclusion	137
VIII. Conclusions and Recommendations	138
Rethinking the Role of Public and Land Grant Universities in the 21 st Century	138
Future of the Land Grant Mission at the University of California, Berkeley	141
Conflicts of Interest and Conflicts of Mission	142
Visions of the University	147
Recommendations	152
References	157
Methods Appendices	173
Interview Methods	173
Media Data and Analysis	174
Consent Letters	176
Sample Interview Schedule	179

Appendices	182
A. Project Title and Amount of Funding by Faculty Member from the University of California, Berkeley – Novartis Agreement	182
B. Plant and Microbial Biology Graduate Program Numbers	184
C. Number of Undergraduate Majors in Comparable Departments to Plant and Microbial Biology	185
D. Summary of Provisions of the University of California, Berkeley – Novartis Agreement	186

List of Tables

Table 1. Syngenta Financial Highlights, 1999-2003	38
Table 2. Chronology of Events	44
Table 3. News Frames, 1998-2002	70
Table 4. Coverage Characteristics	71
Table 5. Number of Passages Coded as Justifications for Entering UCB-N by Interviewee Position	78
Table 6. UCB-N Funding by Faculty Member per year, Ranked by total received in \$1000	89
Table 7. Number of Passages Coded as Benefits from Entering UCB-N by Interviewee Position	91
Table 8. Funds Received by Selected Bioscience Departments, 1995-1998, 1999-2002	98
Table 9. Combined PMB Graduate Program	184
Table 10. Plant Biology Division Graduate Program	184
Table 11. Microbial Biology Graduate Program	184
Table 12. Undergraduate Majors (Fall-Spring Average)	185

List of Figures

Figure 1. Number of UCB-N Grants Awarded Each Year by Funding Amount	96
Figure 2. Expenditures for Life Science Academic R&D, 1990-2001, Millions Constant Dollars	100
Figure 3. PMB Graduate Student Applications, Admissions, Matriculation, 1995-2004	101
Figure 4. Number of Regularly Scheduled Undergraduate PMB Classes, by AY	102
Figure 5. Number of PMB Undergraduate Majors, by AY	103

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Of course, the findings, interpretations, and conclusions drawn here remain the responsibility of the authors.

East Lansing, Michigan
July 13, 2004

Glossary of Acronyms

ARE	Agriculture and Resource Economics
AY	Academic year
Bt	<i>Bacillus thuringiensis</i>
C4	Committee of four (Wilhelm Gruissem, Bob Buchanan, Peggy Lemaux, Gordon Rausser)
CNR	College of Natural Resources
CEO	Chief Executive Officer
COI	Conflict of interest
COR	Committee on Research
CRADA	Cooperative Research and Development Agreement
DANR	Division of Agriculture and Natural Resources
DIVCO	Divisional Council of the Academic Senate
DNA	Deoxyribonucleic acid
DOE	Department of Energy
ESPM	Environment Science, Policy, and Management
EVCP	Executive Vice Chancellor and Provost
ExCom	Executive Committee
FTE	Full-time equivalent
FY	Financial year
IP	Intellectual property
IPR	Intellectual property rights
LECG	Law and Economics Consulting Group
LGU	Land Grant University
MCB	Molecular and Cell Biology
MIT	Massachusetts Institute of Technology
MSU	Michigan State University
NABRI	Novartis Agribusiness Biotechnology Research Institute, Incorporated
NADI	Novartis Agricultural Discovery Institute, Incorporated
NIH	National Institutes of Health
NSF	National Science Foundation
NST	Nutritional Sciences and Toxicology Department
OTA	Office of Technology Assessment
OTL	Office of Technology Licensing
PB	Plant Biology Department
PGEC	Plant Gene Expression Center
PI	Principal Investigator
PIO	Public Information Office
PMB	Plant and Microbial Biology
PPA	Plant Patent Act
PVPA	Plant Variety Protection Act
R&D	Research and development
SAES	State Agricultural Experiment Station
SEC	Securities and Exchange Commission
SPO	Sponsored Projects Office
SRR	Students for Responsible Research
TMRI	Torrey Mesa Research Institute
UC	University of California
UCB	University of California, Berkeley
UCB-N	University of California, Berkeley – Novartis agreement
UCD	University of California, Davis
UCR	University of California, Riverside
USDA	United States Department of Agriculture
WARF	Wisconsin Alumni Research Foundation

Executive Summary

There are arguably three principles and associated practices that must stand at the center of any university that is worthy of the title: creativity, autonomy, and diversity. Although occasionally lost sight of, these principles are central to the ethical framework of the university. Perhaps *the* central principle of universities is creativity. Universities can only be successful as organizations to the extent that they foster and cherish creativity among their faculty, students, and staff. But without autonomy, universities soon lose their *raison d'être*. They become bureaucratic entities that perform their tasks in a rote manner. Without substantial autonomy, scholarly work is likely to fail to achieve its objectives. It becomes subject to the political whims of the moment; critical issues are ignored or papered over. Creativity is often constrained by a lack of diversity. The goods that universities provide are nurtured and made more robust through diversity. A diversity of standpoints is essential to the debate and dialogue that must surely be central to a great university. Together, these three principles – creativity, autonomy, and diversity – define what a university is and how it contributes to the common good. Together these three principles enable the university to generate knowledge, inventions, and innovations, to translate and disseminate knowledge in ways that foster the growth and development of people and communities, and to contribute to discourse about social issues. As we show in this report, the agreement between the University of California Berkeley (UCB) and the Novartis Agricultural Discovery Institute (NADI) both promoted and challenged these three principles. This was the case not solely for the research that was the subject of the agreement, but with respect to the educational role of the university as well. This agreement became an icon for these larger issues.

The issues with respect to the University of California-Berkeley – Novartis agreement (UCB-N) all revolve around the contestation over the institutional meaning, weighting and form of creativity, autonomy, diversity, exchange, need and desert. At UCB, and perhaps even more intensely within the College of Natural Resources (CNR), multiple worlds collided, transgressed and contradicted one another in the events leading up to the agreement and in the controversy that ensued. Part of the controversy over the agreement lies in unaddressed, much less resolved, perspectives on the relative importance of individual *v.* communal diversity, autonomy and creativity, and the public *v.* private character of the modes of exchange, the definition of those in need, and the structure of deserts to be elaborated within the university. Both the history of agricultural sciences in general and the history of CNR in particular affected the way the agreement has been perceived and the effects that it has had. The divide between faculty members engaged in research in conventional agriculture and those who research alternative forms of agriculture, supported by colleagues and activists actors outside of the university, has figured prominently into the agreement itself and its implications.

Lost in the common reading of the controversy as alternative *v.* conventional agriculture, however, is the manner in which the agreement has come to act as a lightning rod for debates, grounded in assumptions rarely made explicit, over the contemporary state and future direction of universities. While the implementation of the agreement has been

relatively uncontested and many of the critics' worst fears have not occurred, the fact that the agreement was widely challenged is important on a number of levels. Interviewees offered four broad reasons why the agreement was controversial: (1) the process by which the agreement was created, (2) the substantive content of the agreement, (3) local conditions at UCB and in the Bay Area, and (4) broader issues that reflect the changing character of the university.

On the surface, the terms and conditions of the UCB agreement appear consistent with the behavior of universities adjusting to the emerging norms of university-based economic development. In the late 1990s, the UCB-N agreement was not far from the norm, yet it did have unique characteristics. One key deviation from the norm was the inclusion of nearly an entire academic department in an agreement with a single firm. A second important deviation was the extended capture of intellectual property rights from government-funded research.

The role of the media in the controversy cannot be overlooked, nor should it be overstated. Media coverage made a real impact on the campus, most particularly newspaper and magazine stories crystallized or reified rifts between faculty and administration, between different colleges, between the university and government, between industry and the university, between private citizens and UCB faculty, and so forth. Reporters were widely perceived to sensationalize the agreement and to focus on the negative. This has caused some UCB personnel, particularly within the administration, to think about how things could be done differently in the future.

Faculty members in the Department of Plant and Microbial Biology (PMB) offered three different justifications to explain why their department sought an agreement with an industrial collaborator. The most prevalent idea was that basic science is increasingly expensive and academic units no longer have the resources (financial or material) to keep up with private industry. Thus departments such as PMB require research collaborations with industry as a means for maintaining their cutting edge status. The second justification concerned the expected benefits that would accrue to PMB from the recovery of indirect costs. It was expected that UCB-N would provide significant support for the daily operation of the department in this manner and thus make it easier for faculty members to conduct research. The third justification centered on the benefits of the agreement for PMB's graduate students.

On the whole the PMB faculty viewed the negotiation process as uncontroversial. Faculty were generally satisfied with the extent and degree of their involvement in the negotiations and trusted their department representatives. In comparison to the faculty's view of the negotiation process, many PMB graduate students felt excluded and deliberately kept in the dark about an agreement that was being proposed partly for their putative benefit. This was not a new state of affairs and the general lack of communication and involvement of graduate students in departmental affairs had been a point of contention before UCB-N negotiations were initiated. Post-doctoral researchers in PMB at the time of the UCB-N negotiations also felt that they should have access to and involvement in the information stream.

The majority of the people directly involved said that UCB-N was implemented in the way they expected. One notable divergence in practice from faculty members' expectations relates to collaborations with the NADI scientists. Several faculty members commented on the infrequency of communication between PMB and NADI personnel and the differential level of access to certain technologies both within and across laboratories. This divergence may be in part because, during the negotiation of the formal contract, there was talk of a second \$25 million from Novartis for a research facility to be built on campus. This facility was proposed as a means of enabling closer collaborations among the PMB and NADI scientists. However, identifying a suitable site for the interface facility proved to be an insurmountable hurdle and although several sites were considered, one year after UCB-N was signed NADI withdrew the money and the idea was quietly abandoned.

The PMB faculty noted a wide range of direct benefits stemming from their involvement with UCB-N. At least fourteen different items were identified by PMB faculty, in striking comparison to the other stakeholders. Two aspects of the agreement stand out as particularly significant. First, money, in one form or another, was by far the most positive aspect of UCB-N for PMB faculty members. 38 percent of the benefits noted by PMB faculty in our interviews were seed money for future projects, general funding, and overhead recovery. Second, NADI made available certain proprietary and confidential databases, permitted faculty to use expensive equipment, and provided expertise unavailable from other sources. These accounted for 34 percent of the claimed benefits in our faculty interviews.

Many faculty in the department argued that the focus of their research moved more quickly in new and emerging directions than would otherwise have been possible. Almost to a person, the faculty of PMB said that the combination of funds, equipment and information, enabled them to explore research questions that they otherwise would have foregone or postponed. While it was repeatedly emphasized that these shifts in direction were not dictated by Novartis, the faculty clearly acknowledged that many of the changes would not have occurred without UCB-N.

All faculty research proposals were funded, and although the level of funding for some faculty members changed from year to year, the average annual award was \$120,500 with a range of \$60,000 to \$200,000. Over the course of the five years, the total amount of UCB-N money spent directly on faculty research was \$14,240,000, 59 percent of the total amount of the agreement.¹ Twenty-five PMB faculty members received money from UCB-N, but two faculty members left PMB during the agreement and therefore did not receive funds for all five years. PMB hired another faculty member late into the agreement and he received UCB-N funding for only the last year.²

¹ This figure is adjusted for the Cooperative Research and Development Agreement reduction of \$1,056,000 bringing the total amount of UCB-N funds to \$23,944,000 over five years. See full text for details.

² Other faculty members hired by PMB during the period of UCB-N chose not to sign onto the agreement.

Expectations with respect to the generation of intellectual property by PMB have, to date, remained unfulfilled. Few or no benefits, in terms of patent rights or income, to either UCB or Novartis/Syngenta have emerged from research conducted in the course of the agreement. Of the 51 disclosures made by PMB faculty during the period from November 23, 1998 to November 23, 2003, 20 have been patented. Ten of these patents were on disclosures funded at least in part through UCB-N; NADI expressed interest in six of the patents, though no options to negotiate an exclusive license remain active today.

The most significant consequence of the agreement for PMB graduate students was the increase in cohort size and annual stipend. During the period of UCB-N, PMB doubled the size of its graduate program. Among post-doctoral researchers, salary was deemed to be the greatest benefit of UCB-N. The benefits for PMB undergraduate education are minor, although no one was able to identify any negative effects. However, the publicity surrounding UCB-N appears to have had the temporary effect of depressing the number of undergraduates who chose to major in PMB.

For the academic community, the agreement stood out because it represented significant industrial funding rather than government funding for Berkeley researchers. PMB's financial objective leading to the agreement was to secure a sponsored research agreement from an industrial sponsor of at least \$5 million a year over five years. The effort's success at winning industrial patronage of this scale proved unique for UCB. Of the twenty-six awards received in fiscal years 1998 through 2003 of \$5 million or more, only four were not from the federal government.

The direct impacts of UCB-N on the university as a whole have been minimal. The agreement has not produced the major changes that many feared it would. However, this is not to say that things have remained the same. First, the agreement brought to the surface a number of long simmering tensions at UCB. Second, the agreement highlighted the crisis-ridden state of contemporary public higher education in California, in Land Grant institutions, and across the country.

Recommendations for consideration by the Berkeley community are as follows. UCB should:

1. Avoid industry agreements that involve complete academic units or large groups of researchers.
2. Reassess in a comprehensive fashion the implications of non-financial and institutional conflicts of interest.
3. Encourage broad debate early in the process of developing new research agendas.
4. Be attentive to the formulation of new goals when motivated by a disruption of patronage or by self-interest.
5. Make organizations associated with UC or supported by institutional resources transparent to the public.
6. Assess institutional obligations and commitments to reliable production and communication of regulatory science.

7. Strive to educate the public on the specific nature of intellectual property, technology transfer, and the nature of institutional accountability.
8. Work to identify and prevent the masking of intended applications of knowledge or potential negative consequences of commercialization with the privileges implied by academic freedom.
9. Begin the difficult task of determining the role a public Land Grant university should play in the twenty-first century by re-examining core commitments.

I. Introduction

It is impossible to examine a single thread without picking up the whole cloth. That is perhaps the central problem in attempting to examine the agreement signed between the Novartis Agricultural Discovery Institute (NADI) and the University of California, Berkeley and its aftermath. While on the surface the issues appear to be a relatively well-defined single thread – the import and impact of a large department-wide grant on faculty, students, the department, the university, and its constituencies – in point of fact, the study required picking up the whole cloth of higher education.

Indeed, higher education in the United States is in serious trouble. After twenty-five years of spectacular growth starting in the 1960s, financial support for higher education stagnated during the 1980s and has, of late, entered into a period of decline. But the story of state and federal governmental support for higher education is not the cause but rather an indicator of a much deeper problem. That problem is perhaps best framed in ethical terms. To put the matter succinctly, universities have lost their way. A century ago we knew (or perhaps wrongly thought we knew) what universities were for. The Kantian model of the university was about reason; the Humboldtian model of the university was about culture. Most American universities borrowed from both models (Readings 1996). Today, we are unsure what universities are for. Thus, we hear that universities should be creators of knowledge, economic growth machines, providers of vocational training for highly skilled technical specialists needed in a modern economy, places of mass education, responsive to their ‘customers,’ or any number of other roles focused by local concerns.

Universities are fundamentally places where people conceive, create, and distribute goods, although the nature of these goods differs considerably from those of other organizations or institutions. Some of these goods are material in form – journal articles, new machines, diplomas that allegedly attest to competencies – and some take the form of ideas, behavior, character. Indeed, the very distinction is somewhat ambiguous since every material good is embedded in a web of ideas and meanings, while every ideational good is linked inextricably to material objects and practices.

Moreover, those of us who dwell in the university do not live in a single world, but in multiple ‘worlds’ (Becher and Trowler 2001; Clark 1987). Within each of these worlds there are different rules, different successful strategies of behavior, different tests and trials to achieve greatness, different principles of justice, different norms of behavior, different roles. Luc Boltanski and Laurent Thévenot (1991) note that each world of human existence has its own largely distinct goods and equally distinct means of attaining those goods. Thus, in the world of commerce, material gain through trade is a central good and participation in the market is the major means of obtaining the good. Similarly, in the domestic world love is a central good and is obtained through care of other family members.

Furthermore, each world is not only populated by humans but by a panoply of things. These things are necessary to each world. Thus, the world of commerce can only exist to

the extent that things are available to trade. The domestic world can only exist to the extent that basic necessities such as food, clothing, and shelter are available.

Universities are rather special when compared to other organizations in that they are charged mainly with generating new knowledge and translating³ it across generations. In Boltanski and Thévenot's terms, the university is a part of a civic world that might be called the world of knowledge. Universities are designed to create new knowledge in the form of inventions and innovations (including institutional and organizational innovations), to conserve and (re)interpret old knowledge, and to translate and transfer knowledge to others through formal classroom instruction, public seminars and publications of various kinds, and service as advisors to both public and private organizations.

As with other worlds, so the world of the university requires its own things – things that literally define the university as what it is. These include classrooms, laboratories, offices, books, chalk, blackboards, pens, pencils, and in this electronic age, access to the internet and its myriad resources. Universities that do not have these things in the appropriate numbers and qualities are impoverished, blocked from pursuing or achieving greatness. In sum, our understanding of UCB-N and the controversy surrounding it must include the contested relations between the multiple worlds of the university, the myriad things tied to those worlds, and the ethical incongruities that emerge during the contestation of institutional developments.

Central Principles

There are arguably three central principles and associated practices that must stand at the core of any university that is worthy of the title: creativity, autonomy, and diversity. Although occasionally lost sight of, these principles are central to the ethical framework of the university. Let us examine each briefly in turn.

A central principle – perhaps *the* central principle – of universities is creativity. Universities can only be successful as organizations to the extent that they foster and cherish creativity among their faculty, students, and staff. Creativity can be nurtured by encouraging freedom of inquiry, but it cannot be created by bureaucratic means. Little evidence suggests that reward systems for scholarly inquiry actually promote an increase in the *quality* of scholarship (although such systems can certainly be used to reward those who succeed).

The reverse is not true, however. Creativity can be thwarted by bureaucratic means. Incessant formal audits, lengthy and burdensome reviews, too great an emphasis on

³The commonly used term, 'transfer,' is misleading in that it suggests that one merely hands the knowledge from one person to another. In practice, the metaphor of translation is more appropriate, in that knowledge is always changed (e.g., abridged, modified, rearranged, summarized) when it moves from one person or group to another. See Latour (1987).

receipt of extramural grants, can and do block creativity because they fail to consider that the pursuit of creativity requires risk taking and failure. Creative scholars are those who bring something new into the world. Doing so almost always requires tinkering, a process of trial and error that is concealed in the final paper, book, or artifact (Knorr-Cetina 1981). Formal audits are far too closely linked to a preconceived language and logic of short term productivity to foster creativity. They ignore the dead ends, the mistakes, the ‘wasted time’ not engaged in ‘productive’ work that is necessary to ensure quality in academic endeavors (Giri 2000). Moreover, such audits raise fundamental questions as to who has the grounds on which to judge and who shall judge the legitimacy of the judges (Bourdieu 1997).

Moreover, in order to achieve greatness in the world of knowledge, a substantial degree of autonomy is necessary. Of course, this autonomy is never absolute, nor should it be. But without autonomy, universities soon lose their *raison d’être*. They become bureaucratic entities that perform their tasks in a rote manner.

Often, basic research is seen as somehow removed from society, without direct social consequences, and thereby more autonomous. But, as Harding (1991, 38) asks, “Why should society, in the face of competing social needs, provide massive resources for an enterprise that claims itself to have no social consequences? There is a vast irrationality in this kind of argument for the purity of science.” Indeed, Daniels (1967) has argued that the perceived distinction between basic and applied research was developed in an effort to create the conditions of autonomy in American science. By creating basic research, researchers could justify activities that seemed to a poorly educated public bizarre and even outrageous (e.g., breeding rats). And, Greenberg (1966) has noted that bootlegging – doing one thing and calling it another – is commonplace in research. Rare is the scholar who cannot cast her or his research in several different ways.

Others might argue that applied or finalized (Schafer 1983) research is less autonomous than basic or fundamental research. Yet, as Pierre Bourdieu (1997) points out, both basic and applied research require a high degree of autonomy. There are two reasons for this: On the one hand, without autonomy even applied researchers will be forced to attempt to find the answers to concrete problems from within a narrow range of options. On the other hand, the very distinction between basic and applied research has of late disintegrated. Especially with respect to molecular biology, what is considered a breakthrough in basic research one day may well be a tool or product the next. Indeed, a central aspect of molecular biology is the difficulty in distinguishing between that research of largely scholarly interest and that likely to lead to new products and processes.

Without substantial autonomy, scholarly work is likely to fail to achieve its objectives. It becomes subject to the political whims of the moment; critical issues are ignored or papered over. But autonomy does not come easily. Throughout the history of American universities, there have been those who have wished to reduce the autonomy of the academic enterprise. The agricultural and related sciences have been particularly vulnerable to these types of attacks for more than a century (Hardin 1955; Lacy and

Busch 1982). President Eisenhower's famous farewell address, quoted in the epigraph above, emphasizes that autonomy requires eternal vigilance (Bella 1985).

Bourdieu (1997, 65; our translation) makes another relevant point with respect to autonomy. As he puts it, "Said differently, the more one is autonomous, the more one has a chance to employ the specific scientific or literary authority that permits one to speak outside one's field with a certain symbolic efficacy." Using the infamous Dreyfus case as an example, Bourdieu sees Emile Zola's critical intervention as linked to his autonomy as an author. Clark Kerr's ability to resist loyalty oaths in the 1950s and the suppression of student free speech in the 1960s depended on the autonomy of the academy, as well as the independence of the Chancellorship of UCB and Presidency of the University of California system respectively. The autonomy of the University was clearly threatened by Kerr's subsequent removal early in Ronald Reagan's first term as Governor of California.

Creativity is often constrained by a lack of diversity. The goods that universities provide are nurtured and made more robust through diversity. A diversity of standpoints is essential to the debate and dialogue that must surely be central to a great university. Even if one accepts the somewhat problematic notion that the study of nature provides us with clear answers to problems posed, we are the ones who pose the problems. The same is true of measurement: "All measurements depend on embodied choices of apparatus, conditions for defining and including some variables and excluding others, and historical practices of interpretation" (Haraway 1997, 116). We (i.e., both within the scholarly community and among the public at large) are the ones who interpret the results in light of our cultural values, longstanding traditions, metaphors,⁴ and culturally defined meanings.

For example, Donna Haraway (1997) notes that the human genome project has been told as a story of human salvation. Similarly, the story of agricultural biotechnology is told by supporters as the end of famine and hunger, while detractors describe it as the advent of frankenfoods. This is not to suggest that someone got the story wrong, but that there is no true story independent of human beings in whom we can have (more or less) confidence. This includes the story that we tell here. Given that aspect of the human condition, diversity is one inadequate and partial, but necessary, remedy to the limits of human beings and of human culture.

Traditionally, in the Western world, including the United States, scholarship was reserved to white, Christian, heterosexual, upper class males. While most scholars today would agree that this narrow definition of who is a scholar is far too confining, one cannot just,

⁴Some years ago Max Black (1962) noted the important role that metaphor plays in the sciences. In an empirical study of a lab, Knorr-Cetina (1981) observed that metaphorical reasoning was central to the creation of research results. Countless others have observed the importance of metaphors in both opening and closing certain avenues of scholarship. See, for example, Hacking (1999), Haraway (1995), Ricoeur, (1977), Turbayne (1970), and Wheelwright (1954).

for example, ‘add women and stir.’ Such an approach ignores the fact that modern scholarship (especially in the natural sciences, but also in nearly all other fields) began as a quintessentially white male endeavor. Thus, the epistemological tradition itself was based on certain assumptions about the range of issues to be addressed, the kinds of methods to be employed, and even how results were to be presented to others. Moreover, the very notion that objectivity resides in individuals, in what Shapin and Shafer (1985) call ‘modest witnesses,’ rather than in the scholarly community, presumes that individuals can transcend their location in the world. While this may be true to some degree, it is quite clearly the case that each of us has a standpoint marked by time and space, culture, gender, class, and status, among other things. Thus, each of us has a necessarily partial view (Harding 1991). By maximizing the diversity of perspectives one can produce what Harding calls strong objectivity, i.e., an objectivity that resides in the community rather than in individuals and that calls background beliefs into question in making knowledge claims. Such an approach avoids both the Scylla of absolutism and the Charybdis of relativism. It makes claim neither to absolute knowledge nor to the unquestioned superiority of any one standpoint.

Together, these three principles – creativity, autonomy, and diversity – define what a university is and how it contributes to the common good. Together these three principles enable the university to generate knowledge, inventions, and innovations, to translate and disseminate knowledge in ways that foster the growth and development of people and communities, and to contribute to discourse about social issues. They are the standards by which universities are measured. Of course, “There is no single standard. But there are standards (roughly knowable even when they are also controversial) for every social good and every distributive sphere in every particular society; and these standards are often violated, the goods usurped, the spheres invaded, by powerful men and women” (Walzer 1983, 10).

As we shall see, the agreement between UCB and NADI both promoted and challenged these three principles. This was the case not solely for the research that was the subject of the agreement, but with respect to the educational role of the university as well. This agreement became an icon for these larger issues.

Tests and Trials

Each world has its own largely distinct principles of justice as well as tests and trials for determining the greatness of both people and things. A great merchant, for example, is surely one who buys low and sells high, while the goods that he or she sells have their own measures of quality. Similarly, great parents are measured by the love and care they give to their children, while the goods of the family are measured by their provision of food, clothing, education, and shelter. To judge someone or some thing, one must know the corresponding principles of justice involved. Both universities and the persons who inhabit and construct them must go through various trials (in both the legal and scientific sense) in order to demonstrate their greatness. Universities are subject to endless public criticism and review both from within as well as from external constituencies.

For example, universities, such as UCB, have been frequently challenged with respect to academic freedom. Great universities have withstood attacks by external critics arguing successfully that, “Certainly science and probably every other study in the university is more successful, judged in purely academic terms, when it is free from either political control or the dominion of commerce” (Dworkin 1996, 185). Similarly, administrators of great universities have often supported faculty whose views or scientific analysis they personally found abhorrent or wrong.

Universities also develop tests and trials for those who inhabit them. In an ideal world of knowledge, individual faculty members are rewarded for their support and furtherance of these core principles. They are rewarded for publishing their research or scholarship in scholarly journals, for generating excitement, interest, and critical thinking among their students, for taking part in public intellectual life. To do these things requires recognition generated outside the university (or at least outside any particular university) by the discipline or field (Bourdieu 1997). Those rules for demonstration and refutation vary from field to field, but they are, and if they are to continue to be effective must remain, largely autonomous, beyond the control of other organizations.

Of particular import is that these tests and trials are relationships between individuals and those around them. As Michael Walzer (1983, 3) argues in his path-breaking work, *Spheres of Justice*, “My place in the economy, my standing in the political order, my reputation among my fellows, my material holdings: all these come to me from other men and women.” The same holds true for those positive and negative sanctions imposed by universities. However, not all rewards are distributed in the same way, either within universities or across all organizations.

Goods may be distributed based on market exchange, need, or dessert (Walzer 1983). Universities distribute their goods in all three ways.⁵ Much formal education and research may (only) be purchased through tuition and research grants and contracts, respectively. Thus, some sort of market is in operation, though not necessarily a free market or even a highly competitive one. Some students may have their tuition reduced as a result of need, while some faculty will provide consulting services at nominal or no cost in cases of need. And, universities are particularly generous with respect to desserts – diplomas, honorary degrees, certificates of commendation, awards of all kinds, sculptures, and even monuments are commonplace sights on university campuses. Universities may provide funds to faculty to support research and education on the basis of some perceived need or dessert. Universities also dispense negative desserts, such as denials of tenure, expulsions and dismissals for engaging in sexual harassment.

Of course, these categories are hardly watertight. Frequently, buildings are named not based on dessert but on the fact that funds for their construction were provided by a particular benefactor. Sometimes the children of alumni are admitted to the university simply because their parents attended the institution and not because they either needed or deserved to be admitted. Less frequently, some persons are the recipients of

⁵ Who determines the rules for distribution is obviously a critical question.

undeserved honors because they have bestowed their largesse on the university. And, sometimes, those who have transgressed university rules of conduct or even violated legal norms fail to get their just desserts.

Moreover, some would attempt to impose a single means for distributing goods on all university activities. Currently, it is proponents of the market who are most likely to insist that that particular means for distributing social goods should trump all other forms. But if university education and research are in fact needed to serve some public purpose, then they must be distributed in some manner other than solely via the market. As Walzer (1983, 89) puts it, “what we do when we declare this or that good to be a needed good is to block or constrain its free exchange.” Thus, a critical question for (public) universities is what roles the market, need, and dessert should play in gaining admission to the university, in partaking of its many goods, in rewarding students, faculty, and staff, and in its overall governance.

Finally, it should be noted that all of us live in multiple worlds, worlds which collide, transgress upon each other, pose contradictions. Thus, what is necessary to be a good merchant may sometimes thwart what is needed to be a good parent. A faculty member might feel pressured into raising the grade of an athlete, or a university administrator might feel pressured to admit a student with inadequate preparation because that student’s parents are major donors. In some cases these issues arise because someone or some group is acting in bad faith or deceitfully. But in many if not most instances, these contradictions occur because those involved are striving to achieve contradictory or even incompatible notions of the common good. All of us are faced with these trials and must navigate our way through them by negotiation (e.g., Strauss 1978) and compromise (e.g., Benjamin 1990).

The issues with respect to the University of California, Berkeley – Novartis Agreement (UCB-N) that we have learned about in our research and developed in our analysis all revolve around the contestation over the institutional meaning, weighting and form of creativity, autonomy, diversity, exchange, need and dessert. At UCB in general, and perhaps even more intensely within the College of Natural Resources (CNR) in particular, multiple worlds have collided, transgressed and contradicted one another in the events leading up to the agreement and in the controversy that has ensued. Earlier we noted that Sandra Harding has argued that strong objectivity lies in the community rather than in the individual. Part of the controversy over the UCB-N agreement lies in unaddressed, much less resolved, perspectives on the relative importance of individual *v.* communal diversity, autonomy and creativity and the public *v.* private character of the modes of exchange, the definition of those in need, and the structure of desserts to be elaborated within the university. Our review of the agreement, its history, controversy and consequences will seek to make this clear.

II. Chronology of Events

Everything is said to have a beginning, although reasonable people may disagree over where that beginning starts. For our story we think it necessary to step back a few years from the initiation of the agreement between NADI and the Plant and Microbial Biology Department (PMB)—perhaps not as far back as the establishment of UCB, in which PMB is housed, but at least to 1993, five years before Novartis entered this scene.⁶

In this section we present a chronology of the events relevant to the creation and implementation of the agreement between NADI and PMB. This chronology has been developed from newspaper accounts, internal documents, and interviews with the various university, government, and industry employees who were centrally involved in the events. While we believe that the chronology we present is relatively uncontested, where information on specific events came uniquely from specific individuals, we have indicated as such. Interview participants were given the option of anonymity; in those cases, we have merely characterized the source of the information.

In 1993, Chancellor Chang-Lin Tien at UCB convened a Biotechnology Planning Board comprising ten distinguished faculty from various biological fields in order for UCB to maintain its preeminence in biotechnology and improve technology transfer with biotechnology firms. William Hoskins, Director of the Office of Technology Licensing (OTL) at UCB, was involved in this board at the request of Joseph Cerny, then Vice Chancellor for Research at UCB. The board decided they wanted to have a relationship with industry patterned on the Scripps-Sandoz agreement in La Jolla that brought in significant investment on the part of industry. The goal for UCB was to get \$5 million per year for five or more years. This board developed a list of faculty to be involved. Mark Alper, faculty member at Lawrence Berkeley Laboratories, was the point person for promoting partnerships between university and industry, in particular with respect to pharmaceutical companies. They engaged in conversations with several companies but nothing came of it.⁷

Plant and Microbial Biology's Strategies

Wilhelm Gruissem, then chair of Plant Biology (PB),⁸ was also a member of Tien's Biotechnology Planning Board. Gruissem "felt that his department certainly needed the research money, so he took that concept [of significant industry investment over a considerable time period] and applied it" to PMB (Hoskins, interview). What emerged from these efforts was the formation of an International Biotechnology Advisory Board, which included fourteen representatives from industry by 1997 (Gruissem, 1997 [March

⁶ The chronology is summarized in Table 2.

⁷ The University of California (UC) manages three Department of Energy (DOE) Laboratories: Los Alamos National Laboratory (LANL), Lawrence Berkeley National Laboratory (LBNL), and Lawrence Livermore National Laboratory (LLNL). Research and Development (R&D) expenditures at the DOE labs fell more than 40 percent between 1988 and 1996 (Jaffe and Lerner 2001).

⁸ Up until 1996 when the Division of Microbial Biology was added, PMB was known as the Department of Plant Biology.

21]).⁹ Gruissem’s first tactic was to invite these company representatives to give money to support the PMB graduate program in the fashion of a consortium where each company gave approximately \$10,000; but none of the companies were interested and this approach failed (Zambryski, interview). Indeed, despite expressed interest from the biotechnology industry, in its three years of existence the Board failed to generate significant funding for the department. However, it did lay the groundwork for the agreement between PMB and Novartis by fostering departmental ties with industry.

In 1997, a research relationship between PMB (as a department) and Monsanto/Calgene was pursued within the context of the International Biotechnology Advisory Board. However, OTL discouraged PMB from creating an agreement similar to that between Monsanto and Washington University in St. Louis. There were particular terms in the latter agreement that OTL wanted to avoid such as: 1) control of patent prosecution by Monsanto, and 2) no requirement of Monsanto to make timely intellectual property (IP) licensing decisions. Carol Mimura, Associate Director of OTL, asserted, “Both terms would have been so far outside of University of California (UC) policies that we didn’t think we could negotiate an agreement with Monsanto.” When these negotiations failed, Gruissem put together a committee of four—himself; Bob Buchanan, PMB Professor; Peggy Lemaux, Cooperative Extension Specialist; and Gordon Rausser, Dean of the College of CNR, hereafter called C4—and approached OTL for advice on the best way to obtain private funding for the department. Such a move had at least the tacit approval of the highest administrators within the UC Office of the President (UCOP). That office issued guidelines that stated, “faculty members are encouraged to engage in appropriate outside professional relationships with private industry” (University of California 1989, 1). In addition there was a UC President’s Retreat at UC Los Angeles, January 30-31, 1997 on “University Relations with Industry in Research and Technology Transfer” that addressed further ways of assisting university-industry relations.

The ultimately successful approach C4 took to secure funding for PMB was based on Rausser’s suggestion to reverse the usual relationship between funder and recipient. Under his plan, faculty would choose the source and conditions of corporate funding by pitting the companies against each other in competition for the right to collaborate with PMB. Rausser argued that any university agreement with industry should meet four basic criteria:

1. Select a single industrial partner for a research alliance that will maximize the financial, technological, and intellectual benefits for PMB, the university, and California agriculture;
2. Use traditional business models to encourage competitive bidding among candidates for partnership;

⁹ We have included the full date for unpublished memorandums and letters, and also selected other references, in order to help clarify the chronology of events related to the development and implementation of UCB-N.

3. Insist that the strategic alliance generate large uncommitted, unrestricted funds for the department to use for research in the public interest, without oversight by the industrial partner;
4. Require that the industrial partner make significant intellectual contributions to the university in the form of access to technology and data useful for departmental research that would otherwise be prohibitive because of costs or proprietary reasons (PMB 2002).

This reversal in the power dynamic between grantor and grantee was a major shift in the pursuit of university-industry relations and became commonly referred to as “auctioning” the department. A senior UCB faculty member described this shift as an effort to break what Rausser saw as the stranglehold that natural science corporations had on the direction of research.¹⁰ A CNR professor suggested that this new approach was rooted in Rausser’s argument that the value of PMB would only be determined by creating a bidding process.

Auction Process

A letter announcing the availability of PMB expertise was sent out to sixteen selected companies under Rausser and Gruissem’s signatures; five companies replied and were visited by C4 who, in turn, made presentations to each of these companies. A number of guiding principles were laid out during these presentations, although not all of them were incorporated into the final agreement. The principles were as follows:

- The industry partner selects participating faculty for interactions
- In return for provision of unrestricted funds to the Department, the industry partner has free access to all uncommitted research of selected faculty
- Funds are to be used for research by participating faculty and support of Department and related campus programs
- Research and publication of participating faculty remain unrestricted but are subject to review by participating industry partner
- The industry partner obtains the right to negotiate for a license to technologies generated by participating faculty
- Participating faculty can make individual arrangements with the industry partner to sponsor a particular program without affecting their role in the overall program
- Participating faculty are committed to the industrial partnership program and cannot negotiate funding of a specific project with other companies unless the industrial partner relinquishes interest in the specific project

¹⁰ It is important to note that already by 1998 the level of economic concentration in the agricultural biotechnology industry was substantial. A handful of firms, including Monsanto, Syngenta, Dow, and DuPont, dominated the fledgling agricultural biotechnology industry. Using a combination of purchase of seed companies and small biotechnology firms, and cross-licensing of patents among each other to permit freedom to operate (Barton 2002), they had already effectively established themselves as the trend-setters in the industry.

- Industry partner may choose to have a full-time scientist located on the UCB campus (PMB 2002; Rausser 1998 [July 19])

Following the presentations, written expressions of interest were received from Monsanto, Novartis, and jointly from DuPont and Pioneer Hi-Bred.¹¹ Representatives from these companies then came to UCB and met with the Chancellor, the Vice Chancellor for research, and PMB faculty. All of the participants wanted to work quickly within a strict time frame, so PMB limited itself to a thirty-day period to review the proposals and decide on a corporate partner. Several PMB faculty members noted that each PMB faculty member had to sign a confidentiality agreement in order to look at the competing proposals from industry. Apparently these companies verbally promised many things in an attempt to get the benefits of a relationship with PMB for their company, but these promises were not part of the companies' "term sheets."

Enter Novartis

In the late 1980s there was widespread enthusiasm about the potential applications of biotechnology – in pharmaceuticals, in crop and animal production, and in food processing. The nation's research universities scrambled to develop various biotechnology centers and institutes, while the large chemical and pharmaceutical companies began to invest in seed companies. There was little doubt among both supporters and detractors of these new technologies that what came to be known as the 'life sciences' would never again be the same.

Leading the charge was Monsanto. Long seen as a leading chemical company, with two key patents providing considerable revenue – aspartame (NutraSweet) and glyphosate (Roundup) – Monsanto soon captured a considerable share of the new market for genetically modified crops (Charles 2001). In contrast, Novartis was a latecomer to the field. Created in 1996 through the merger of the Swiss chemical giant Ciba-Geigy and Vienna-based Sandoz, by 1998 Novartis was simultaneously among the world's largest health care products companies, the largest agribusiness company (including a large seed division, Novartis Seeds, formed by a merger between Northup-King and Ciba Seeds in 1997), and the third largest nutritional supplements company. Moreover, it employed some 87,000 people in ten nations. It also had managed to develop and market an apparently valuable new plant product. By 1997 Novartis's *bacillus thuringiensis* (Bt) corn (conferring insect tolerance [resistance through Bt toxin in the plant]) was planted on over three million acres (Kasper 2000).

Like other chemical giants such as Dow, DuPont, and Monsanto, Novartis attempted to redefine itself as a 'life sciences' company. The new terminology reflected a widespread agreement that commodity chemicals were becoming less and less profitable and that research in biotechnology offered new possibilities to integrate human, animal, and plant health issues. The very name of the company – adapted from the Latin *Novae Artes* (new

¹¹ In 1997 DuPont purchased 20% of Pioneer Hi-Bred, the nation's leading producer of hybrid corn seed. It purchased the remaining shares in 1999.

skills) – represented this new potential. Moreover, the company was organized into three profit centers – healthcare, agribusiness, and nutrition – even as integration was emphasized. The agribusiness division in turn was organized into three subdivisions: animal health, seeds, and crop protection. Within the seed and crop protection subdivisions, Novartis pursued goals shared widely by the industry. Specifically, like most of the biotechnology giants, Novartis would attempt to improve agricultural productivity through identification of genes conferring insect resistance and herbicide tolerance, would use bioreactors to develop new products derived from plant cells, and identify or create valuable plant traits such as oils with specially tailored fatty acid composition for industrial use.

The Novartis Agribusiness Biotechnology Research Institute, Inc. (NABRI), formerly the Ciba-Geigy Agricultural Biotechnology Research Unit, had been established in 1983 in Research Triangle, North Carolina. With considerable reserves in the bank –\$19 billion in 1998 – and substantial revenues from its health care division, it seemed poised to make its mark on agricultural biotechnology. Novartis President and Chief Executive Officer (CEO), Daniel J. Varella, hired Steven Briggs to develop a strategy for its new plant genomics research endeavor, NADI.

While NADI was funded at a handsome \$600 million over 10 years, it was clearly dwarfed by the \$8 billion spent by Monsanto between 1996 and 1998 (Kasper, 2000). NADI was to be a wholly owned entity of the Novartis Research Foundation, itself a part of the Novartis Corporation. But since Novartis was a latecomer to the plant biotechnology arena, it was decided to take a different approach to the field than that taken by Monsanto, DuPont, and others. Specifically, NADI would become the Bell Labs of plant biotechnology. It would engage in fundamental research considerably removed from the product development common at other Novartis labs. The coincidence of the establishment of NADI and the opportunity to collaborate with PMB proved fortuitous for each institution.

A study by the Scottish Universities Policy Research and Advice Network at the University of Edinburgh, based on executive interviews conducted in 1999, summarized the distinctions between the two research institutions:

In strategic planning for new product development the next ten years is irrelevant for R&D [research and development] decision making. Any decisions taken for research today are for after 2010. In Novartis Agribusiness ‘the present day’ covers the period up till 2005, mainly the operating companies engaged in product development. ‘Tomorrow’, covers time lines approximately 2005-2010, roughly, and involves research conducted at Novartis Agricultural [Agribusiness] Biotech Research Institute (NABRI) in North Carolina. ‘The day after tomorrow,’ covers 2010 and beyond and involves mainly the Novartis Agricultural Discovery Institute (NADI) in California. But these dates are approximate

and the technology can surprise a company positively or negatively (Tait and Chataway 2000, Annex C12, 22).

In addition, unlike its competitors, Novartis would attempt to develop partners outside the company who might help it to advance its goals. As one observer put it,

Under this model, Novartis would neither attempt to buy critical technologies from outside, nor build them in-house, but rather acquire them through a web of relationships with external companies and academics. Briggs would design his organization to appeal to top researchers, many of whom might not feel at home in a large corporate bureaucracy. His organization would acquire some of its own researchers, but also function as the nexus of a larger maze of interconnected, but independent, scientists (Kasper 2000, 7).

This approach was far cheaper than that of Monsanto, which in 1998 had bought DeKalb seeds for \$5.4 billion (Kasper 2000). Briggs determined that the best location for NADI was San Diego, where likely collaboration between Novartis and Scripps Research Institute could be undertaken. Furthermore, the excellent weather in the San Diego area would attract a top flight research team (Kasper 2000).

Indeed, one difference in the proposals is reported to have been that Novartis was “the most accommodating of the university spirit,” including academic freedom and the principles set out by PMB.¹² This may have been rooted in Novartis’s relatively weak position in plant biotechnology in 1998 and its desire to establish university-industry synergies with NADI.

Although the relationship with Scripps never materialized, the solicitation of interest on the part of PMB at Berkeley arrived at precisely the right moment. Moreover, Steven Briggs and Wilhelm Gruissem had known each other for some time, undoubtedly lending a personal dimension to the project.

Given the noticeably different character of the Novartis proposal – combined with the fact that they offered more money than did Monsanto or DuPont/Pioneer – the faculty decided to enter into further negotiations with Novartis. Put more precisely, and as noted above, PMB did not enter into an agreement with the Novartis Corporation *per se* but rather with NADI, which was formally funded by the legally distinct Novartis Research Foundation.¹³

¹² LaPorte (2000, 67) argued that the other bids “were considered predatory and not at all in the spirit of the design; these bids were rejected, almost out of hand.”

¹³ Novartis supports numerous ‘in-house’ foundations. According to the company website, the Novartis Research Foundation “supports scientific research projects, particularly high-risk projects in areas of new technologies, that are compatible with the long-term interests of Novartis and its partner organizations.” See: Novartis (2004).

Other connections also fed the selection of NADI. Steven Briggs had been working at Pioneer when PMB began its search for an industrial partner. Briggs was not the only person to move from Pioneer to NADI and indeed when the four representatives of PMB came to present their plan to NADI they found many people they had seen a few months earlier at their Pioneer presentation.

Negotiations

Once PMB decided on Novartis in May 1998, they wrote a letter of intent to the company containing a thirty-day time frame within which the agreement would be written. PMB conferred with OTL during these discussions in order to clarify issues with respect to university policies and procedures, but prior to this they did not work closely with each other. Indeed, PMB had intended to hire an outside attorney to write the agreement but Vice Chancellor Cerny argued that the agreement should be drafted by OTL, and by Hoskins in particular. The concern was that an outside attorney would not be familiar with the aims of UCB; the agreement was expected to have unusual characteristics that were not typical of university-industry agreements; and, in addition, there was a rigid time frame of thirty days.

At this point there was a meeting between Joyce Freedman, Director of the Sponsored Projects Office (SPO), Cerny, and Hoskins, where Cerny made it clear that he wanted Hoskins to write the agreement. This meeting was necessary because the usual route for university-industry contracts was through SPO first with OTL only involved later if there were IP issues to be resolved. Hoskins was worried about this inversion and the perception that OTL was stepping on SPO's territory and he wanted Cerny to publicly say that he, Cerny, wanted it done this way with OTL's involvement from the start.

There was insufficient time to write a full comprehensive draft agreement because PMB had promised one to Novartis within thirty days. So Hoskins started with a model agreement that UC San Francisco had signed with Daiichi. It was smaller in both scope and dollars. Hoskins also looked at the UC Irvine-Hitachi contract, which included the construction of a building. A team of people were involved in the drafting of the agreement between UCB and Novartis: three PMB scientists, two senior people from NADI, two senior administrators from OTL, and two attorneys from Novartis. Perhaps remarkably, they managed to stay within the 30-day time frame and had the first draft of the agreement written by June 1, 1998. Once drafted, it was passed on for review to the UC Office of the President, the UC general counsel's office, and Novartis's corporate headquarters in Basel, Switzerland.

Negotiations continued on the structure and content of UCB-N as each party received feedback on the draft agreement. In September 1998, Hoskins and Carol Mimura (Associate Director of OTL) gave presentations on the draft agreement to the assembled PMB faculty. Hoskins described this process as detailed and frequent: "Carol and I would go over there at about three o'clock in the afternoon and we stayed as long as it was necessary, and we went over every article of the agreement." He recalled that there

were approximately four meetings, each lasting two or three hours with thirty or forty faculty, and “none of them had ever seen an agreement, I don’t think, of that magnitude or that complexity.”

During the negotiation of the formal contract there was talk of a second \$25 million from Novartis for a research facility to be built on campus along with the \$25 million research grant. This facility was proposed to enable closer collaborations among the PMB and NADI scientists. Although the interface facility was discussed from the very beginning Hoskins said, “That was nice in principle, but I could see after about the first month, that it wasn’t going to happen in my lifetime. So I set that aside and I said ‘we need to focus on getting the research agreement done because that’s important to the faculty.’” Indeed, Appendix E of UCB-N, *Guidelines for working in NADII-UCB facility*, states “the development of these Guidelines is deferred until the NADII-UCB facility is identified” (NADII and UC 1998, 44).

Identifying a suitable site for the interface facility proved to be an insurmountable hurdle. The ideal site had to be close enough to campus that people could walk to it and it had to be built or renovated quickly so that the participants in UCB-N could use it for the majority of the five years of the agreement. Although several sites were considered, the process simply took too long and one year after UCB-N was signed NADI withdrew the money and the idea was quietly abandoned.

Another part of the negotiations concerned whether United States Department of Agriculture (USDA) employees at the Plant Gene Expression Center (PGEC) in Albany, CA would be involved in UCB-N through their adjunct status with PMB. Athanasios Theologis, PGEC scientist, said that Novartis sought to include the PGEC employees because of their excellence in research. However, the USDA hierarchy was unhappy with their employees participating directly in UCB-N. Bob Buchanan recalled, “Some high-ranking people from the USDA came out and visited when this [the agreement] was beginning to gel, and they just couldn’t commit to one corporation, right, because of the government position.” Interestingly, according to Peter Quail, Research Director at PGEC, UCB-N was the only grant gained through adjunct status at UCB to which the USDA objected. In the end, PMB returned \$1,056,000 of the \$25 million from NADI because the PGEC scientists could not be involved in the agreement. In turn, each PGEC principal investigator (PI) who wanted to be involved then negotiated an individual Cooperative Research and Development Agreement (CRADA) with NADI to have access to funds, equipment, and databases.

In sum, from the perspective of PMB faculty, the agreement with Novartis would contribute to the common good. It would support the three central principles noted above. It would provide a high level of autonomy to faculty to pursue their research interests. It would promote (or at least not stifle) creativity as well by minimizing the paperwork and reduce the time needed to obtain grants of significant size. And, by involving the nearly entire department, it would promote a sort of diversity – diversity with respect to research approaches and standpoints of extant PMB faculty.

Furthermore, the agreement combined the three forms of distribution noted earlier in a novel way. Funds would be obtained through free exchange (via the ‘auction’ process). The need for research funds would be met, and those who deserved the funds would receive them based on peer review of proposals. But the concerns raised at PGEC presaged broader and more challenging concerns on the part of both UCB faculty and students as well as external stakeholders.

Emerging Opposition

The main part of the negotiations between PMB and Novartis occurred during the summer months when few faculty or students were on campus. However, as students and faculty returned to campus for the fall semester, rumors began to circulate with respect to an alliance that CNR was forming with Novartis. Several of the first-year students in the Department of Environmental Science, Policy, and Management (ESPM) in CNR were particularly incensed upon hearing of the potential alliance. They formed an organization called Students for Responsible Research (SRR), and sought further information. Many CNR faculty members, along with individuals across campus, were also concerned about the process through which UCB-N was being created, the repercussions of this agreement as it was put into practice, and the implications it posed for the future of the university.

On October 2, 1998, Rausser held a CNR ‘town hall’ meeting. Multiple attendees (faculty, student, and staff) have described that meeting as a forum to dispense information about a done deal rather than as an arena in which to solicit advice. Several of the faculty members who attended this meeting were struck by how few people spoke out, even though there were widespread indications that many faculty members had privately held strong reservations about the agreement.

One of the main points of contention that surfaced during this meeting, and underpinned much of the subsequent controversy concerning UCB-N, was the precise academic unit with which NADI was entering an agreement. Up to this point it was a PMB agreement but there had been a deliberate decision to formally extend it to CNR as a whole. In retrospect, almost everyone in PMB thinks that this was a serious mistake. Rausser was the key person arguing for a formal extension to the college for three reasons: (1) Rausser’s involvement in the negotiations with companies raised the credibility of, and potential resources offered by, PMB; (2) Any negative criticism could be directed at CNR rather than PMB, i.e., CNR had more resources to handle the media and any questions; and (3) CNR needed unencumbered funds that would come from its share of the indirect costs. However, by this time the agreement was in its final stages of negotiations and no additional time was available to include the participation of other CNR faculty members.

At the town hall meeting Rausser outlined the draft agreement, and according to David Quist, ESPM student and member of SRR, said there was no secrecy surrounding the agreement and that the draft was available in the Dean’s office for anyone who wanted to review it. Four days later on October 6, Quist visited Rausser’s office to look over the draft. All he found were Rausser’s outlined notes on the presentation he gave to a

commodity group on potential strategic alliances, a presentation that contained no contractual language on the agreement with Novartis. Quist attempted to take notes on what he saw but had these notes confiscated by the Dean's office staff. In an interview with our team Quist argued, "At that point, obviously, that kind of signaled that the process wasn't as transparent as he [Rausser] was trying to making it seem it was."

SRR continued to search for reliable information about UCB-N through both formal and informal channels. Having little success in this effort, the group turned its attention outward by way of a media campaign that sought broader public involvement and commentary. On October 14, SRR presented the UC Regents with a petition of 400 signatures predominantly from graduate students in ESPM along with undergraduates and staff members from across the campus and a handful of people unaffiliated with the university (Students for Responsible Research 1998a). The petition asked for a delay in formally signing UCB-N until their various concerns had been resolved. It was effectively ignored.

After SRR had approached several newspapers with their reservations about UCB-N, the organization met with Rausser on October 16. At this meeting Rausser made a public show of returning Quist's notes to him and tried to assure SRR that the agreement with Novartis was fine; however, from the vantage point of the students, their questions remained unanswered.

At the same time that SRR activities were developing, the Executive Committee of CNR (ExCom) also became actively involved in the controversy. ExCom had appointed a new chair, Ignacio Chapela, an untenured professor in ESPM, just one week before getting notice that UCB-N was in the works. In 1997 there had been some theoretical discussions in ExCom regarding university-industry contracts in CNR, but this was the first time they had dealt with any specifics. Rausser brought the tentative agreement to ExCom for their approval. Approval was not forthcoming as several committee members expressed reservations about numerous aspects of UCB-N. Andrew Gutierrez, Professor of Ecosystem Science, said

Since we [ExCom] are advisory, I think that it was important for him [Rausser] to have some stamp of approval of the faculty and we being representatives of the faculty could have easily legitimized it. And in one fell swoop it would have gone through. And then maybe a year or so the later the faculty would start raising hell themselves. It didn't happen that way. We questioned it right away.

One way this happened was through a survey that ExCom distributed to faculty in the college as a means of assessing their opinions regarding the then pending agreement (CNR ExCom 1999). This survey was based on concerns and questions that faculty had previously raised in informal meetings and conversations in corridors, but to which they had received partial or unsatisfactory information from the Dean's office. While this survey had a response rate of 59 percent, it was discarded due a perceived failure to maintain anonymity. (The survey failed to follow the common procedure of using two

envelopes, one inside the other, only the outer of which would have a name attached.) This meant there was no representative assessment of CNR faculty opinion regarding the agreement prior to its inception.

Involvement of the Academic Senate

There are at least three different accounts with respect to how the Berkeley Academic Senate was informed about and came to be involved in discussions concerning UCB-N. One version has Chancellor Berdahl asking C4 to talk to the Academic Senate in order to open up the process without making it public.¹⁴ Another version has Carol Christ, then Executive Vice Chancellor and Provost (EVCP), asking for the Academic Senate's consultation. The third has Rausser informing Todd LaPorte, then chair of the Academic Senate's Committee on Research (COR), of the impending agreement. The documentation we have been able to gather (Brentano 1998 [August 26]) indicates that Rausser contacted Robert Brentano, then chair of the Divisional Council of the Academic Senate (DIVCO), in mid-August 1998 to request that the Academic Senate consider the potential difficulties that might arise with UCB-N.

This request marks a point of departure from the usual state of affairs as the Senate had never previously been consulted about a forthcoming contract with industry and, according to the policies of UCB, Rausser was under no formal obligation to inform the Academic Senate about a potential alliance between the university and a private company. These separate accounts may not be contradictory, as the agreement concerned many people across many different levels and locations on the Berkeley campus. Moreover, as LaPorte (2000, 71) argued, "This explosion of faculty concern was an amazing outpouring on the part of a faculty that usually focuses on its individual research and teaching activities." Thus, many faculty raised concerns independently of each other at about the same time.

In any event, Brentano was not familiar with university-industry relations and delegated to LaPorte the task of leading a working group comprised of Robert Spear, then vice chair of DIVCO, and four other chairs of the relevant Senate Committees: David Littlejohn (Academic Freedom), David Hollinger (Budget and Interdepartmental Relations), Richard Fateman (Academic Planning and Resource Allocation), and John Lindow (Graduate Council). From September 1998 onwards, the Berkeley Academic Senate closely followed the UCB-N negotiations and the growing concerns of people across campus.

The working group and COR gathered what information was available at that time from C4. In turn, this information was given to other Academic Senate Committees and the ExCom of CNR. It was also discussed at two DIVCO meetings. By September 30, the

¹⁴ In July 1997, Chancellor Tien retired and was replaced by Robert Berdahl. Berdahl was soon brought up to speed on the process undertaken by PMB and was involved, albeit from a distance, from that point onwards.

working group had compiled thirty-seven questions, some with many sub-questions, regarding UCB-N. Further, they drafted a proposal to treat UCB-N as an experimental form of university-industry relation that required further study. Brentano, as chair of the Academic Senate, sent this document to Carol Christ, on October 6 (Brentano 1998 [October 6]) and received a response on October 16 (Christ 1998 [October 16]). The Committee on Academic Freedom expressed the strongest reaction to the administration's response:

[W]e were frankly disappointed in Vice Chancellor Christ's reply...we were surprised to see the Vice Chancellor dismiss all of our concerns out of hand. The most generous characterization we could give to many of these answers was 'evasive': they simply eluded or ignored the point of the question; or juggled statistics, assured us all would be well, or informed us we didn't know what we were talking about (Littlejohn 1998 [October 29]).

On November 18, based on the feedback from DIVCO and various Senate Committees, Brentano (1998 [November 18]) wrote, "the Senate cannot fully endorse the Novartis agreement at this time as there are core issues which have not been, and perhaps cannot be, adequately addressed." The two main sticking points were the lack of a faculty member without ties to CNR or Novartis on the UCB-N Advisory Committee,¹⁵ and the need to treat UCB-N as an experiment and conduct an "on-going assessment of the institutional impact of the agreement." Less than one week later, Christ (1998 [November 22]) agreed to the Senate's demand for an assessment and appointed the Center for Studies in Higher Education (CSHE) to direct it.

Signing of the Agreement

At the end of October 1998, Hoskins left for a two-week trip to Hungary. As a result, Carol Mimura handled the final rounds of UCB-N negotiations. After UCB-N was signed, OTL's role was effectively complete, except to the extent that discoveries and potential patents arose. These issues were subsequently assigned to Mimura. Given the draft character of the original agreement, OTL expected changes in the contract to be necessary. Hoskins said, "If we had stopped and waited to get the approval of everybody that we needed to get approval for, in writing, probably the agreement wouldn't be done today." As it turned out, though, there have only been three minor amendments to UCB-N.¹⁶

¹⁵ The UCB-N Advisory Committee was a six-member committee charged with managing the relationship between UCB and NADI, except for the specific research projects undertaken by UCB-N participants. It was comprised of the Vice Chancellor for Research, the Dean of CNR, a non-CNR UCB faculty member, and three industry representatives.

¹⁶ The amendments involved minor changes in funding, waiting periods for reviews and patent claims, use of instruments provided by third parties, and the name change from NADI to TMRI. See NADII and UC (2000a), NADII and UC (2000b), and TMRI and UC (2002).

The agreement was more or less ready to sign in early November but, perhaps as a response to the emerging controversy, UCOP sent new attorneys to review the agreement at this point. These attorneys were not versed in IP law, and also had to be informed with respect to the history of the negotiations, clarifying the points of law and the background of the agreement. This pushed back the formal signing a few weeks.

At 11 a.m. on Monday, November 23, 1998, the institutional representatives of UCB and Novartis held a joint press conference in Koshland Hall, the home of PMB, at which UCB-N was officially signed (Public Information Office 1998). On behalf of UCB were Robert M. Berdahl, UCB Chancellor, Joseph Cerny, UCB Vice Chancellor for Research, and Gordon Rausser, Dean, UCB College of Natural Resources. Douglas G. Watson, President and CEO of the Novartis Corporation, and Steven P. Briggs, President of NADI, represented the company. Various people from print and radio media were present to cover this event. They were able to report on the opposition's response as well, which came in the form of a pie thrown at Rausser and Cerny that only hit the latter. Immediately following the UCB administration's press conference, SRR held their own press conference denouncing UCB-N as an "improper relationship between a public institution and a private company" (Students for Responsible Research 1998b).

Continued Questioning

The story did not end with the signing. Indeed, in many ways the official establishment of UCB-N only heralded the end of the first chapter. With the start of a new semester, in January 1999, ExCom sent out a second survey in an effort to get CNR faculty opinion on UCB-N. The format for this survey had been slightly modified (some questions were re-worded to be relevant as the agreement had already gone into effect), and the distribution method was revised to overcome criticisms of the first attempt. The response rate was at an acceptable level of 68 percent, in comparison to 59 percent for the first survey (CNR ExCom 1999). Among other things, the results from the second survey indicate the extent of division among the departments that comprise CNR. While the majority (72 percent) of CNR faculty who responded agreed that biotechnology was an appropriate area of research, there was disparity over the appropriateness of various funding structures within which this research should occur. The responses from PMB faculty were notably different from other CNR faculty. PMB faculty overwhelmingly supported all forms of university-industry funding arrangements. Moreover, PMB was the only department where the majority of the faculty members considered the use of university facilities by industry scientists to be appropriate. Not surprisingly, PMB was most supportive of the agreement and expected it to have mostly positive consequences; in contrast, ESPM faculty (specifically the divisions of Ecosystem Science, and Resource Institutions, Policy, and Management) were most critical of the agreement and saw it having mainly negatively affects.

In addition to these debates at UCB, eighteen months later, on May 15, 2000, the California State Legislature also queried the agreement. The Senate Committee on Natural Resources and Wildlife and the Senate Select Committee on Higher Education

held a joint hearing, with Senator Tom Hayden as chair, entitled: “Impacts of Genetic Engineering on California’s Environment: Examining the Role of Research at Public Universities (Novartis/UC Berkeley agreement)” (2000). The involvement of the State Senate in a review of a particular university-industry contract was perhaps unprecedented, at is certainly uncommon. Indeed, such an involvement raised concern in the UCB Academic Senate. Ronald Amundson, chair of the Committee on Academic Freedom, said “The choice of research directions and the way it is developed *must* be initiated and controlled by the faculty of the University, not by outside institutions.... At the very least, direct legislative investigations of individual UC departments and programs *must be vigorously opposed by the Academic Senate*” (Amundson 2002, 3; original emphasis).

In sum, the many disparate voices of discord challenged the actions of those who supported UCB-N. They implied a different view of the common good, different (and divergent) views of the three central principles of the university, and different views of the distributive aspects of UCB-N. They questioned whether the agreement permitted sufficient autonomy to those involved. They asked whether it might stifle the creativity of PMB faculty in subtle and perhaps invisible ways. And, they suggested that the involvement of CNR as a party to the agreement might actually reduce intellectual diversity by a shift of resources toward molecular biology and away from other fields of endeavor.

External Study

Creating the Request for Proposals

While those faculty who signed onto UCB-N got down to the business of writing proposals and generally implementing the agreement, a subcommittee of the Academic Senate COR debated throughout the spring semester about how the independent study of UCB-N would be structured. This subcommittee took over much of the work that COR and the working group had done on UCB-N and comprised many of the same people. At the end of May 1999, Jean Lave, then Vice Chair of COR and Professor of Social and Cultural Studies, offered to write the request for proposals (RFP) to which research teams would respond. After negotiations with Christ

it was informally agreed that due a) to the timing of the first annual disbursement of \$5 million of Novartis funds in Spring 1999, and b) to the imperative of developing at least some credible baseline data on the existing situation, the EVC [Executive Vice Chancellor] Office would make available resources for one month’s summer salary and research assistance to enable Professor Jean Lave to assemble an initial data set on conditions in the College (LaPorte 1999 [June]).

With this support Lave hired Gwen Ottinger, a doctoral candidate in the Energy and Resources Group, and together they formally interviewed nineteen people over the course of five months, held informal discussions with many others, and collected various

university documents (Lave 1999 [November 8]). At the beginning of November Lave drafted an RFP based on this information that sought “a proposal for a single, interdisciplinary team research project, whose PIs are from outside the Berkeley community” (Lave 1999 [November 8], 1).

At this point EVCP Christ asked Anne MacLachlan, a senior researcher at CSHE, if she would interview PMB graduate students to get some baseline data on how they saw and were affected by UCB-N, and to name how much money she needed. With six month’s worth of funding, and Lave’s one month of summer salary paying for the assistance of Mary Crabb, a graduate student in Social and Cultural Studies, MacLachlan and Crabb conducted thirty-five interviews with PMB graduate students in the first half of 2000 (MacLachlan 2000).

After giving the chancellor’s office a draft RFP, and while MacLachlan conducted her study, Lave went to Copenhagen for six months to conduct research for a separate project. When she returned, she found very little had happened to move the external study of UCB-N closer to fruition. In June 2000, Lave contacted John Cummins, Associate Chancellor and Chief of Staff to Berdahl, and explained the probability of negative consequences for the university if their public promises of an independent study never happened. Indeed, Spear said that the Academic Senate negotiated with the administration to have an external review because many of the campus concerns regarding UCB-N were “what if” questions, and simply could not be answered *a priori*. The promise of an independent study contained the faculty controversy and, as one faculty member remarked, “if there had been no agreement like this [an external review], then there would have been hell to pay. There was enough faculty concern that I think there would have been a lot of trouble had it not been for the administration’s agreement to actually investigate the impact of this thing.” However, those working hardest to get the external study into operation thought that they were being stonewalled by the administrators who were most closely involved in negotiating UCB-N; alternatively, the administrators did not view the study as important and because it was not a priority it took several years to get an adequate budget and commitment to enable the review to begin.

As these negotiations continued, on July 1, 2000, Richard Malkin succeeded Gordon Rausser as Acting Dean for CNR and Paul Gray replaced Carol Christ as EVCP. By this point it appears that enough pressure had been created about the administration’s promise to treat UCB-N as an experiment that conditions were finally established to enable the commencement of the external study. At the beginning of November 2000, Gray held a meeting to establish an oversight committee to recruit and select the PI for the external study (Upshaw 2000 [November 8]). Chancellor emeritus Ira Michael Heyman, then Acting Director for CSHE, agreed that CSHE would be the source of administrative support and guidance for both the Oversight Committee and the external research team. This committee was chaired by Professor Emeritus Michael Teitz who was a former chair of the Academic Senate and Director of Research and Senior Fellow at the Public Policy

Institute of California. The Oversight Committee represented a range of conflicting viewpoints regarding UCB-N.

Funding the Study

The amount of time it took to secure funding for an external study of UCB-N was one reason for the delay in the commission of the study. In May 2000, nearly two years after the inception of UCB-N, Carol Christ (2000 [May 2]) contacted the W.K. Kellogg Foundation to formally request \$150,000 to fund the study. A reply on September 6 indicated that while the Foundation agreed that such a study was important, they had further questions before being able to decide whether to provide funding (Hesterman 2000 [September 6]). In February 2001, a letter of clarification was written to the Kellogg Foundation confirming the request for \$150,000 as matching funds and explaining the creation of the Oversight Committee and expected directions to be taken by the external researchers (Gray 2001 [February 2]). However, it appears that this source of money was not subsequently pursued.

Selecting the External Principal Investigator

To carry out its charge the Oversight Committee had to decide what leadership qualities they wanted, how to inform potential leaders that the study was available to undertake, how to select the candidate, and finally how to oversee the implementation of the external study. These discussions were lengthy; the final Terms of Reference (TOR) were settled at a meeting on March 16, 2001. Following that, each committee member proposed candidates they believed were capable of leading the study. By May 2001 eight candidates remained as potential PIs. Jean Lave contacted all eight candidates; two of whom were uninterested while the other six were sent the formal request for proposals. By the beginning of September 2001, the committee had received five complete proposals. At a meeting on September 10, the Michigan State University (MSU) team was selected to pursue the study. After resolving some internal debates at UCB over budgetary issues, SPO was asked to draft a standard contract based on the MSU proposal. Anne MacLachlan recalled, “We finally got properly moving when Paul Gray managed to get \$75,000 from CNR to cover the amount we all on the committee thought he had originally promised and which was in the TOR.” This financial breakthrough occurred on November 27, but progress was then slowed by SPO’s request for further information deemed irrelevant by CSHE. The two UCB organizations disputed this matter until December 20, 2001 when the contract was sent to MSU’s grants and contract office. MSU officials then initially sought indirect costs, before agreeing to accept the grant without any overhead.

The Oversight Committee dissolved once its mission was fulfilled with the selection of MSU to conduct the external study of UCB-N. At this point another committee, initially also called the Oversight Committee, was formed by EVCP Gray to act as a liaison between UCB and the MSU team. This second committee was chaired by Robert Spear and consisted of six people, most of whom had long been interested in the issues raised by UCB-N.

Reconfiguration of Novartis Agricultural Discovery Institute

While there was a significant degree of consternation on campus regarding the agreement and a hard push for the establishment of an external study, the industrial partner in the contract morphed into a new entity. By 2000 the market for agricultural biotechnology had substantially contracted. A combination of longer lead times for product development, public opposition to genetically modified foods, lower return on investments when compared to the highly lucrative pharmaceutical industry (Deutsche Bank 1999), and the collapse of the “life science” strategy (Assouline et al. 2002), led to the divestment of agricultural biotechnology companies. Pharmacia, the successor to the UpJohn Corporation, sold off Monsanto. Novartis merged its interests with Zeneca Agrochemicals to form Syngenta AG. NADI was renamed the Torrey Mesa Research Institute (TMRI) and initially remained a key part of Syngenta’s corporate strategy.

But much as the breakup of AT&T made the basic research at Bell Labs too costly to maintain, so the separation of Syngenta from Novartis meant that the company’s commitment to a basic plant science research would be abandoned.

According to filings with the U.S. Securities and Exchange Commission (SEC), Novartis’s agribusiness activities made up 22 percent of their business activities before the separation (year ending December 31, 1999). In the same year, Novartis completed major acquisitions in the areas of animal health, pharmaceuticals, and specialty lenses. Syngenta AG, which is headquartered in Basel, Switzerland, has its largest sales from selective herbicides designed to control weeds in corn, cotton, rice, sorghum, soybeans, sugar cane, and wheat. Fungicides and insecticides are the next largest product groups. Syngenta’s rather lackluster financial performance during the term of the agreement is summarized in Table 1 below:

Table 1. Syngenta Financial Highlights, 1999-2003

Fiscal Year (FY)	Sales (Billions)	Net Profit (Millions)
1999	\$4.678	\$135
2000	4.876	564
2001	6.323	34
2002	6.197	(27)
2003	6.578	268

Source: Syngenta (2004)

As noted above, while NADI was affiliated with Novartis it was funded by the separate Novartis Research Foundation, but with the spin-off of Novartis’s interests in agricultural biotechnology NADI was no longer of use to the parent company. Syngenta formally

purchased NADI and changed its name to the Syngenta Agricultural Discovery Institute, Inc. before changing it again to the TMRI. Section 19 of the original UCB-N contract allowed for the agreement to be continued by any industrial successor. Furthermore, Syngenta's mission for TMRI was similar to that of NADI: long-term (10 or more years) research for future product introductions.

However, Syngenta announced the closing of TMRI in December of 2002. A portion of TMRI's research activities continued in California through its sale of technology and IP to the biotech startup Diversa Corporation in San Diego, in which it held 14% equity (Syngenta 2002), for \$39 million (pre-tax) (Syngenta 2004). According to SEC filings by Diversa, on February 20, 2003 Syngenta committed to provide at least \$118 million of research contracts to Diversa over seven years. The former CEO of NADI and TMRI, Steven Briggs, joined Diversa as Vice President for Research and Development as well (Vogel 2002). In addition to Syngenta, at the time of the agreement Diversa had alliances with Dow Chemical Company, DuPont Bio-Based Materials, Givaudan Flavors Corporation, GlaxoSmithKline plc, and Invitogen Corporation.

Syngenta consolidated its remaining interest in agricultural biotechnology into its main U.S. operations in North Carolina. Some 80 positions were eliminated and 30 were moved to North Carolina. Seventy-six employees were to move to Diversa. As Dr. David Lawrence, head of Syngenta Research and Technology put it, "The agreement [between Syngenta and Diversa] enables us to broaden our biotechnology capacity and bring innovative products to market more quickly" (Syngenta 2002, 1). In short, Syngenta retreated from the long-term research initially proposed for NADI. Nevertheless, it did honor the remaining portion of its \$25 million commitment to PMB. But the closure of TMRI and the decline in the fortunes of the company made renewal of the grant impossible.

University of California, Berkeley Internal Review

At the beginning of October 2002, the Office of the Vice Chancellor for Research disseminated the results of their administrative review (Price and Goldman 2002). During the exchange between DIVCO and EVCP prior to the signing into existence of UCB-N, Christ (1998 [November 22]; 1999 [February 17], 13) agreed to such a review to be done at the half-way point in the five year agreement so that any necessary adjustments highlighted by the review could be incorporated for the second half of the contract. The review's authors did not recommend any adjustments in the language of the contract or in its implementation concluding that "virtually none of the anticipated adverse institutional consequences has been in evidence" (Price and Goldman 2002, 39).

The review was circulated among members of the Academic Senate and four of the committees (Academic Freedom, Research, Academic Planning and Resource Allocation, and the Graduate Council). The Graduate Council chose to formally respond at the February 10, 2003 meeting of DIVCO. While they agreed that this review was informative, all of the committees were disappointed with its narrow focus and

unwillingness to generate broader conclusions about future university-industry relations (DIVCO 2003).

Implementation of the Agreement

While COR and the Academic Senate strived to bring about an external study of UCB-N, those intimately involved in the daily implementation of the agreement got down to work. The first proposals from the faculty participants to the UCB-N Research Committee¹⁷ were submitted at the end of 1998 with Novartis's first installment being paid in January 1999. After that proposals were submitted annually to the Research Committee in the first half of October to give the committee sufficient time to review the proposals before the next funding year began. All of the proposals were funded at the amounts requested, and although the level of funding for some faculty members changed from year to year, the average annual award was \$120,500 with a range of \$60,000 to \$200,000. Twenty-five PMB faculty members received money from UCB-N, but two faculty members left PMB during the agreement and therefore were not funded for all five years. PMB hired another faculty member late into the agreement and he received UCB-N funding for only the last year.¹⁸

Wilhelm Gruissem, the central person in creating the agreement and its PI, was one of the faculty members who left. On July 1, 2000, he took a position as Professor of Plant Biotechnology at the Swiss Federal Institute of Technology in Zurich, Switzerland. Upon Gruissem's resignation from PMB and as PI of UCB-N, Brian Staskawicz was appointed PI of the agreement.

During the period from November 23, 1998 to November 23, 2003, PMB made 51 disclosures to OTL, 12 of which resulted from research funded solely by NADI. In total 20 of the PMB disclosures were patented, with 10 of these resulting at least in part from funding provided by UCB-N.¹⁹ Six of the patented disclosures were pursued by NADI. However, no options to negotiate an exclusive license remain active today.

In addition to the unstructured collaborations that occurred among PMB and NADI scientists via email, telephone calls, and visits to the NADI site in La Jolla, there were also formal annual retreats for the participants of UCB-N. The first of these took place in January 1999 and served as an opportunity for everyone involved to meet one another and find out each other's academic interests. There was a second meeting in October 1999 that took the form of a workshop whereby affinity groups of PMB faculty and NADI personnel formed around particular topics that were held to be of mutual interest. For the remainder of the agreement, annual retreats occurred in October and provided

¹⁷ The UCB-N Research Committee consisted of five members, two from NADI and three from PMB, charged with evaluating the merit of the research proposals submitted by the participating UCB-N faculty and awarding the funds.

¹⁸ Other faculty members hired by PMB during the period of UCB-N chose not to sign onto the agreement.

¹⁹ These figures only include active, pending or issued patents. Provisional applications that were filed and then abandoned were not counted.

updates on the research sponsored by NADI. The last retreat was held on October 23, 2003, exactly one month before the agreement ended.

Aftermath

Although not directly connected to the UCB-N agreement, two other sets of events took place that many interpreted, rightly or wrongly, as consequences of the agreement. The first concerned the handling of Professor Ignacio Chapela's tenure case. The second was the subcontract between Professor Tyrone Hayes and a consulting firm with a contract from Syngenta. In both instances the existence of the UCB-N agreement certainly influenced the process and perhaps the outcomes. Let us consider each in turn.

Ignacio Chapela's Tenure Case

As noted above, Ignacio Chapela, an untenured faculty member in ESPM, was appointed chair of the ExCom of CNR in 1997 just before UCB-N became a public issue in 1998. Chapela himself was a highly public vocal critic of the agreement both in his role on ExCom and as a concerned faculty member. As the chair of ExCom of CNR, Chapela also headed the faculty survey on UCB-N, which itself became quite controversial.²⁰

In the November 29, 2001 issue of *Nature*, David Quist, a graduate student who was also a critic of UCB-N, and Chapela published an article alleging that native maize landraces in Oaxaca, Mexico contained introgressed transgenic deoxyribonucleic acid (DNA) constructs (Quist and Chapela 2001). Furthermore, they argued that the transgenes were unstable. To some observers, this implied the destruction of peasant landraces that might be used in maize improvement for future generations. Their paper generated far more criticism than the vast majority of scientific papers.

As Latour (1987) notes, for a finding to become a scientific fact it needs to both enroll other scientists (i.e., through citations in the article) and be enrolled by other scientists (i.e., cited by other scientists in other papers). Papers that are published in scientific journals suffer one of three fates: First, they may be widely cited by others who base their own claims on those in the original paper. Second, as is the fate of most scientific articles, they may be ignored as obvious, weak, or even erroneous. Such articles are not frequently cited, and soon become forgotten. Finally, and quite rarely, those who disagree with the results reported may make that disagreement public in the form of, for example, a letter to the editor or an article challenging the legitimacy of the reported findings.

²⁰ As noted above, the first survey became mired in controversy – primarily as a result of issues related to its distribution – and was deemed invalid. A second, slightly modified, survey was then collected and analyzed by The California Survey Research Center – an institute affiliated with UCB – after the agreement. The surveys themselves, how they were conducted, and the findings all became the subject of further controversy. If anything, the surveys had the affect of deepening the divide between many proponents and opponents of the agreement within CNR.

The response to Quist and Chapela's article fits into this small third category. It suggests that far more was at stake than biological theory and scientific integrity. Debate exploded in the scientific world and especially the biotechnology sector with respect to Quist and Chapela's findings. Their paper most likely would have attracted little attention outside the field were it not for a heated debate that began on the AgBioWorld website (<http://www.agbioworld.org>). While the British newspaper, *The Guardian*, provides evidence asserting that the debate was initiated by several fictitious scientists traced to a public relations firm hired by Monsanto (Monbiot 2002), the main protagonists in the debate were several members of the PMB department. The debate ultimately resulted in something resembling a retraction by *Nature* (Campbell 2002).

In September 2001 the tenure review process for Chapela by his colleagues in ESPM began. As is typically the case for university tenure decisions, the precise details of the debate over tenure were not made public. However, a large – some might say an extraordinarily large – number of letters were solicited from external reviewers of Chapela's work. As far as can be discerned, they were overwhelmingly positive about his work. Moreover, in the Spring of 2002 the ESPM faculty voted 32-1 with 3 abstentions in favor of tenure. The case was then forwarded by the Dean to the Campus ad hoc tenure committee for further review.

In an unusual move, the chair of Chapela's ad hoc tenure committee, Steve Beissinger, asked that those involved in the review have nothing to do with UCB-N, ostensibly as a result of the controversy over UCB-N and the ensuing dispute over the *Nature* article. The ad hoc committee recommended tenure unanimously on October 3, 2002.

According to some observers, at this point the Vice-Provost asked the ad hoc committee chair to reevaluate the case with additional external letters. Soon after, the chair of that committee resigned, renouncing the report of his own committee and citing a lack of expertise on the kind of research that Chapela conducted. A member of the ad hoc committee, Wayne Getz, called Chapela's tenure review disgraceful (Walsh 2004).

The dossier was then forwarded to the Academic Senate Committee on Budget and Interdepartmental Relations, a faculty committee that normally reviews tenure decisions. At that point, critics of the process, including Dean Richard Malkin, objected to the role played in the decision making process by Professor Jasper Rine. Rine was on the UCB-N Advisory Committee (Abate 2003). The Chancellor argued that no such conflict of interest existed and permitted Rine to remain on the Committee. On June 5, 2003 the Budget Committee moved to deny tenure to Chapela. Despite some appeals by both the chair of ESPM and the Dean of CNR, the Budget Committee made its decision final on November 20, 2003. The Chancellor concurred with that decision.

Regardless of whether Chapela's denial of tenure was justified, there is little doubt that the UCB-N agreement played a role in it. First, the very existence of UCB-N changed the rules of the game. Certain faculty were denied participation in the process because of the agreement. Second, while the administration saw fit to avoid conflict of interest

(COI) among faculty, they ignored the potential for COI among administrators. Thus, regardless of its validity, the decision of top administrators to accept the decision of the Budget Committee was seen by many as a COI. Finally, as a result of the conflict, the process of tenure review took far longer than is normally the case, leading Chapela to hold ‘office hours’ in front of California Hall in protest.

Tyrone Hayes’s Contract

While many people have expressed concern that UCB-N is qualitatively different from typical university-industry contracts because it involves almost every faculty member in one department, others have pointed with approval to this same feature as a safeguard against the disadvantages of contracts made between individual faculty members and a private company.

A recent panel discussion held at UCB, entitled “The pulse of scientific freedom in the age of the biotech industry,” presented the stories of four well-known physical scientists who had tussled with private biotechnologies companies and felt that their experiences illustrated the influence that the biotechnology industry has over the work of public scientists (University of California, Berkeley 2003). One of the participants was Tyrone Hayes, an associate Professor of Integrative Biology, who was hired in 1998 by Ecorisk Incorporated to evaluate the effects on amphibians of the herbicide atrazine. The crop protection division of Syngenta gave \$2 million to Ecorisk to fund these studies and “in the contracts covering Dr. Hayes’s work and that of many of the other researchers, Syngenta and Ecorisk retained final say over what and whether the scientists could publish” (Blumenstyk 2003, A26). Hayes ran up against this provision when his research began to show that frogs were physiologically affected by low levels of atrazine. While working on this problem for Ecorisk, Hayes felt they inhibited and delayed his research and did what they could to prevent his publication of the results. The attempts at controlling the dissemination and questioning the credibility of Hayes’s work continued even after he left the employ of Ecorisk and began funding his research on atrazine by himself (Blumenstyk 2003).

This scenario points to the possible consequences of university-industry relations where the industrial partner is able to exert a seemingly disproportionate amount of power over the actions of the public university partner. That such situations can occur gives weight to the concerns of those wary of UCB-N with respect to how Novartis would try to influence the research directions and publication of the PMB scientists. However, this particular comparison also points to the potential differences between individual university-industry contracts and those involving entire departments. As is illustrated in the operation of labor unions, with greater numbers comes negotiating power. Certainly, those public scientists acting in concert to create UCB-N had far fewer restrictions regarding their research than did Tyrone Hayes as a solitary public scientist. We return to this issue in a discussion of conflict of interest issues below.

Table 2. Chronology of Events

1993	UCB Chancellor Chang-Lin Tien established the Biotechnology Planning Board. PMB established the International Biotechnology Advisory Board.
1997	Representatives from PMB consulted with the Dean of CNR, Gordon Rausser, regarding how best to procure industry funding for PMB. The “committee of four” (C4) was established in PMB.
December 1997- January 1998	PMB contacted nine companies indicating that a large group of PMB faculty was interested in seeking industry funding from a single company. Six companies responded.
February-April 1998	The C4 made presentations to the six companies that responded to their proposal.
April 30, 1998	PMB received four proposals for a joint partnership.
May 1998	PMB chose Novartis for its industrial partner. Novartis approved the proposal to construct NADI.
June 1, 1998	The first draft of the agreement was completed.
August 1998	The Academic Senate was contacted regarding the pending agreement between PMB and Novartis.
September 1998	William Hoskins and Carol Mimura presented a draft of the agreement to PMB
October 1998	ExCom of CNR conducted the first survey of CNR faculty members.
October, 2 1998	Rausser held a “town hall” meeting to present the agreement to the UCB community.
October 6, 1998	Robert Brentano, Chair of the Academic Senate, sent a document outlining the Senate’s concerns regarding the pending agreement to Carol Christ, EVCP
October 14, 1998	SRR presented the UC Regents with a petition of 400 signatures asking for the signing of the agreement to be delayed until various concerns are able to be resolved.
October 16, 1998	The Academic Senate received a response from Carol Christ regarding their concerns about the pending agreement between PMB and Novartis.
November 18, 1998	The Senate stated that it cannot fully endorse the agreement. It also stated that it would like the agreement to be treated as an experiment and that an on-going assessment of the agreement’s impacts should be undertaken.
November 22, 1998	Carol Christ agreed to the Senate’s stipulations and appointed CSHE to direct the assessment of the agreement.
November 23, 1998	The agreement was formally signed.

January 1999	ExCom of CNR conducted its second survey on faculty opinions relating to UCB-N. NADI paid the first installment of funds for UCB-N.
November 1999	Jean Lave created the first draft RFP for the external study.
February – June 2000	Anne MacLachlan interviewed PMB graduate students on their opinions of UCB-N.
May 15, 2000	The California State Legislature held a hearing to review the agreement.
July 1, 2000	Richard Malkin succeeded Gordon Rausser as Acting Dean for CNR. Paul Gray replaced Carol Christ as EVCP Brian Staskawicz replaced Wilhelm Gruissem as UCB-N PI.
November 2000	The Novartis Oversight Committee, Michael Teitz as chair, was established to oversee the selection of the PI to do the external study of UCB-N. Novartis spun-off its agribusiness division and combined with the agribusiness division of Astra Zeneca to create Syngenta.
January 2001	Syngenta bought NADI, renamed it TMRI, and took over the agreement with PMB. Beth Burnside replaced Joseph Cerny as Vice Chancellor for Research.
August 2001	Letter of invitation sent to prospective PIs by Michael Teitz for the Novartis Study Committee
September 2001	Proposals submitted to Novartis Study Committee
December 2002	Syngenta announced the dissolution of TMRI.
November 23, 2003	UCB-N expired.

III. Points of Contention

While the implementation of the agreement has been relatively uncontested and many of the critics' worst fears did not occur, the fact that the agreement was widely challenged is important on a number of levels. The controversy over the agreement is informative in that it sheds light on some of the larger issues and contested transformations taking place in higher education and, more specifically, at UCB. Furthermore, many of the controversies surrounding UCB-N are still ongoing both locally, as exemplified by the denial of tenure for Ignacio Chapela, and more generally in higher education.

In responding to our questions, interviewees proposed a number of reasons for why the agreement was controversial. The reasons can be divided into four broad groups: (1) issues relating to the process by which the agreement was created and signed, (2) the substantive content of the agreement, (3) local conditions at UCB and in the Bay Area, and (4) broader issues that reflect the changing character of the university. Each of the reasons will be briefly examined below.

Process

The process by which UCB-N was developed and made public brought to the fore an issue of considerable debate. Indeed, much of the initial opposition to UCB-N was rooted in concerns regarding the process by which the agreement was formulated. For example, SRR, a graduate student organization that formed in response to UCB-N, and remained active in subsequent debates concerning the future of CNR, claims to have developed first and foremost in response to the process by which the agreement was negotiated and presented.

Four aspects of the agreement emerged as particularly controversial in the responses of interviewees. First, a number of faculty, students, and interested parties outside the university objected to the secrecy under which the agreement was formulated. Second, there was concern that the normal channels of governance and oversight for agreements with external parties were bypassed. Third, a number of participants argued that the way the agreement was presented and how the public relations were handled was responsible for much of the controversy. Lastly, a number of faculty and graduate students raised questions concerning Rausser's consulting activities and his role in securing the agreement with Novartis.

There is general agreement by both proponents and opponents of the agreement that the process by which the agreement was formulated and agreed upon was less than transparent. While faculty in PMB were kept abreast of negotiations and their input was solicited, other faculty in CNR and the university were not informed that negotiations were underway until the start of the semester in which the agreement was signed. Moreover, the contents of the agreement were not made public until after the official signing. A number of faculty in PMB and UCB administrators argued that such secrecy was necessary in order to negotiate an agreement of this sort. One faculty member in PMB remarked that the secretive character of negotiations was a "necessary evil," because the details had to be kept private to protect Novartis's business interests. However, other faculty and interested parties felt that they had a right to know what was in the contract and were entitled to a say in its outcome because UCB is a public institution. (Graduate students and post-doctoral researchers in PMB were also largely excluded from the processes through which the agreement was developed. This will be discussed in greater depth in the section on PMB.)

The lack of transparency became especially contentious when the agreement was officially extended to CNR. Some faculty in CNR, though not PMB, also argued that they were included in the agreement, but received no direct benefits as a result. Consequently, it was argued that, while they received the negative stigma that was attached to the agreement, no benefits were forthcoming. Regardless of whether they felt that secrecy was necessary or not, most interviewees agreed that the lack of transparency made the agreement more contentious.

In addition to a lack of transparency, critics argued that the agreement was negotiated in such a way that it bypassed the normal channels for agreements with external parties, particularly by going through OTL and not SPO. Regardless of the validity of the justifications for this aberration, there was a perception on the part of many faculty that the agreement was purposely developed in such a way as to preclude involvement by the larger university community. While the Academic Senate was involved, its participation was quite limited as it was only included near the end of negotiations. Furthermore, the Academic Senate was consulted in an ad hoc and highly contingent manner rather than in a fashion that tied together the workings of the Administration, the Academic Senate, SPO and OTL. Indeed, the involvement of the Academic Senate was not required, and it could have been bypassed altogether. The perception that the agreement was negotiated behind the scenes without following normal procedures signaled an erosion of shared governance to a number of faculty. For such faculty, not going through normal channels made the agreement troublesome, regardless of its substantive content.

How the agreement was presented and communicated also became a source of problems. Many faculty, graduate students, and post-doctoral researchers within and outside PMB felt that they were unable to acquire adequate information regarding the agreement. For example, a post-doctoral researcher in PMB at the time remarked that in his opinion,

the faculty at least, and the college, did a pretty poor job of keeping people informed and knowing what was happening and why it was happening ahead of time. They just presented this agreement with all its stipulations as a done deal and people jumped on the stipulations and didn't spend any time thinking did it make any sense to do this sort of agreement.

Furthermore, it was argued when information was presented regarding the then pending agreement, it was done in a way that precluded discussion and debate. The town hall meetings that Rausser organized to inform the Berkeley faculty of the agreement were often described as a public relations event “to convince everyone that this was a good idea” as opposed to a real public forum. This position was clearly articulated by a faculty member in CNR who said that “the whole thing [the development of the agreement] was so carefully stage managed that before anyone said ‘and what do you people think’ the whole subtext was ‘never mind, it’s a done deal.’”

The perception that information on UCB-N was being stage-managed was exacerbated by two events. The first was the hiring of a public relations person specifically to oversee the release of information regarding the agreement. Marie Felde, Director of UCB Media Relations, and Robert Sanders, UCB Senior Public Information Representative, both noted that hiring an outside public relations person was very unusual. Neither could think of any other time when someone outside of UCB Public Relations had been hired to create and manage press releases. The second event was an email sent by the CNR Dean's office to all CNR faculty suggesting that calls from the media be directed to public relations. Some faculty indicated in interviews that they saw the email as an attempt to prevent critical views of the agreement from reaching the media. Regardless

of the intentions of the Dean's office, the email generated even more wariness among parts of the CNR faculty regarding the agreement.

Other actions taken by UCB faculty contributed to deepening the controversy as well. Specifically, in 1988, Gordon Rausser and three other UCB faculty members founded the Law and Economics Consulting Group (LECG). As allowed under UC policy, Rausser continued to be both a principal in LECG and a full-time Berkeley employee even as he became Dean of CNR (1994-2000) and participated in the negotiations that created UCB-N. Although many benefits undoubtedly may be gained through such consulting agreements, people on and off-campus were concerned with this arrangement between Rausser and LECG because of the large sum of money that Rausser reportedly made through his involvement and the ties LECG had with the forerunners of Novartis (Richardson 1997; Students for Responsible Research n.d.). In 1996, Rausser earned \$1.3 million from LECG, significantly more than his salary as Dean. The company followed by an Initial Public Offering on December 18, 1997, at which Rausser planned to sell 16 percent of his shares for \$2.2 million (Marshall 1997; Securities and Exchange Commission 1998). Finally, less than one year later LECG was acquired by the Metzler Group for \$200 million.

A number of concerns were voiced about university-industry consulting arrangements in general and Rausser's involvement in particular. Len Richardson (1997, 5), editor of *California Farmer*, acknowledges that UC policy limits faculty members to less than 49 days per year of paid outside activity but asks in regard to LECG: "Can you build a \$30 million business on 48 free days? Is the good name and reputation of UC becoming a faculty profit center?" Others were also concerned that having the majority of public university faculty members' income from off-campus sources "compromises their academic objectivity" (Marshall 1997, C-1), and noted that, "At least in the independent consultant community ethics is an issue that is recognized and debated, unlike in the University consulting community, University administration or regents" (Richardson 1998, 5).

There was also uneasiness with the close substantive ties between Rausser, LECG, and the Novartis parent companies. Along with other large agribusinesses like Monsanto and Heinz, both Sandoz and Ciba-Geigy were important clients of LECG (Securities and Exchange Council 1998) and in 1996 they merged to form Novartis. LECG offered its clients economic analyses on "environmental issues, water rights and technological innovation in agricultural machinery, hybrid seeds, engineered plants and species..." (Securities and Exchange Council 1998). People grew more disquieted with this arrangement as the UCB-N negotiations proceeded with Rausser as a lead collaborator: "The company [LECG], and Mr. Rausser in particular, specialize in corporate mergers, IP, and agribusiness – just the skills that were improved in creating this alliance [UCB-N]. We feel there *may* be a conflict of interests" (Students for Responsible Research n.d.; emphasis in original).

Several people inside and outside UCB mentioned Rausser's consulting activities in connection with the creation of UCB-N. One CNR faculty member said, "Dean Rausser had been writing, for years, about how it was unavoidable, that universities had to get into these private relationships as institutions, these institutionalized relationships. So here he is presented with an opportunity." A number of interviewees expressed their belief that Rausser was using the establishment of UCB-N as a proof of concept for his vision of how public and private entities should interact in the future. Peter Rosset, Co-Director of Food First, and Miguel Altieri, Professor in ESPM, both pointed to this motivation for Rausser, especially given his history of being hired as a consultant by the Consultative Group for International Agricultural Research and the World Bank on building public-private partnerships in research institutions. Conversely, Rausser's interest in expanding industry-sponsored research in this timeframe was widely shared by other university administrators across the U.S. (e.g., Condit and Pipes 1997). It cannot be assumed that a commercial bias was necessary or significant in his support of this trend.

One professor in CNR recalled that there were many questions regarding the amount of time Rausser spent on his consulting activities while he was Dean. There was such outcry regarding the involvement of UCB faculty members in LECG that UC President Richard Atkinson formed a task force to review the UC policies related to outside professional work (Academic Senate 1998). In March 2003, faculty responsibilities were further clarified by the Technology Transfer Advisory Committee in "Guidance for Faculty and Other Academic Employees on Issues Related to Intellectual Property and Consulting" (Office of Technology Transfer 2001).

In sum, from the perspective of those desiring the agreement, the process by which it was pursued was merely expedient. Something had to be done and it had to be done quickly. This was an expression of their autonomy both as individuals and collectively. In contrast, from the perspective of those affected by the agreement, their lack of participation was evidence of hidden agendas and a lack of transparency at best, a direct threat to their autonomy at worst.

Substantive Concerns

In addition to issues surrounding the process, there were three parts of the agreement itself that were particularly controversial. The first was the scale and scope of the agreement. A number of interviewees viewed the agreement as problematic because it was with an entire department as opposed to a single faculty member or a small group of faculty. It was argued that the scale of the agreement shifted responsibility from the individual to the institution. Some viewed this as troubling, since if something went wrong, then UCB as a whole would be implicated. In addition, some argued that a department-wide agreement signaled a deeper "penetration" of industry into the university and the incorporation of the university into an "industry complex." Finally, the novelty of an agreement with an entire department meant that channels by which to negotiate and oversee its development and execution had not been established.

The structure of intellectual property rights was also a source of concern. The agreement, with some restrictions, granted Novartis the right of first negotiation on an exclusive license to commercial research conducted by signers of the agreement; the agreement gave Novartis the option to exercise that right on a portion of the results equal to the percentage of external research funding that it provided. The right of first negotiation applied to all research conducted by signatories of the agreement, regardless of whether Novartis funded that research or not, with the exception of DOE and funding from other private parties. In other words, if funds from Novartis constituted one-third of PMB external research funding, Novartis got the first right of negotiation to one-third of all PMB discoveries, including research funded by the National Institutes of Health (NIH), the National Science Foundation (NSF), and other public institutions.

Since Novartis only got the right to be first to negotiate a license, the license would still have to be negotiated to the satisfaction of OTL. With OTL's ability to negotiate the terms of a license, Novartis would most likely reach an agreement with reasonable compensation returned to UC. However, given the company's ability to distinguish between significant inventions (i.e., dominating patent positions) and minor ones, it cannot be assumed that the inventions remaining after Novartis's option would have a value proportional to their financial support. The principle that Novartis was given the right to be first in negotiation of patent licenses on research supported with *its* funds has become routine at major research universities. However, the fact that Novartis also received extensive access to publicly funded research caused notable disbelief and outrage. Because Novartis would be given commercial access to public-funded research, a number of critics argued that the agreement gave too much control and power to industry.

Critics of the agreement tended to view the intellectual property rights arrangement as unusual. However, representatives from OTL disputed this claim. They commented that the intellectual property rights arrangement, in addition to much of the rest of the agreement, was based on previous agreements between public research centers and industry. Nevertheless, the perception that UCB-N represented a "watershed" in university relations with industry heightened the controversy.

The third structural component of the agreement that caused consternation among the campus community and others was the possibility Novartis scientists would be given adjunct status. While the agreement does not preclude the possibility for adjunct status for NADI employees, it never materialized. Several interviewees noted that this is most likely because of strong opposition from faculty outside of PMB. This position is supported by the second survey conducted by the ExCom of CNR. Few respondents to the survey thought adjunct status was appropriate for industry scientists from a firm that was either providing funding to CNR or one of its departments. In interviews, a number of faculty argued that granting Novartis scientists adjunct status would have bypassed the established governance procedures and stringent standards that are normally required for adjunct status. Many critics of the agreement also felt that the offer of adjunct status was a way for Novartis to buy its way into the UCB campus. However, some of those

involved in the negotiation of the agreement argued that adjunct status for NADI employees was proposed by PMB as a way to facilitate closer interaction. At the same time, a supporter of the agreement argued that that UCB faculty as a whole would never allow corporate researchers to be adjuncts and that everyone knew that. This raises the question of why the possibility was even on the table in the first place.

In addition to the particulars of the contract, the perception that UCB-N was unlike previous university agreements with industry also made it questionable. While the novelty of the agreement is debatable, nearly all interviewees agreed that an agreement with an entire department was something new. However, in contrast to many of the critics of the agreement, its supporters tended to view the scope and scale of the agreement as unproblematic. A number argued that, in fact, by being with an entire department, it allowed for greater academic freedom and allowed more faculty to participate.

In contrast to the perception that the agreement was novel, a number of interviewees, almost all of whom supported UCB-N, thought that much of the controversy regarding UCB-N was an outcome of a lack of understanding of university relations with industry on the part of the faculty. It was argued that faculty in the social sciences and humanities knew little about “normal research policy” or university relations with external parties. Paul Gray, the EVCP Provost of UCB, remarked, “It was a kind of a case where the arts and humanities and social science side of campus all of a sudden were brought face to face almost by accident with this animal they hadn’t really seen before and weren’t really familiar with.” It was also argued that faculty in CNR tended to have little experience with industry agreements, whereas faculty in engineering had been conducting relations with industry for a long time. Consequently, because faculty in CNR, and also other parts of campus, were unaware of the history of UCB’s relations with industry, some interviewees argued that they made UCB-N into something larger than it really was.

In particular, proponents singled out intellectual property rights as an area that many opponents of the agreement did not understand; they argued that such rights thereby became the source of more controversy than should have been the case. A number of interviewees also accused opponents of the agreement of criticizing the agreement without knowing its specifics. As one faculty member in PMB remarked, “They comment on what they believe to be the content of the document.... Rather than feeling compelled to read the document before making comment.” The interface facility was the most cited example of misinformation. In particular, misinformation surrounded the question of whether Novartis pledged \$25 million to construct a building and, if so, what happened to the money. As a result of a lack of knowledge of university relations with industry by many faculty, it was argued, many of them were amazed and shocked by UCB-N, and were likely to misinform others. This, in turn, generated even more anger and controversy.

In short, the very provisions of the agreement that proponents saw as desirable or at least reasonable were seen as compromising by detractors of the agreement. The department-wide access to faculty, the new building, and the adjunct status for Novartis researchers

were seen by supporters as enhancing the potential for creativity of PMB, and of cementing its role as a leader in the field. As such, the generous IP options were a reasonable enticement for Novartis. In contrast, opponents saw the agreement as selling off the university to the highest bidder, thereby compromising deeply held values. For them, Novartis by its financing and physical presence would define the research agenda, thereby restricting intellectual diversity in CNR to those issues of interest to the company.

Local Conditions

The historical legacies and local conditions of UCB and the Bay Area are in part also responsible for some of the controversy and its magnitude. A number of interviewees commented that the agreement generated so much controversy because it occurred at UCB. It was noted that UCB has a history of being one of the most liberal campuses in the U.S. (a point disputed by others). Additionally, Dave Henson, the Director of Occidental Arts and Ecology, argued and also that the Bay Area community “has the largest active set of proponents of ecological agriculture and opponents, for very good and diverse reasons, of corporate privatization of genetic engineering.” Consequently, a number of interviewees argued that if an agreement was going to arouse criticism, it would happen at Berkeley. Furthermore, because of its reputation as both a leading university and a place for social activism, it was argued that Berkeley also attracts more public interest and media attention than most other universities. In other words, it was argued that if the agreement had happened at a different UC campus, for example, Riverside or Davis – the other places where research on crop plants is also conducted in the UC system – there would not have been nearly as much public scrutiny or media attention (see, for example, Knudson and Lee 2004). Whether this would have been the case is obviously speculative, but one should remember that the formation of Calgene by University of California, Davis (UCD) faculty member, Ray Valentine, in 1980 made national headlines as well.

At the same time, within UCB, and most notably in CNR, there are historic relations and local conditions that very much influenced how UCB-N was perceived. Historically, both populist and productivist kinds of science have characterized CNR. Productivist scientists are generally interested in making agriculture more productive, while populist scientists are interested in the needs of small farmers and the social and environmental impacts of large-scale agriculture. While both have coexisted in CNR, there have always been tensions between the two, which have been exacerbated in the past decade due to changes made in CNR. For example, one overview of agricultural pursuits on campus dating back to the 1970s concluded:

Although some departments continued work relating to agriculture, its overall focus shifted increasingly toward conservation and resource studies and toward ever more fundamental and theoretical work in the natural sciences. In Berkeley’s highly urbanized, intellectual milieu, relatively little understanding or sympathy remained for production

agriculture, and in fact some of the most stinging criticisms of California's agricultural system would eventually emerge from there (Scheuring 1995, 176).

A large number of interviewees argued that the two sides are culturally and philosophically opposed and that this was responsible for much of the controversy. Nevertheless, as is the case in many controversies, "the other side" is usually presented as monolithic, and without nuance. Therefore, it can be argued that much of the concern over UCB-N was the outcome of a longstanding cultural clash among some faculty in CNR.

One divide is between what one interviewee termed the "old biology," such as botany and zoology, and "biotechnology." The different perspectives and approaches are most evident between faculty in ESPM and PMB. A number of interviewees argued that there was inherent strife between these two departments, as they were interested in similar problems, but approached them from very different standpoints. One faculty member summarized the difference in the following way: "In the case of plant biology, so far as I can perceive, you study the natural world to bend it to human interests and needs; whereas in botany, you study the natural world, plants of course, to help humans fit into a broader fabric of nature." This philosophical difference has been a long-standing divide in CNR, but a number of CNR faculty commented that UCB-N acted as a lightning rod for the dispute. This may have been because, as one interviewee observed, UCB-N signaled that PMB and molecular approaches were "winning," while other approaches to biology and ecology were becoming marginalized.

Broader Issues

The broader concerns that became intertwined with UCB-N revolved around the appropriate role of industry in a public university and the kinds of research that it should undertake. These concerns reflect a more general crisis and set of transformations that are taking place in higher education throughout the U.S. regarding what is public, what is private, and the appropriate relation between these spheres. Much of the opposition to UCB-N was rooted more generally in debates over the "privatization" of things that were once public. For many critics of the agreement, industry involvement with UCB, a public university, and biotechnology research, at least in its current form, represents the increasing encroachment of the private into the formerly public sphere.

A number of those interviewed questioned the appropriate role, if any, of a corporation in a public university such as UCB. One interviewee questioned UCB-N by asking "[what is] the rightness, appropriateness, the morality of a private company sponsoring research at a university using facilities paid for with tax money for the company's eventual profit?" Questions pertaining to the appropriateness of industry relations with the university took several forms. There were concerns whether Novartis, because it made up a significant percentage of PMB funding – 28% in fiscal year (FY) 1999 – would

control either directly or indirectly the kind of research undertaken by faculty.²¹ There was also concern over whether Novartis was using the university as a cheap source of labor. Critics of UCB-N accused UCB of “giving away our patrimony ... to Novartis for chump change.” In some people’s minds Novartis was given free reign to take and privatize research that had been made possible by decades of public investment. Although new to many UCB faculty, this issue is hardly new in higher education (see, for example, Fairweather 1988).

A number of those interviewed were also worried that conflicts of interest would develop as a result of university relations with industry. These statements took two forms. On the one hand, some questioned whether faculty with Novartis funding would be able to fulfill both their contractual obligation to Novartis and their responsibilities as members of a public university. On the other hand, a number of faculty, particularly those in ESPM, were concerned as to whether aligning CNR with Novartis would undermine their ability to participate in policy debates and to be perceived as objective experts.

Concerns regarding the kind of research that a public university should undertake arose primarily in response to questions pertaining to the appropriateness of biotechnology research at UCB. At the time that UCB-N was being debated there was escalating disagreement over agricultural biotechnology generally. The development of agricultural biotechnologies and the concurrent expansion of the industry have been paralleled by a “proliferation of citizen’s voices challenging the biotechnology industry on economic, environmental, cultural, and moral grounds” (Schurman and Munro 2003, 111). Without question, debates over agricultural biotechnology influenced how both supporters and critics of the agreement understood it and the controversy that surrounded it.

For many critics of the agreement, research on biotechnology goes against the Land Grant and public missions of the university because it serves agribusiness corporations and not the people of California. For many populist agricultural and environmental advocacy organizations, their opposition to biotechnology was grounded in a critique of the kinds of biotechnologies that are currently being developed. Peter Rosset, Co-director of Food First, argued that CNR “shouldn’t be developing products for private profit but it should be looking at what are the social and ecological impacts of various ways of exploitation of natural resources and what are alternative ways to exploit them in a more sustainable fashion.” In a parallel argument, several faculty and graduate students in CNR also argued that the increasing focus on biotechnology research is forcing other approaches to agriculture and ecology to the margins.

In interviews, a number of supporters of the agreement argued that ideological opposition, rather than any substantive issues regarding the agreement itself, was responsible for the bulk of the controversy. Some interviewees argued that UCB-N fed

²¹ Our figures differ slightly from the Price and Goldman (2002, 7) report because they averaged over 1998-2002 whereas we examined each year individually. The annual percentage of PMB’s extramural funding from UCB-N continues at 26% (FY2000), 39% (FY2001), 20% (FY20002), and 20% (FY2003) (data from SPO).

into and brought together existing opposition to both biotechnology and corporatization. A central administrator remarked that UCB-N was so explosive because it brought together biotechnology and globalization in ways other agreements with industry, such as those in engineering, had not previously done. However, while both proponents and opponents of the agreement agreed that UCB-N became, in part, so controversial because it was with Novartis, a multinational biotechnology corporation, very few opponents of the agreement named biotechnology as among their chief concerns. In other words, while concerns regarding biotechnology clearly contributed to the controversy, supporters of the agreement tended to see it as a larger issue than it appears to have been for many opponents. Rather, the fact that the agreement was associated with biotechnology seems to have made UCB-N more visible than it otherwise would have been.

Conclusion

The controversy that surrounded the agreement did have some tangible effects. While it is not possible to establish clear causation, the level of concern did affect the implementation of the agreement. Most prominently, Novartis scientists were not granted adjunct status and the interface facility was not constructed. It also can be asked whether the degree of controversy had the effect of discouraging the UCB administration, other public universities, and corporations from similar kinds of agreements. The controversy also seems to have had some lasting effects within CNR, as illustrated by the on-going debate on academic diversity. It also continues to affect certain individuals. This is most clear in the conflicting perceptions of the reasons and processes for the denial of tenure to Chapela – and its relationship to the debate on academic diversity. From the perspective of Novartis, while the controversy was quite surprising and created some negative public relations, it has had few, if any, lasting effects. One representative of the company remarked that the agreement was “definitely not on the radar screen of the shareholders” and most of their customers would not have heard of it, because it was such a small amount of money. Lastly, it needs to be noted that the controversy did produce this external review, and the possibility for dialogue on the future of the university.

IV. Overview and Analysis of the Agreement

As detailed by Zucker, Darby, and Armstrong (2002), commercially viable innovations may be expedited by academic and industrial scientists working closely together. Legal agreements between universities and commercial entities often define these relationships and associated finances. Numerous tutorials instruct practitioners to bridge the gap between university and business practices when drafting agreements of this type (American Council on Education and the National Alliance of Business 2001; Berneman 1995). The UCB-N agreement is one notable illustration of the complexities and challenges that can emerge. The UCB-N agreement with its 10 appendices runs 60 pages. The agreement’s recitals define the parties’ joint interest in conducting basic science and NADI’s interest in developing commercial plant traits. During its brief history, NADI in collaboration with PMB specialized in plant genomics with special

attention to *Arabidopsis* and rice.²² The agreement terms and conditions detail the intellectual property rights (IPR) of both parties.

For the academic community, the UCB-N agreement stood out because it represented significant industrial rather than government funding for Berkeley researchers. PMB's financial objective leading to the agreement was to secure a sponsored research agreement from an industrial sponsor of at least \$5 million a year over five years. The effort's success at winning industrial patronage of this scale proved unique for UCB. Of the 26 awards received by UCB in fiscal years 1998 through 2003 of \$5 million or more, only four were not from the federal government. Two of these came from foundations, one from the state government, plus the UCB-N agreement.²³ Thus the continuing importance of sponsored research projects from federal agencies can be seen in the projects received by UCB over the term of the UCB-N agreement. At least for the life sciences, the bleak forecast for federal support that had informed the President's Retreat less than two years earlier had turned bright as significant new and multi-year funding began to flow into genomics. For example, UCB's Molecular and Cell Biology (MCB) Department received \$38.6 million from the National Center for Human Genome Research in fiscal year 1998. UCB went on to launch the Center for Integrated Genomics in 2002. The Center includes the departments of MCB, Integrative Biology, Statistics, Computer Science, Bioengineering, Plant and Microbial Biology, Biostatistics, Mathematics, Physics, Public Health and Lawrence Berkeley National Laboratory.

Of particular relevance to PMB, the most significant opportunity for extramural support at the time was the Collaborative Research and Infrastructure Projects within NSF's Plant Genome Research Program. PMB's assertive effort to scale up its capacities in genomics was part of a larger competition for newly available federal funds, as well as industrial interest in the field. For example, Cornell University assembled a Genomics Task Force that defined the Cornell Genomics Initiative by March 1998. Purdue University launched its Agricultural Genomics Initiative by December 1998. In the same year, the Donald Danforth Plant Science Center in St. Louis, Missouri was established as an independent non-profit. Funding for the St. Louis Center came from the Danforth Foundation and the Monsanto Fund to support researchers from the University of Illinois, the Missouri Botanical Garden, the University of Missouri (Columbia), Purdue University, and Washington University (St. Louis) to work alongside Monsanto scientists. Berkeley researchers and administrators proved successful in this competition for federal funds. For the 20 NSF awards over \$5 million, UC was the lead institution on five and a partner on three others.

Proper analysis of the UCB-N agreement relative to the more familiar support of the federal government requires sensitivity to prevailing norms at the time of the agreement. Norms relative to university-industry relationships evolved in the years leading up to the agreement and were themselves a source of discord. Attempts to commercialize biotechnology in the 1970s and 1980s exacerbated tensions within academia. From the

²² A genome is the complete genetic code of an organism. Genomics is the study of genomes.

²³ Compiled from UCB Sponsored Projects Annual Reports (1998; 1999; 2000; 2001; 2002; 2003)

first patent issued in the field, the demarcation between academia and commerce fostered disagreement (Hughes 2001; U.S. Congress Senate Committee on Commerce Science and Transportation 1978). By 1981, commercial interests were found to be “seriously dividing members of the academic community” (Fox 1981, 39). A few years later, the U.S. Congressional Office of Technology Assessment (OTA) took up the topic relative to industry-university relationships within Land Grant Universities (LGUs). OTA documented concerns “over who controls the university research agenda, the allegiance of scientists to their university employer, the willingness of scientists to discuss research discoveries related to potentially patentable products, and potential favoritism shown particular companies by the university because of its research ties” (U.S. Congress Office of Technology Assessment 1985, 71).

While such questions lingered, academic entrepreneurship expanded markedly in California with lasting results. By the 1980s, leading life scientists had garnered considerable business experience. Prominent examples include UCB Professor Donald Glaser founding the Cetus Corporation (1971); UC, San Francisco Professor Herbert W. Boyer and Stanley N. Cohen at the Stanford University School of Medicine launching Genentech (1976); UCD Professor Ray Valentine and Roger Salquist of Stanford establishing Calgene (1980); UCB Professor Edward E. Penhoet²⁴ co-founding Chiron Corporation along with his former Professor William J. Rutter and Pablo Valenzuela (1981); and UCD Professor Raymond Rodriguez launching of Applied Phytologics, Inc. (1983). Many observers saw this trend as proof that leading scientists could work effectively with industry *and* in the public interest. Reflecting on his own industrial experience with a start-up company (DNAZ) and a multinational firm, Stanford Nobelist, Arthur Kornberg wrote:

For the university concerned with pursuit of knowledge and its transfer to promote human and economic welfare, the DNAZ achievements demonstrate that basic science can be pursued quite effectively in another setting, and they should direct attention to the shortcomings inherent in the operations of large academic institutions that impede the creativity of their faculties. Finally, the DNAZ-Schering-Plough relationship illustrates that, in the long term, the scientist and the industrialist, with mutual confidence and trust, can produce good science and sound business of significant social merit (Kornberg 1995, 260).

In addition to start-up ventures, early university-industry agreements in biotechnology included: Monsanto and Harvard Medical School’s \$23 million, 12-year deal beginning in 1974 (Culliton 1977); Harvard Medical School’s affiliate Massachusetts General Hospital’s \$70 million agreement with Hoechst AG in 1981 (Bowie 1994) where exclusive right to commercialization of any invention from Mass General’s Department of Molecular Biology was provided to Hoechst; Allied Corporation and UCD \$2.5 million agreement in 1981; Washington University Medical School and Monsanto’s \$23.5 million, 5-year 1982 agreement (Kenney 1986); and UC Irvine’s Department of

²⁴ Penhoet returned to academia on July 1, 1998 as Dean of the UCB’s School of Public Health.

Biological Chemistry and Hitachi Chemical Company's \$12 million deal in 1988 where industrial and academic researchers shared the same building (National Research Council Committee on Japan 1992). Other agreements of note included DuPont's collaborations with the California Institute of Technology, Harvard University, and the University of Maryland; W.R. Grace's work with the Massachusetts Institute of Technology (MIT), Rockefeller University and Washington University (U.S. Department of Commerce International Trade Administration 1984). In the same vein, Syngenta Biotechnology, Inc. was established in Research Triangle, North Carolina in 1983.

Numerous concerns simmered as the number of university-industry agreements grew. Points of contention included the potential loss of U.S. competitiveness in biotechnology to foreign firms teaming with American scientists, LGUs being left at a disadvantage relative to private universities, and industry in greater control of research agendas (U.S. Congress Office of Technology Assessment 1991; Blumenthal et al. 1986a; Blumenthal et al. 1986b). A Government-University-Industry Research Roundtable organized by the National Academy of Sciences stepped in to codify acceptable terms and conditions for sponsored research agreements in 1988. The Roundtable further amplified workable approaches to the still contentious management of IP in 1993 (National Academy of Science Government-University-Industry Research Roundtable 1988, 1993).

With both success stories and occasional role confusion brimming from American campuses, a number of new government policies advanced the academic role in innovation and economic development. Responding to economic stress, lawmakers rolled out a stream of government initiatives aimed at removing what were seen as the restrictions on American innovation. With a struggling economy, policymakers combined the Cold War scientific agenda with an industrial competitiveness rationale to loosen antitrust laws, expand IP practices, relax financial restrictions, and weaken environmental regulations. The flow of legislation included:

- Stevenson-Wydler Technology Innovation Act (1980)
- Bayh-Dole University and Small Business Patent Act (1980)
- Small Business Innovation Development Act (1982)
- National Cooperative Research Act (1984)
- Federal Technology Transfer Act (1986)
- Omnibus Trade and Competitiveness Act (1988)
- National Competitiveness Technology Transfer Act (1989)
- National Defense Authorization Act (1991, 1993, 1994, and 1995)
- National Technology Preeminence Act (1991)
- Defense Conversion, Reinvestment, and Transition Assistance Act (1992)
- Small Business Technology Transfer Act (1992).
- Small Business Research and Development Enhancement Act (1992)
- Private Securities Litigation Reform Act (1995)
- Small Business Programs Improvement Act (1996)
- Small Business Reauthorization Act (1997).²⁵

²⁵ (National Academy of Science 2003, 102-103; Reamer et al. 2003; Slaughter and Rhoades 1996).

Universities and corporations found new ways to work together using independent boundary organizations to help relieve the tension between the private and public sectors. In this way, universities could claim an “arm’s length” relationship with for-profit aims. Pioneering organizations of this type include the Research Corporation, established with the assistance of UC in 1912, and the Wisconsin Alumni Research Foundation (WARF) formed in 1925 (Marcy 1978; Apple 1989). Over the years, these approaches evolved, taking on many names with essentially the same function (e.g., industrial parks, research parks, technology parks, business technology centers, and business incubators). Brooks and Randazzese (1999, 383-385) illustrate the nature and function of boundary (or buffer) organizations:

The incompatibilities between industry and the academy – those of research style, objectives, disclosure policies, intellectual property, and conflicting financial interest – threaten to undermine the basic purpose of universities and frustrate the expectations of the economic benefit that comes from closer university cooperation with industry.... Many communities, often with state government assistance, have created incubator institutions next to universities to encourage the formation of new firms based on university research. The core employees of the buffer institutions could carry out the necessary translation of academic research results to the point where they could be more readily adopted by small and medium companies.

Proliferation of these arrangements led to two new professional organizations. The National Business Incubation Association, a membership organization of incubator developers and managers was established in 1985 and the Association of University Research Parks was launched in 1986. A variety of boundary organizations had become widespread by the 1990s with a direct impact on the development of biotechnology.

Boundary organizations (including professional and trade associations, as well as agricultural commodity groups) grew to become important vehicles for the formulation of government standards, regulations, and trade policy. By the 1990s, these types of organizations were specifically empowered by government. For example, the National Technology Transfer and Advancement Act of 1995 states:

Federal agencies and departments shall consult with voluntary, private sector, consensus standards bodies and shall, when such participation is in the public interest and is compatible with agency and department missions, authorities, priorities, and budget resources, participate with such bodies in the development of standards (National Technology Transfer and Advancement Act of 1995 [P.L. 104-113 Section 12d]).

As events progressed, the winding down of the Cold War raised concerns that America’s science infrastructure would erode under declining federal funding. For example, NSF noted the changing climate: “As the 1990s opened, the United States faced the novel

challenge of redefining its goals and priorities in the post-Cold War era” (National Science Foundation 2000, 1-21). This reprioritizing shifted attention from national security to economic development (Kleinman and Vallas 2001; Slaughter and Rhoades 1996; Brooks and Randazzese 1999). MIT President Charles M. Vest (1996, 71) captured the pressure for change concisely: “We cannot justify the investment of federal funds in 1996 on the fact that we won the war in 1945. We need to look to the future, conceive of improvements in our role in the national innovation system....”

In this political and economic climate, state universities rediscovered a vested interest in championing, or at least claiming credit for, economic growth in order to show a return on government support (Eisinger 1988). Osborn (1988, 37) explained that a barrier to economic vitality was “the chasm that separates academia, where most basic research is done, and business, where new products are created.” University administrators and scientists alike were generally reluctant to bridge the chasm, but ultimately awoke to the reality that concern for the economy was the new “ticket to survival and to resources” (Kaplan 1986, 100). Representative of the tension, UC guidelines released in 1989 made clear the external nature of the new agenda by stating that not the university, but “...legislators increasingly see [university-industry] cooperation as a way of enhancing national R&D efforts and of helping to make the State and the nation more competitive” (University of California Office of the President 1989). LGU faculty involved in agricultural research also saw the need to align with the new agenda, one decidedly different than the emphasis on rural and community development found in the Smith-Lever Act, especially as amended in 1955 (Feller 1987; Feller et al. 1987).

In general, the terms and conditions of the UCB agreement appear consistent with the behavior of universities adjusting to the emerging norms of university-based economic development. Given the history of biotechnology, it may not be surprising that the agreement drew immediate controversy. After squabbles surrounding nonproliferation, laboratory safety, IPR, industrial concentration, academic entrepreneurship, field trials, environmental protection, and food regulations from the late 1960s on, one might reasonably view heated debate as the norm. In other words, it cannot be assumed that controversy was an outcome of the agreement’s content or construction. In many ways the agreement is consistent with governmental and industrial promotion of biotechnology. In fact, UC behavior regarding agricultural biotechnology in general appears to be in step with government policy. The agreement, properly labeled as an experiment, also falls neatly into the learning-by-doing evolution of university technology transfer. Perhaps the closest comparable agreements in timeframe and subject matter are those used by the Consortium of Plant Biotechnology Research, Inc. While UC did not elect to participate, the Consortium counted most of the key LGUs and biotechnology firms as members. The standard research agreement of this largely federally funded group did not deviate markedly from the UCB agreement in grant of rights or restrictions on IP.

In the late 1990s, the UCB-N agreement was not far from the norm, yet it did have unique characteristics. One key deviation from the norm was the inclusion of nearly an

entire academic department in an agreement with a single firm. UCB administrators knew that the “collaboration by a large number of faculty with a single corporate entity over five years [was] unique” (Public Information Office 1998). This thinking ran outside the mainstream. For example, in an informational booklet on university technology transfer dated November 30, 1993, the Council of Governmental Relations (1993, 20) asked the salient question: “When is it appropriate for license rights to future federally assisted inventions to be committed to an industrial sponsor?” The organization of research universities answered: “universities should not grant to a single industrial sponsor the rights to federally assisted inventions from the entire institution or major units such as departments, centers and laboratories. The granting of rights must be specific to the scope of work funded.”

UCB administrators also had the benefit of lessons learned from the controversy surrounding a long-term multimillion-dollar deal between Sandoz Pharmaceutical Corp. (later part of Novartis AG) and the non-profit Scripps Research Institute in La Jolla, California. The 1992 agreement precipitated new guidelines from the NIH (National Institutes of Health 1994). The guidelines dated July 1, 1994 cautioned NIH grantees when “the sponsor’s prospective licensing rights cover all technologies developed by a major group or component of the Grantee organization, such as a large laboratory, department or center, or the technologies in question represent a substantial proportion of the anticipated intellectual output of the Grantee’s research staff.” The NIH advised that a “Grantee should consider establishing some mechanism to limit the review and licensing rights of the sponsor to a particular segment or percentage of the inventions and for a set period of time” (National Institutes of Health 1994, 13). The UCB-N agreement fell short of at least the spirit of NIH’s guidelines since all non-commercial inventions were open to review by the sponsor.

A second important deviation from the norm was the extended capture of government-funded IPR. Precisely what inventions fell under the agreement and whether the IPR arrangements covered the whole department calls for further elaboration. The agreement was a legal contract between two parties, namely NADI and UC (in this case, technically, The Regents of UC). As is normal practice, it was not a contract with a department or college but with the UC as a legal entity.²⁶ PMB as a department is mentioned in the agreement regarding oversight of the Research and Advisory Committees, but the agreement remains with UC. The inventions within the scope of the agreement are tied to the specific individuals who signed on to the agreement and not to the PMB Department as a whole. About thirty PMB faculty signed on over the term of the agreement, but a few did not. As such, the inventions of the whole department did not fall under the agreement. However, a collaborative project involving one or more of the few not signing and anyone receiving funds under the agreement would also fall under the agreement. In sum, it is fair to say that the whole department was impacted by the agreement. On the other hand, one could argue that the UC was within the letter of the NIH guidelines since not all members of PMB signed the UCB-N agreement.

²⁶ It should be noted that although most funds went to PMB, CNR negotiated the agreement, UCB’s OTL wrote it, and the system-wide Board of Regents accepted it.

Under the agreement the University owns the IPR developed with NADI having the first right to negotiate a license on a portion of the patentable discoveries made. While the Bayh-Dole Act provides for a small business preference, the Act includes a provision that a right of first refusal may be extended to a large firm in consideration for multiple-year funding. NADI could elect to negotiate an exclusive license within a set range of royalties when an invention led to a seed trait or without predetermined royalties if the invention did not. NADI received a free non-exclusive right to inventions that derived in part from their proprietary information. Defining royalty rates in a research agreement is rare and suggests an expectation that valuable seed traits would be generated under the agreement.²⁷ With a pre-negotiated range, a commercial entity is assured that royalties will not exceed a given level, while the UC has a figure that royalties cannot fall below. To fall under the agreement, inventions by researchers needed to be funded by NADI or a non-commercial entity, such as a government agency (e.g., NIH, NSF, USDA).

On the other hand, the agreement is carefully crafted to acknowledge UC's real and potential constraints under its policies, as well as federal laws and contractual obligations with third parties (e.g., government agencies and commodity groups). For example, the language "to the extent the University is legally able to do so" hints to possible entanglements or restrictions regarding control of future inventions created with public funds. One example of the agreement in practice is a U.S. patent application for a gene sequence and promoter.²⁸ This application derived from research conducted with both USDA and TMRI funds. Under the terms of the agreement, the benefit of the government funding flowed directly to a single firm. Such an occurrence strains conventional thinking on the proper stewardship of public funds.

The conclusions of the National Science and Technology Council's Interagency Working Group for Plant Genomics provide a useful baseline for the concerns that engulfed the UCB-N agreement. Ten months before the UCB-N agreement was signed, Interagency Working Group released its final report. The Group sought to address IPR concerns in the field, but did not have a definitive approach for resolving public-private tensions:

Limitations in the availability of public funds... combined with current patenting policies, have led to a significant investment by the private sector which now is unable to make the information freely available. While it is undesirable to duplicate private sector efforts, both philosophically and economically, the government must now act to provide critical data and research tools to the entire plant science community. Government officials, as representatives of the public research community, should continue to hold discussions with private industry in an effort to minimize current and future impediments to plant

²⁷ The actual range remains confidential and was not available to this review.

²⁸ U.S. Patent Application 09/828,068 filed on April 6, 2001 and published electronically by the PTO on October 24, 2002. A corresponding academic paper was submitted to *The Plant Cell* on March 6, 2001, accepted on May 29, 2001, and appeared in the August 2001 issue (Aubert et al. 2001).

genome research (National Science and Technology Council Committee on Science Interagency Working Group on Plant Genomics 1998).

Moreover, the government report recognized industry's coincident interests and was sensitive to the private sector's position:

...companies have become major players in all phases of genomics, including plant genomics, with a particular focus on crops with the highest market value such as corn and soybeans, in the United States. Biotechnology companies face the challenge of a long product development cycle, making them particularly dependent on the ability to obtain enduring capital investment through the research, development, and manufacturing period preceding product marketing (National Science and Technology Council Committee on Science Interagency Working Group on Plant Genomics 1998).

Although the UCB-N agreement covered some questionable terrain, it seems unreasonable to expect UC faculty or administrators to have found a timely and elegant solution to the very difficulties perplexing the federal government.

Finally, a persistent theme in the debate over the ideals and norms of academia draws on the premise that government funding roughly equates to basic or pure research, and industrial funding equates to applied research tied to potentially suspicious motives. The ideals of basic science, in turn, form the foundation for concern that academic research agendas may creep undesirably toward the interests of industry. Even though the UCB-N agreement covered the selection of research projects in some detail, it is an arguable assertion that government funding and the interests of the private sector were significantly divergent. With the dominant path of agricultural biotechnology within the intended scope of the agreement, government, academia, and industry have relatively little distinction relative to the science at hand (e.g., National Science Foundation Office of Legislative and Public Affairs 2001). As such, articulated concerns over potential changes in PMB's research agenda look misplaced. When it comes to the scientific and commercial agenda, all sectors seem eager to row the same boat – before, during, and after the UCB-N agreement.

In sum, the period before and during the agreement was marked by a growing consensus within university administrations, government, and the private sector that closer relations between universities and the private sector were desirable, if not an undiluted good. Although there were certainly critics and detractors, few were those who raised the tough questions about the role and mission of public and LGUs. While it would be unfair to conclude that the proponents of closer relations between universities and industry ignored the public good, broader questions of that sort were often brushed aside as of merely 'philosophical' import. What mattered were the immediate goals of securing financing, advancing scientific research, and balancing annual budgets.

V. The Agreement and the Public Stage: The Role of Media in Framing the University of California, Berkeley – Novartis Agreement

While internal controversies over policies and decisions within organizations are commonplace and even expected (e.g., Morrill 1991), they are not typically presented on a public stage. The following section recounts how the UCB-N controversy was characterized in popular news releases and articles and press releases coming from both Rausser's team of public relations specialists and from the UCB Public Information Office (PIO).²⁹ In addition, interpretations of the media coverage from people involved in the controversy are discussed, and a perspective for thinking about active participation among the audience is introduced.

The Agreement became a public/social issue on October 9, 1998 when *The San Francisco Chronicle* issued a report that these two organizations were reaching the final stages of their negotiations. The report mentioned that similar agreements between universities and private businesses had become commonplace, though concerns were raised that the scope of this particular arrangement would give industry even more control over the research agenda of the Berkeley campus. On October 14, 1998, a letter to the editor of *The San Francisco Chronicle* agreed with these concerns, showing how quickly some readers were judging the potential impact of this relationship.

These two news items, which appeared prior to the signing of the agreement, highlight the roles of the media and social responses to reporting in shaping public debates. First, the media deal with a range of issues ranging from unproblematic (e.g., a sports score, a weather report) to contentious (e.g., the pros and cons of agricultural biotechnology). Second, when others see issues appearing in the media for which they may have a vested interest, they may mobilize resources to emphasize or attenuate attention given to the issue or themselves (e.g., Montgomery 1989). The focus of this section is to look closer at these two roles, offer a descriptive account of the articles, and investigate the interpretations of the public aspect of the Agreement from some of the individuals with vested interests in it. We begin with a brief overview of the roles of the media.

The Two Roles of the Media

The social problems model put forth by Blumer (1971) and Hilgartner and Bosk (1988) often defines a social problem as something that appears in a public arena, which leads to public awareness and controversy in some form or another. The social problem then generates various forms of legitimation by those supposed, or claiming to be, knowledgeable about the issue at hand. Social problems researchers then measure, operationalize, and analyze the public arena in order to gain an understanding of how the controversy has been constructed and how those constructions play out across different sectors of the populace (Ader 1995; Best 1991; Lange 1993).

²⁹ The UCB Public Information Office is now known as Media Relations, and is housed within the Office of Public Affairs. We will refer to this office through this section as PIO.

Additionally, however, there is a “bounce” or “ripple” effect where actors who have a vested interest in the social problem react to various constructions of the issue. This can affect actors with either direct or indirect ties to the issue. Those with direct ties may find that they have to answer questions about their behavior, while those with indirect ties may decide to change their behavior in order to avoid similar problems and controversies in the future. Both media effects – problem constructions and legitimating behaviors – are important to understanding the impact of the Agreement as many different actors were (potentially) affected by it.

Some readers unfamiliar with the sociological approach to social *problems* may feel that we are defining this activity as illegal or somehow inherently problematic. This is not our intention. Instead, we argue that coverage of the agreement did include confrontations between UCB administrators and some groups who felt that an agreement with a company involved in the researching and marketing of products derived from biotechnology was a threat to UCB’s academic freedom. In other words, not only were some individuals outside of UCB concerned with the Agreement, but reporters felt that these concerns were newsworthy. Taking such an approach does have consequences for both the public presentation of the issue and how it is researched. In other words, a social problem is any issue which gains prominence in public arenas due to conflicting interpretations of the situation.

Once an issue is considered controversial for reporters, professional ethics dictate that they be willing to offer time and space to various sides of the debate, though it is not necessary to treat these sides equally (Gans 1979; Gitlin 1980; Tuchman 1978). By contrast, Ericson et al. (1989) have argued that some organizations have more control over news reports than others. Big businesses, the criminal justice system, and government offices often have direct links to reporters which offer opportunities to shape news reports to fit their agendas, while smaller groups are often overlooked, underplayed or reinterpreted as reporters and editors add their own interpretation to the story. Given the resources controlled by UCB and Novartis, we would expect these organizations to be able to have some control over the content of news reports related to the Agreement.

The research agenda which often develops to study the trajectory of a social problem involves the tracking of the actors involved in the debate, the placement of the debate within the public arena where it appears, and studying the general slanting of the discourse which surrounds it, including changes in evaluative positions. In addition, the research agenda may include analysis of public perceptions of the debate.³⁰ A typical methodological approach is to perform content analyses on public documents, such as news articles, to offer some kind of oversight into how the issues are being, or have been, presented. Before turning to the popular press, we will offer a descriptive account of the public presentation of the Agreement as put forth by UCB.

³⁰ See Gaskell and Bauer (2001) for a discussion of a research agenda concerning the biotechnology debate within policy arenas, media discourse, and public opinion.

The Public Relations Campaign

It is often hard to discern whether an organization develops a public relations campaign to be proactive about a situation, to set up a front for problems it sees on the horizon, or to react to public input (whether positive or negative). The information coming from within UCB concerning the Agreement seemed more concerned about developing a front than reacting to detractors. This conclusion is based on both the timing of press releases and their content. This reconstruction of the campaign developed and maintained by UCB rests largely on articles that appeared in a) *The Berkeleyan* – the faculty and staff newspaper at UCB, and b) on the UCB PIO web site. Nine articles from *The Berkeleyan* and four releases from the PIO website were analyzed. All thirteen pieces were found using the Internet, though other articles or releases may have been made that were not available over the web. Six of the articles and releases appeared in November and December 1998, three appeared in 1999, two in 2000, and two in 2003. While these two types of information – press releases and the UCB newspaper articles -- are not synonymous, both were available to various audiences in different and similar forms. Press releases would have been given to reporters and made available on the web site, while *The Berkeleyan* would be available to those on and around the campus, as well as those who would visit the same web site. In addition, both are connected through the UCB web site, and many of the articles appearing in *The Berkeleyan* were written by individuals in the Public Affairs office. While these two sources would also be different with respect to likely audiences, both were constructed by those with some vested interest in UCB, though not necessarily from the same perspective.

Importantly, as one person from PIO noted, the Dean's Office in CNR and leading faculty in PMB controlled the release of most of the official information concerning the Agreement prior to its signing. The first mass media newspaper article on the Agreement was published in October, 1998, while the first four press releases from PIO were made available on November 23, 1998, the day the agreement was signed.³¹

The press releases from UCB which appeared on November 23, 1998, highlighted the positive aspects of the Agreement. One of the releases, for example, was comprised of three quotes from representatives of California's agricultural industry, individuals outside the university, all of whom praised the potential impact of the Agreement on the agricultural community.³² Another, written in a question and answer format, asked the question: "Will NADI be able to influence internal department policies or direct the research agenda?" and answered in the following way:

³¹ All articles used here can be found online at <http://www.berkeley.edu/news/berkeleyan/search>. Users of the site can distinguish between press releases and *The Berkeleyan*, as both are archived on the same site. For heuristic purposes, only those articles or releases from which we use direct quotes will be referenced. Readers can find the other articles and releases by looking at the dates provided in the body of this text.

³² These individuals were: Thomas DiMare, former chair of the Western Growers Association and the California Tomato Board; Stuart Woolf, Chair of the California League of Food Processors, and Phil Larson of the Fresno County Farm Bureau.

No. The two NADI members of the Research Committee will have no voice in department or University policy. The research agenda will continue to be determined by the interests of individual PMB faculty who may or may not choose to apply for NADI funding. Most faculty researchers have indicated they will participate, but virtually all will also continue to seek funding from federal and state agencies and foundations, and several will continue to work with other private companies.

NADI and Novartis Agribusiness Biotech Research, Inc. (NABRI) members of the Advisory Committee can only make recommendations to the University and to the department, they cannot set policy (Public Information Office 1998).

The other two statements which were released at this time provided background details on the Agreement, again emphasizing the fact that this was a positive (and experimental) arrangement between UCB and Novartis. “This is the first, though experimental, step in what we hope will be a long and fruitful relationship,” said UCB Chancellor Robert M. Berdahl. “Novartis brings significant intellectual assets as well as financial support to an important area of fundamental research” (Mena and Sanders 1998).

The next mention of the Agreement came on December 2 in *The Berkeleyan*, reiterating that it had been signed and affirming that this “unique collaboration will keep Berkeley scientists and California farmers at the forefront of agricultural biotechnology” (Sanders 1998). As will become clear, this view was hardly unanimously shared by all department members, though it should be clear that this presentation of the issue would be viewed by many as the “official” stance of UCB. In addition, it was mentioned that some students were concerned with the Agreement, though their discussion group was joined by the Dean of the college, making it appear that UCB administrators were taking positive steps to address internal opposition, and that students had the ear of the Dean. Included in the release was a note that a group of “rogue... anti-biotech activists,” made their opposition to the agreement known during the signing when they threw pies at the Dean and others involved in the agreement. The article pointed out that these individuals “sneaked into the press conference,” were “subdued by campus police,” and “the press conference quickly resumed” (Sanders 1998). The release also suggests that the research to be accomplished under the Agreement was likely to yield rapid benefits for California agriculture.

The sole article that carried any critical commentary of the Agreement was published in *The Berkeleyan* on February 17, 1999, nearly three months after its signing. In this case, David Noble of York University had given a talk at UCB which was critical of commercial and industrial incursions at universities. Noble critiqued everything from the exclusive contract UCB signed with Pepsi for soda pop vending machines to the UCB-Novartis Agreement. This stance, however, was not left unchallenged. *The Berkeleyan* noted that Rausser stated that either Noble had not read the Agreement or misunderstood it. Noble was not given the opportunity to respond, echoing Hoynes and Croteau’s

(1991) observation that controversy is often spun in a way that suggests that criticism of internal policies is only generated by uninformed outsiders.

The other two pieces of information coming from UCB in 1999 were generated by PIO and offered cautious optimism for the Agreement. In one case, the Chancellor of UCB said that while the Agreement would be closely scrutinized, such arrangements were going to become more common in the future as public funding became less available for research, and that in this specific case the promises of genomic research were too important to ignore. In the other press release, a UCB distinguished professor argued that while not everyone was happy with the terms of the Agreement, the criticism may have been a catalyst for putting a more stringent research protocol in place.

Only two articles appeared in 2000, both appearing in *The Berkeleyan*. One simply mentioned that the Agreement would need to be studied in more detail as it unfolded, and the other used the Agreement as an example of corporate linkages which would bring money to universities but risk loss over control of research agendas. This latter article stated that the Berkeley Faculty Association had joined the American Association of University Professors, a group which was looking into concerns with private and public funding at universities.

The next article appeared on January 29, 2003, in *The Berkeleyan* and was focused on the events surrounding the Agreement as it neared its completion (Sanders 2003). The release mentioned that Syngenta – the successor company of Novartis – had not discussed a continuation of the Agreement with the university, though an informal conversation between a public relations officer and Syngenta researchers revealed that if it was to be continued it would be much more limited. The release continued with supporting and opposing viewpoints, using terms such as “positive attitudes toward the agreement,” “students have been among the biggest beneficiaries of the agreement,” “a contract with the devil,” and “commercial interests.” While this is the first press release noting that some individuals connected to UCB were openly critical of the Agreement, of the 27 paragraphs in the release, thirteen were neutral, ten were positive, and only five were negative. The final press release, appearing on September 25, 2003, mentioned the Agreement within a long list of accomplishments under Chancellor Robert M. Berdahl’s tenure at UCB.

A caveat is in order at this point. These press releases and articles, while available to a large audience, are not necessarily read by anyone, including those on the UCB campus. What we have been trying to show is the way in which the Public Affairs office was presenting the Agreement to anyone who would listen. We do not know if others found these articles and releases interesting or insightful, though we do know that this issue was covered by newspapers outside the Berkeley campus. We now turn to that coverage.

Newspaper Coverage

For our study, articles were collected from a Lexis-Nexis search,³³ newspaper archives (*San Francisco Chronicle*, *San Francisco Examiner*, *San Francisco Guardian*, *San Jose Mercury News*, *Contra Costa Times*, *Daily Californian*), a general Internet search, and articles coming directly from people at UCB. Of 71 articles found on the topic between October 1998 and June 2002, 29 (40.8%) appeared between October and December of 1998.³⁴ Thus much of the attention given to this issue attenuated shortly after it was signed. This is unsurprising, as to date research undertaken within the parameters of the Agreement has not resulted in controversial technologies or products. It should be noted, however, that some news reports did emerge in 2002 when Ignacio Chapela – a UCB Professor in ESPM who was an opponent of the Agreement – found traces of genetically modified genes in traditional landraces of corn in Mexico, as noted above. Some of this coverage mentioned Chapela’s opposition as a possible catalyst for concerns other researchers might have had with both Chapela conducting the research and the research methods employed.

Most media analyses seek patterns in seemingly chaotic environments and the patterns are often called frames, or seen as evolving patterns of framing a social problem. These frames, according to Gamson (1984, 80), are viewed by reporters and audience members as merely reflections – the natural order of things. “In short, news presents a packaged world, and not all of the recesses of the package are visible.” Gamson and Modigliani (1989), for example, studied editorials and political cartoons as a means of exploring changes in the coverage of nuclear power. Similarly, Ten Eyck (2000a) found that the press marginalize food safety concerns by clustering stories on these issues. In both cases, the discovery of patterns in media representations imperceptible when reading a newspaper on a daily basis illuminated processes internal to the workings of the media and social problems.

In Gamson and Modigliani’s (1989) study of nuclear power, it was found that “Progress” frames (this is a good thing) dominated early coverage on the issue, followed by frames such as “Pandora’s Box” (only bad will come of this) and “Runaway Technology” (the technology is out of control and it is too late to turn back). These two latter frames tended to coincide with the environmental movement of the 1970s and the accident at Three Mile Island. This *sequence* of frames was not followed in the UCB-Novartis coverage, as reporters used both progressive and controversial frames from the beginning of the coverage, focusing on the issue from the context of private funding and corporate control of higher education rather than that of environmental movements and disasters. Reporters, according to Zelizer (1993), follow local practices of journalism as they seek ways to make sense of issues which will be accepted by colleagues and readers. This would include taking into account such factors as the history of UCB as an activist

³³ Lexis-Nexis is a database of leading newspapers and other information sources in the U.S. and other parts of the world.

³⁴ A more recent, follow-up, search of Lexis-Nexis found only three articles on this topic, all appearing in California newspapers, between June 2002 and October 2003.

campus, the controversial nature of biotechnology, and the declining government funds for research – themes which have been used successfully by other reporters. In other words, journalists make a priori assumptions concerning the factors that are most pertinent to the public take on how the Agreement is, has been, or ought to be covered.

While other frames were used throughout the coverage, within the media trajectory of the Agreement, one of the more interesting findings is that the “Progress” and “Pandora’s Box” frames were both present from the start. Table 3 shows how these frames and others played out between 1998 and 2002. While Pandora’s Box was introduced in the beginning and continued to be salient throughout the coverage (accounting for 38 of the 71 articles [53%]), the second most used frame was Economic (money/financial benefits and/or risks) present in 11 of the 1998 articles. Of the nine articles coded as having a Progress frame, seven appeared in 1998. A more general Ethics frame – a framing in which the Agreement is discussed as positive or negative for the university without drawing on the other frames such as a supporting progressive science, the economics of university funding, and so forth – was used twice in 1999 and once in 2002, and one Runaway Technology article appeared in 1998 and another in 2002.

Table 3. News frames, 1998 - 2002

<u>Frames</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>Total</u>
Pandora’s Box	8	<u>8</u>	<u>11</u>	5	<u>6</u>	<u>38</u>
Economic	<u>11</u>	1	0	<u>6</u>	1	19
Progress	7	0	1	1	0	9
Ethics	2	0	0	0	1	3
Runaway Technology	1	0	0	0	1	2

In short, while Pandora’s Box had the most staying power, no dominant frame emerged, as a number of potential trajectories were constructed at the beginning of coverage. Those who followed this story through the pages of the press were often led to believe that only bad things would come from the Agreement -- mainly in the form of private business control over campus research. For example, an Associated Press release noted that some in the California State Senate were questioning the Agreement: “Senator Steve Peace, D-El Cajon, blasted the UC system for what he called ‘inherent conflicts of interest’ in which private companies help decide what research is funded and who gets the money, often without the public being any the wiser” (Thompson 2000).

Framing is a conceptual tool used for media analysis which is open to numerous interpretations, and while we think it is helpful, it is also important to think more deeply about the context in a way that is not as abstract or susceptible to idiosyncratic interpretations. Within the articles, we categorized eight different themes – 1) general

research; 2) education of students; 3) economic concerns; 4) corporate control of higher education; 5) general ethics; 6) general activism; 7) food/agriculture issues; and 8) political issues. We coded up to three themes for each article, and found that Corporate Control of Higher Education was the dominant theme, appearing in 57 of the 71 articles. The second most discussed theme was General Research, appearing in 48 articles, followed by Economic Concerns (46 articles) and General Ethical issues (16 articles). Activism was a popular theme in 1998 (six articles), as newspapers covered pie throwing incidents involving UCB administrators who had signed the Agreement, but this theme only appeared in one article in 1999 and three articles in 2000. Coverage of corporate control over higher education continued to be the dominant theme throughout the coverage. Table 4 summarizes these various aspects of the media coverage.

Table 4. Coverage Characteristics

<u>Theme</u>	<u>Count</u>	<u>Section</u>	<u>Count</u>
<i>Corporate Control</i>	57	<i>National News</i>	24
<i>General Research</i>	48	<i>Local News</i>	13
<i>Economic Concerns</i>	46	<i>Commentary/Op-Ed</i>	11
<i>General Ethics</i>	16	<i>Business</i>	11
<i>Food/Agriculture</i>	12	<i>Science</i>	2
<i>Education of Students</i>	7	<i>Other</i>	10
<u>Actors (top five)</u>		<u>Word Count</u>	
<i>UCB Administrators</i>	39	<i>Less than 500</i>	31
<i>Non-UCB faculty</i>	22	<i>501 - 1000</i>	28
<i>UCB, not PMB, faculty</i>	19	<i>1001+</i>	12
<i>Activists</i>	18	<u>Author</u>	
<i>UCB students</i>	16	<i>In-House Reporter</i>	41
<u>Page</u>		<i>Wire Story</i>	13
<i>Front page/front of section</i>	12	<i>Outside Commentary</i>	11
<i>Other</i>	59	<i>Other</i>	6

The change in coverage from specific events – pie throwing to protest the Agreement – to more general issues about corporate control and (perceived) economic necessities within universities, highlights a change in coverage. The metaphors were disappearing, as were the activists and student protests, but the issue remained important to some degree.

Activists were not the only actors involved in the story. In fact, UCB administrators dominated stories, appearing in 39 articles (again, we coded up to three sources), while

activists appeared in 18 stories. UCB faculty appeared in 25 articles, UCB students appeared in 16 articles, while Novartis interests appeared in 12 articles. Faculty and administrators from other universities appeared in 30 articles, emphasizing the degree to which this issue was felt at other institutions of higher education -- a subject discussed below.

If all of this had remained front page news, one could make an argument that the public was truly concerned about what these actors were saying. In fact, only four of the articles were found on the front page (two in the *San Francisco Chronicle*, one in the *San Diego Tribune*, and one in *The Atlantic Monthly* as the cover story), and another eight were on the front page of various sections of different newspapers. This means that 45 of the articles were placed deeper within newspapers or other publications, including 15 from news services. It should be emphasized that some of these articles did not come from traditional newspapers (19 of these articles are from other kinds of print media). Of the articles, 24 appeared in national news sections, 13 in local news sections, and 11 each in the opinion pages and the business section. Only two appeared in science sections. Most of the articles were written by in-house reporters (41) followed by wire stories (13). Forty of the articles included some kind of negative commentary provided by the author, 22 had no commentary by the author, and nine contained some positive commentary by the author.

Finally, it is important to note the wording used in the headlines of these articles. According to various observers, headlines encourage readers to take a specific slant on a story, so even a story which praised the Agreement may be read as derisive if accompanied by a negative headline – not an unusual situation as headlines are not written by the reporters themselves (e.g., Parenti 1993; Pfau 1995). Of the 70 articles, 35 headlines were negative, 27 were neutral, and eight were positive. One article was a wire service story with no discernable headline. If one argues that readers are likely to encounter a headline on a random basis, they were much more likely to see a negative headline than a positive one. Given the frequency of negative frames and the salience of activists within the stories, especially early in the coverage, we feel it is safe to say that much of the coverage offered by the newspapers was not optimistic. At times this was based on the explicit role of activists in staging an event, while at other times these publications seemed to be more interested in playing up the negative aspects of the Agreement which were being discussed in various circles.

What news consumers read and read into articles is a difficult question to answer. In a study of political party members prior to a major election, Gunther (1992) found that Republicans tended to think the media favored Democrats, while Democrats tended to think the media favored Republicans. While we coded our overall evaluations of the articles – 46 articles were either very or somewhat critical of the Agreement, 12 provided both positive and negative aspects, and 13 were either very or somewhat positive toward the Agreement – we felt that a more active approach was needed to serve as a proxy for reader engagement. One way to approach such an undertaking is to think of the issue as a breach of a norm (given our classification of the Agreement as a social problem).

Schonbach (1990) studied how people react when faced with a situation in which a social norm has been broken. Schonbach found that when people were asked to account for their actions in a norm breaching situation, a) refusing to give an account or b) using a justification (putting the blame on an external force/actor) tended to escalate conflict between the parties, while c) using excuses (putting the blame on an internal force) or d) offering a concession tended to manage conflict.

Accounts were given in 41 articles, of which 38 were justifications, two were refusals, and one was an excuse; no concessions were ever reported. The most popular justification given was by UCB administrators and faculty who said that the money was needed because public research funds were waning. According to Schonbach, this strategy would lead to a higher level of conflict between the opposing sides. It should be noted that those supporting the Agreement may have viewed the situation as normal and not a breach in the normative structure of university activities. This may have an effect on what type of account is given when questioned, as the actor who feels s/he is right will ignore or belittle an accusation, which would lead to an escalation in concern for those who feel wronged.

One interesting note to this finding is that the only excuse mentioned was actually in the popular press, while one of the refusals was in the popular press and another in the UCB campus newspaper. In other words, all audiences (of the 71 articles coded, 51 appeared in the popular press, eight in the UCB campus newspaper, four in scientific journals, two in higher education journals, and six in other sources) were receiving the same type of accounts – justifications. Actors involved in the coverage were not changing their stories as the issue moved to various media outlets.

If Schonbach's (1990) findings are correct in that refusals and justifications will lead to greater conflict among the parties involved, we would assume that people who were interested in this topic and reading these reports would find that UCB administrators were offering unacceptable accounts for their actions. For example, in an Associated Press story released on May 15, 2000, a state official is reported as saying that "California universities have little choice but to seek private research money because state funding has failed to keep up with rising costs" (Thompson 2000). For opponents, this kind of constraint does not warrant this kind of response as the university is not willing to admit it can seek and distribute funds in other ways. That such a reaction could be found among some of the public was made clear during the early days of the Agreement, when an editorial in *The San Francisco Chronicle* stated that the Agreement had been negotiated behind closed doors, and that "[w]e...cannot ignore the implications for academic freedom in a college beholden to corporate interests" (Rosset and Moore 1998, A27). Part of the concern for these individuals was that the funding would go to a whole department instead of a single individual or lab (Rosset and Moore stated that the money would be given to CNR, while an add-on from the newspaper mentions the tie to the PMB).

It should be noted that while editorials – especially those from individuals with a vested interest in the topic being discussed – and regular news items may be interpreted

differently by audience members, both types of information can be found in the same information source, making it difficult to determine the exact impact of these on public opinion. In this specific case, the first comment can be regarded as a negative evaluation of a refusal to seek other advice and to give an account for the Agreement, while the second statement is a warning as to what will happen when corporations give money to public universities. It is not hard to interpret this editorial as a public declaration from individuals with an agricultural interest trying to escalate the conflict. If readers are approaching this topic from the standpoint that they need an explanation for why UCB is seeking outside funding, it could be argued that they may have felt the same way as the writers of the letter to the editor.

Comments on the Coverage

As mentioned earlier, coverage of an issue is only one role played by the media in U.S. society. The reactions of those with direct or indirect ties to the issue are an indication of how the media are affecting those with vested interests which may, in turn, affect their own activities. While we do not have survey or interview results of how administrators, faculty, and students at other colleges and universities were reacting to the publicity given to UCB, there is some indication that there was a backlash against the Agreement within some circles. An article in *The Chronicle of Higher Education* shortly after the Agreement was signed noted that it was “sparking fierce debate on the Berkeley campus - - and throughout academe -- about the influence of industry money on academic research” (Blumenstyk 1998, A56). This debate within the academic community did not subside. For example, a letter to the editor of *The Chronicle of Higher Education* published in 2001 contended that while an earlier article had stated that none of the worst fears of corporate control had come about, there was no way to prove this, saying that “[d]emanding that critics provide instances of overtly compromised research encourages non-overtly compromised research” (Arzoomanian 2001, B18).

These results show that while the effects of the Agreement were mixed, there were individuals within higher education who were unwilling to travel the same road. The media, including *The Chronicle of Higher Education*, are the ones disseminating (and framing) this issue for many people. In one case where a U.S. government agency employee from outside the university was interviewed and mentioned the role of the media, it was felt that the Agreement had caused a split between UCB and the government. This statement may have been partly due to previous negative press aimed at linking the Agreement with government involvement in other controversial biotechnological applications. By being associated with biotechnology, any negative press about new concerns with biotechnology and biotechnology interests would reflect poorly on the government.

While responses from people beyond the UCB campus have been, for the most part, gathered through secondary sources, the interviews which were conducted with people on campus, as well as a few others from around the Bay Area, did shed light on how the public debate over the Agreement was affecting them. Most UCB individuals we

interviewed were quick to condemn the coverage, though most were also supporters of the Agreement. As one UCB administrator we interviewed said, “the Agreement was expensive to UC in terms of negative public relations.” It is unsurprising, however, to find an abundance of negative comments from those with vested interests in an issue which has received negative coverage.

At the same time, there are some who did benefit from the publicity as it gave them a story to cover and a way to use the history and mythology of Berkeley to make the story interesting. A Bay Area journalist, for example, said that this Agreement had parallels to the Free Speech Movement of the 1960s, giving an anchor for the story which has deep resonance both within and outside Berkeley. It matters little whether others agreed with this anchoring – that an arrangement with a pharmaceutical company in the 1990s is similar to student protests in the 1960s – the link was made, and it was a link some audience members could use to contextualize the situation. The UCB campus was thought to be democratic, and administrative decisions were to be made with a high degree of transparency. This was part of the motivation for the movements of the 1960s, and some saw the Agreement as a return to deals made behind closed doors. Similar statements can be found within many of the interviews.

In addition, the agitation caused by the Agreement was thought to be affecting others. An administrative specialist, for example, argued that “we would be worried if there wasn’t any press, because this Agreement may signal a shift in how university-industry relations are constructed,” while another UCB administrator said that journalists had blown the whole thing out of proportion, but that was not surprising given the fact that journalists are only trying to sell their stories to consumers. While the “take” on the media is different among these individuals, both thought that UCB should have been involved in the public relations campaign, as both journalists and consumers were not knowledgeable enough to develop and interpret the story on their own. These are standard third-person responses (Davidson 1983; Ten Eyck 2000b) in which others are considered to be more influenced by the media, including journalists, than oneself. As one professor put it succinctly, the coverage was “inflammatory,” though one can only assume this person was both concerned with the coverage and thought that reporters were fanning the flames of public resentment.

While the majority of comments about the press from UCB employees were negative, some saw it as either balanced or in some way a positive contribution to the UCB trajectory. One professor mentioned the article in the *Atlantic Monthly*³⁵ as “spot-on” in discussing the relationship between universities and industry, while a Dean said that the range and degree of all the publicity “may lead to future contracts.” These multiple readings of the reporting on the Agreement show that issues reported in the media are

³⁵This article, titled “The Kept University” (Press and Washburn 2000, 39-54) used the voices heard on the Berkeley campus in the 1960s concerning ties between colleges and industry to discuss the UCB-Novartis agreement. One of the statements, which has been echoed throughout this report, states, “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.”

rarely treated as homogenous across media sources (Gamson et al. 1992), and interpretations of the same information will vary from person to person (see also Hoijer 1992; Morley 1980), and may even change for the same person as they move from one social context to another (Fiske 1992).

Conclusions

The role of the media in bringing the Agreement between UCB and Novartis to the public's attention cannot be overlooked, nor should it be overstated. As Dearing and Rogers (1997) contend, the media give us issues and topics to think about, but do not necessarily tell us how to think about them. Everyday news consumers in Berkeley, in California, and in the U.S. are awash with information. At the time Agreement was signed and made public, candidates and voters were considering a mid-term election (November 1998), the Clinton-Lewinsky affair was still fresh on many people's minds, fighting continued in the former Yugoslavia, many of the Asian Tigers were in a financial tailspin, and a baseball team from California (the San Diego Padres) was in the World Series. All of these stories, as well as a myriad of others and daily activities were vying for the attention of consumers and reporters. It can be assumed that some were interested in the Agreement, while others were content with their ignorance of the issue.

The story, however, did have real and perceived impacts on the UCB campus and beyond. As noted by those involved, the Agreement and its coverage at the time crystallized or reified rifts between faculty and administration, between different colleges, between the university and government, between industry and the university, between private citizens and UCB faculty, and so forth. Reporters were thought by many to be focusing on the negative and sensationalizing the arrangement, causing some UCB personnel to think about how things could be done differently in the future, as well as giving material to those who write about issues of higher education. It is this aspect of the news – the fallout from coverage – which is often overlooked by media scholars, but is a measure of the effectiveness of the press. Whether or not similar agreements between universities and industry will be handled in the same way or given the same amount of attention is an empirical question, though it is clear that, at least for the time being, media coverage has changed both individual and collective behavior on the campus of UCB.

Finally, it should be noted that the framing done by the media, whether or not the result of conscious decisions on the part of reporters, had contradictory effects on the various parties to the dispute. For some, attempts at simplification by some reporters portrayed the issue in the form of a stark contrast among opposites. The very notion that stories must have opposing sides, common in American journalism, probably tended to polarize views. Others may have found that various nuanced accounts of the Agreement were developed by the press which helped some persons to form their own understandings of the situation. Indeed, a few news stories raised questions about how the Agreement might affect the core values and principles of the university. Unfortunately, to date, only a handful of the protagonists have seriously considered these questions.

VI. The Effects of the University of California, Berkley – Novartis Agreement on the Department of Plant and Microbial Biology

Much of the controversy generated by UCB-N stemmed from the potential consequences such an agreement might have for the various constituents of PMB. There were questions regarding the effect of UCB-N on the research directions of faculty, post-doctoral researchers, and graduate students: Would the large amount of noncompetitive money from UCB-N result in faculty pursuing and securing fewer competitive grants? What might the effects be for teaching, at both the undergraduate and graduate levels? Many of the questions posed by DIVCO and other concerned parties were unanswerable prior to the implementation of the agreement. Indeed, the need for this present report is directly related to this dilemma and this report is a necessary, although perhaps insufficient, response to the decision to treat UCB-N as an experiment.³⁶

In this section we present views of UCB-N from the multiple standpoints of PMB members – graduate students, post-doctoral researchers, staff, tenured and untenured faculty. We also examine the material and cultural consequences of the agreement for PMB, to the extent that we were able to discern them, in order to answer some of DIVCO's questions. This section ends with a discussion of a number of issues raised by PMB's close department-wide involvement with a private research corporation.

Views on the Partner Selection Process

There was much discussion among the PMB faculty with respect to the desirability and shape of any agreement with industry prior to the visits by the C4 to companies that had expressed interest in a potentially department-wide agreement. Those most involved in establishing UCB-N said it took a while to get faculty to see it was okay to reverse the usual form of agreements and in effect have companies compete for the honor of allying with PMB. Many faculty members indicated that there were, to them, endless discussions on the ethics of such an agreement and whether they should go with just one company. In the end the department concluded that the single company route would preserve academic freedom in the department whereas an agreement with multiple companies would be more likely to balkanize PMB. In addition, they decided that IPR would be problematic if several companies were involved. All but two of the PMB faculty members agreed with the "one company" strategy.

Wilhelm Gruissem, former PMB Professor and initial PI for UCB-N, described the solicitation process as open and transparent until the proposals were received from Novartis, DuPont, Monsanto, and Pioneer. At this point the companies were told that the details of their proposals would not be disclosed to anyone other than the PMB faculty and relevant senior administrators. As noted above, anyone who wished to see these

³⁶ Numerous people, both opponents and advocates of UCB-N, argued that any effort to treat the agreement as an experiment required an external team to collect information from UCB-N's inception, or indeed, beforehand in order to have control, baseline data for comparison. Our study first conducted interviews in January 2002, although we were able to use transcripts of some interviews that Jean Lave conducted from July to December 1999.

proposals had to sign a confidentiality agreement confirming that they would only discuss the contents of the proposals with those who had also agreed to confidentiality.

Justifications for Entering the Agreement

Three different justifications were offered to explain why PMB sought an agreement with an industrial collaborator. Within PMB only faculty members gave explanations as to why their department sought a university-industry agreement of the design that resulted in UCB-N. No graduate student, post-doctoral researcher, or staff member that we interviewed offered any reason for the agreement's inception. The most prevalent idea (see Table 5) was that science is expensive to conduct and academic units do not have the resources (financial or material) to keep up with private industry. Thus departments such as PMB require research collaborations with industry as a means for remaining on the cutting edge. One example of this position is the explanation that biology, particularly in its molecular and genetic disciplines, has moved into the realm of 'big science' with the use of very expensive and/or proprietary technologies; information is necessary to move biological knowledge forward by even a tiny step. Russell Jones, PMB Professor, said, "What we did rely on was [Novartis's] technology. But you know, this is how science is today; that you cannot do it with a piece of string and a piece of chewing gum anymore. You have to have this highly technical infrastructure and this is what we got out of TMRI."

Table 5. Number of Passages Coded as Justifications for Entering UCB-N by Interviewee Position

Position	For department	For graduates	Science is expensive
PMB faculty	13	11	13
PMB post doc	0	0	0
PMB student	0	0	0
PMB staff	0	0	0
PGEC	0	0	1
CNR faculty, not PMB	3	1	4
SRR member	0	0	0
UCB faculty, not CNR	0	0	3
UCB administrator	4	1	6
UCOP administrator	0	0	0
Industry	0	0	0
Commodity group	0	0	5
Advocacy group	1	0	0
Total	21	13	32

The second justification concerned the expected benefits that would accrue to the PMB Department from their recovery of indirect costs. It was explained that PMB was in financial straits with a significant departmental debt, no management service officer, only one-fifth of a secretary's time, and no prospect that the departmental budget from UCB was likely to become sufficient to cover operating costs anytime soon. Again, Russell Jones provides the clearest example:

We pay for our own telephones, we pay for our own computers, we pay for our own office furniture, so there's nothing that the university goes out of its way to provide. And you know, I can't blame the university, but if a department wants to run a program that's a cut above, then the department has to find alternative sources of funding. And research grants to individuals don't do this, because if I have a research grant, it's for me.

It was expected that through PMB's recovery of indirect costs, UCB-N would support the daily operation of the department and thus make it easier for an individual to conduct research.

The third justification offered for establishing UCB-N centered on the benefits of the agreement for PMB's graduate students. Even though there was general encouragement from the Chancellor and President to enter closer relations with industry (see further discussion in the next chapter), PMB faculty said that UCB-N was initiated by the department based on an assessment of their own needs to establish a good graduate program. Indeed, Wilhelm Gruissem asserted that their original goal was to support the graduate student program.

Reasons for Novartis's Interest

Plant and Microbial Biology Faculty Perceptions

Apparently discussions were never held among PMB and NADI scientists specifically regarding the reasons why the company wanted to enter into a collaborative research agreement with an academic department. However, this did not prevent the PMB members from speculating on the possible motivations. Several people thought that UCB-N was attractive because it was a way for Novartis to cheaply explore the new field of agricultural biotechnology at a time when they were reconsidering the direction of the entire company. The agreement gave the company access to much of the research done by the entire department, including post-doctoral researchers and graduate students, without having to pay for their salaries or benefits. Indeed, if Novartis had tried to replicate the profile of the department at NADI, PMB members argued, "it would be a lot more than \$5 million a year, for five years, just to pay all those salaries alone."

When asked to speculate as to why Novartis wanted to enter UCB-N, another faculty member replied, "because I think, if you don't mind my saying so, we have really excellent plant scientists in this department and I think they [Novartis] really wanted to enrich their own research program." While Patricia Zambryski, PMB Professor, thought

that Novartis was more interested in having the direct scientific exchange with PMB scientists rather than only focusing on IP, Sydney Kustu, argued

it is my sense that Steve [Briggs, NADI CEO] is also bright enough to realize that the biggest things to come out of the alliance in terms of research are things that he did not foresee. So he foresaw enough to say, ‘Hmm, we will get adequate return,’ and he knew enough to know that he probably did not foresee some of the things that might turn up.

Novartis/Syngenta Explanations

By and large the explanations offered by employees at Novartis and Syngenta regarding their involvement in UCB-N do not differ dramatically from the speculations of the PMB members. The merger of Ciba-Geigy and Sandoz that created Novartis really “inhibited the organization from taking new initiatives,” according to one employee. One result of this inhibition was that competitors such as Pioneer, Monsanto, and DuPont explored genomics much earlier than did Novartis. As noted above, in 1998, Novartis realized that it had fallen behind and needed some way of not only catching up but surpassing its competitors. Thus the agreement with PMB was a way “to accelerate the rate of discovery, the basis of agricultural traits, beyond what we could do with our limited staff and facilities at that time.” Novartis’s plan was to build in-house capabilities as well as make use of the academic expertise, because while the former would take several years to establish, the latter could be used to jumpstart the program.

Two employees involved with the agreement maintained that it was established with PMB rather than any other group of public scientists because PMB offered a very broad range of academic interests (disease, development, transformation, plant biology) and is populated by very clever people. They said that the company did not really know what it wanted from such an arrangement, which was why UCB-N disbursed unrestricted money. If they had known precisely what they wanted, then the company would have entered the usual restricted relationship with one faculty member or laboratory to do work in a particular area. While securing new IP was important, because the company always seeks to increase its patent portfolio, it was not the primary motivation for entering UCB-N. Instead, Simon Bright, Head of Technology Interaction for Syngenta, described the company’s mindset as one of “let’s be surprised” by what PMB can do. In a similar vein, Bright declared that Syngenta would not be interested in setting up an agreement similar to UCB-N elsewhere because the other places do not have the same confluence of intelligence and abilities.

Uniqueness of Novartis Agricultural Discovery Institute

Prevalent among many people on campus was the notion that NADI was unique and thus that UCB-N was an unrepeatable alliance between two specific entities at a particular moment in time. In large part this notion stemmed from the structural characteristics of NADI in that it was part of the research-oriented Novartis Foundation, rather than the

product-oriented Novartis Corporation, and thus the research institute of NADI was buffered to a degree from the business concerns of the corporation. Peter Quail, PMB Professor and Research Director of PGEC, said that he thought the initial success and attraction of NADI as a research partner for PMB was partly due to Steve Briggs's knowledge of and desire for an academic environment that was in turn enabled by NADI's research independence accompanied by monetary support from Novartis. Scott Kroken, a former PMB student, post-doctoral researcher, and TMRI employee, agreed that "the agreement was really quite natural between this company [NADI] and the university because this company really functioned in a sort of quasi-university manner in the first place." In describing those she collaborated with at NADI, Talila Golan, a PMB post-doctoral researcher, said "the people I interacted with were hired as scientists, not as industry people; they were hired to think and take a project and run with it wherever it goes, so they had all the thinking of an academic scientist rather than industry people."

Steve Briggs's background and already established personal relationships with people in PMB were other factors deemed important both to the uniqueness of NADI and choice of NADI as PMB's partner. Briggs's experience as an academic was an especially significant point that distinguished him from other industrial scientists. In addition, while at Pioneer, Briggs collaborated with academics at the Cold Spring Harbor Laboratory, whose plant biology program was headed by Barbara McClintock. The program was essentially defunct but Briggs restarted it with money from Pioneer and it is functioning today. Briggs also started two data access programs at Pioneer for academics to have access to Pioneer's plant gene sequences and functional genomics tools. Such a history and apparent conviction to work with academics marks Briggs as apart from most industry scientists. One TMRI employee described the situation:

You know, most companies have no interest in providing access to their data or technology. You look outside of agriculture and it just doesn't happen, full stop. In agriculture, I think you could trace the instances of it back to initiatives that [Briggs] made both at Pioneer and at Novartis and that's put pressure on the competition to do a little bit, but not much. I mean, still, the only organizations today that really work collaboratively are Pioneer and Novartis. And of Novartis, it's basically TMRI. Providing this access is just not considered desirable and there's [*sic*] very, very few companies in the world that will do it.

However, with the dissolution of TMRI in 2003 the broad, department-wide type of university-industry collaboration, exemplified by UCB-N, appears to have disappeared. One former TMRI employee argued, "the main reason I think TMRI was closed down by Syngenta, its new parent company, was because the research was really too empirical, of the type where the products were just too far down the pipeline." Because TMRI was not separated from Syngenta in the same way that NADI was from Novartis, the opportunity for TMRI to be a quasi-academic research laboratory vanished. While some people pointed to the change in management as the reason why TMRI was terminated and UCB-N was not renewed, others said that the biggest change in the move from NADI to TMRI was in the market, i.e., the economy had weakened and it became more important for

TMRI to create products quickly. In addition, Bright said that TMRI was not as “blue sky” as the PMB people seemed to think it was – it had always been geared towards the creation of commercial products.

Views on the Negotiation Process

Faculty Views

On the whole the PMB faculty viewed the negotiation process as uncontroversial and not in need of adjustment. Faculty were generally satisfied with the extent and degree of their involvement in the negotiations and trusted their representatives to create an agreement that would benefit PMB. One associate professor said that before the decision was made to go with Novartis, the departmental meetings focused on whether it was a good approach to take; after the decision, the meetings became more informational as only a few were involved in the actual negotiations. Not all faculty members participated to the same degree. Sydney Kustu, PMB Professor, described her involvement as the result of being “carried along by those who wished, initially at least, to forge the agreement for plant science.” Even so, another professor said that one of the things that surprised him was that the meetings were always well attended by faculty, half of whom often do not attend regular faculty meetings. He further described the PMB meetings as a spirited and openly democratic sharing of ideas, which suggested to him that the faculty were very interested in getting a good contract with private industry and wanted to shape the final terms of agreement. Most faculty members agreed that the departmental discussions about UCB-N were geared towards consensus-building. However, several professors were concerned that these discussions centered on whether PMB was being sold to Novartis rather than considering the agreement’s consequences, positive or negative, for graduate students and the teaching mission.

By all accounts it is at this point in the months immediately surrounding the decision to go with Novartis and during the negotiations that PMB, as a department, grappled with questions about the appropriateness of an entire department at a public university entering a research agreement with a private corporation. Similar questions related to the appropriateness of individual faculty contracts with industry appear not to have been considered previously. Therefore, one early consequence of UCB-N was that it engendered a space to have important discussions about the character of university research. Regrettably, this space seems to have been limited to PMB and only existed for the short period of time during the early phase of negotiations.

Graduate Student Views

By comparison to the faculty’s view of the negotiation process being open and democratic, many PMB graduate students felt excluded and deliberately kept in the dark about an agreement that was being proposed partly for their putative benefit. This was not a new state of affairs and the general lack of communication and involvement of graduate students in departmental affairs was a point of contention even before UCB-N.

According to most of the PMB members there were no graduate student or post-doctoral representatives at the faculty meetings where UCB-N was discussed. Indeed, graduate student representatives had been excluded from all faculty meetings held since September 9, 1998 (PMB Graduate Students 1998 (December 14)). Scott Kroken, former PMB graduate student and current bioinformatics staff scientist for the Diversa Corporation, explained that Gruissem handpicked Susan Jenkins, a student in his lab, as the graduate representative and that she was subsequently held up as an example of graduate student involvement. However, because Jenkins was a member of Gruissem's lab and he was the one most involved in creating UCB-N, Kroken said that the rest of the graduate students knew she would be unable to voice their disagreements or concerns. In turn, Jenkins was not at liberty to tell the other graduate students what went on in the meetings. Thus, while she acted as a token presence, she was not a representative.

While several graduate students and post-doctoral researchers paid little attention to the negotiation process, others were angry at their exclusion. One PMB graduate student said that the agreement was "touted as being done for grad students when they didn't know what happened." Another observed, "All graduate students really resented being left out of the loop. We were given less information than available to the media; we were just expected to support it no questions asked.... Faculty rammed the agreement through without consulting the graduate students" (quoted in MacLachlan, 2000, 3).

During the first half of 2000, Dr. Anne MacLachlan and Mary Crabb of the Center for Studies in Higher Education (CSHE) conducted a survey of PMB graduate students regarding their educational experience in PMB and their thoughts about UCB-N. This study was commissioned by then EVCP of UCB, Carol Christ. The final report was circulated around UCB but was not officially published. This survey was conducted 18 months after the creation of UCB-N; nevertheless, it is the earliest source of information regarding PMB graduate students' involvement with, and assessment of, UCB-N. Based on this survey, MacLachlan concluded there were four main reasons why graduate students were unhappy with the process of negotiating UCB-N. These were:

1. The secrecy of the negotiations in the department
2. Information being available to others in other departments and the press
3. Lack of consultation with the students
4. The kind of communication from faculty to students about the agreement before it was finalized (MacLachlan 2000, 3).

Our study supports these conclusions and indicates that while there were initial attempts to improve the collegiality among PMB faculty and students, these efforts were largely transitory.

One graduate student who stayed on as a post-doctoral researcher said that graduate students expressed their opinions about UCB-N and its process of negotiation in individual conversations with Gruissem as chair of the department. He also came and talked with the graduate students at one of their group meetings but only after the

agreement had been publicized. In December 1998, the PMB graduate students, as a collective, wrote a letter to the PMB faculty that was characterized by one graduate student as very controversial and confrontational. It created conflict between students and faculty. The letter laid out the main concerns regarding the exclusion of all but faculty members from the negotiations:

One consequence of the restricted flow of official information is that graduate students have been forced to rely on rumors and supposition throughout the negotiation process with Novartis. Thus, we must take issue with recent newspaper quotes which claim that the agreement with Novartis was “arrived at through an open process” (Vice Chancellor Cerny’s Letter to the Editor of the *San Francisco Chronicle*, 11/7/98). We are not aware of any meetings within PMB which provided information to or sought input from graduate students or post-docs. Apparently several open meetings were held within the College of Natural Resources, but most PMB students were not aware of these or were told that the meetings were open only to faculty. We find it puzzling that students in ESPM were informed of the CNR meetings while we were not. While many students hope that the faculty simply did not realize the extent of graduate student interest in the development of the agreement, others find it difficult to believe that the consistent lack of information from official channels has been merely an oversight (PMB Graduate Students 1998 [December 14]).

One positive development from this experience, at least in the short-term, was that graduate students became more active in attending committee meetings, writing up their notes for everyone, and were generally more interested in departmental and university life.

Post-doctoral Researcher Views

The post-doctoral researchers in PMB at the time of the UCB-N negotiations also felt that they should have been more included in the information stream. Paul Bethke, assistant research specialist, thought the approach taken by the department was unnecessary. He said:

You were presented with this thing, ‘okay now here’s some stipulations that apply to you, which you have no say in, essentially.’ It was different for people hired in later where you could essentially say ‘I understand the rules and I’m willing to accept those.’ It’s a different situation to say ‘I’m not willing to accept those and I’ll just leave.’ My own feeling is that the faculty at least, and the college, did a pretty poor job of keeping people informed and knowing what was happening and why it was happening ahead of time. They just presented this agreement with all its stipulations

as a done deal and people jumped on the stipulations and didn't spend any time thinking did it make any sense to do this sort of agreement.

Jennifer Vorih, former PMB Student Affairs Officer, agreed with Bethke's assessment. She said that while graduate students had been more involved with departmental affairs before UCB-N, that was not the case for post-doctoral researchers and that, "post-docs, I think, became a little more politicized because of this." However, this reaction appears not to have been long-lived. When Todd Leister was hired into PMB as a post-doctoral researcher in 2000 he heard very little about UCB-N and was given no information about the structure of the agreement. The overall indignation may have attenuated quickly because of the relatively high turnover of post-doctoral researchers and their lack of involvement in departmental affairs beyond their specific lab affiliation.

Implementation of the Agreement

Arguably, the Collaborative Research Agreement between UCB and NADI has never been fully implemented, thus automatically curtailing the extent and degree of the agreement's impact. In particular, the construction of a joint UCB-NADI research facility (Appendix E of the contract) and the appointment of NADI employees to UCB academic positions (Article 7.2 of Appendix D of the contract) failed to materialize. Given this situation, we can only speak to the consequences stemming from the parts of the agreement that were actually put into practice.

With respect to the formal language and structure of the agreement, the majority of the people directly involved said that UCB-N was implemented in the way they expected. One faculty member said, "It worked out just painlessly." While some people were against the idea of UCB-N in principle, those funded through the agreement generally concurred with Zacheus Cande, jointly appointed MCB and PMB Professor, who said that the implementation of UCB-N and its "practices have been amazing benign, I think, from my perspective." Others pointed to the small number of amendments that were added during the execution of UCB-N as evidence of the soundness of the original contract. William Hoskins, director of OTL, said there were "no major problems with the agreement that we couldn't handle with an amendment ... and these were not significant amendments." To a large degree this view is also held by those in charge of the agreement on behalf of Novartis, one of whom said that he does not think there was anything overlooked in UCB-N that would need to be changed to make the agreement more successful for his company.

There were also ways in which the agreement diverged in practice from what was expected; sometimes positively, sometimes negatively. Bob Buchanan, PMB Professor, said that the implementation differed from their expectations when they negotiated UCB-N because "from the scientific standpoint, it exceeded expectations in the yield, in what's come out of it." At least one person was disappointed that Briggs's vision of UCB-N did not reach fruition. Sydney Kustu, PMB Professor, lamented that Briggs's "capacity to see that perhaps this was going to be a new and wonderful way in which people could cooperate" was not realized in the actual operation of UCB-N.

Collaborations

One way UCB-N diverged in practice from faculty members' expectations was through the collaborations with the NADI scientists. Several faculty members commented on the infrequency of communication between PMB and NADI personnel and the differential amount of access to certain technologies both within and among laboratories. These perceived drawbacks were closely tied to the failure to build an interface research facility on or near campus that would have housed the NADI scientists, technologies, and information. For example, Paul Bethke, assistant research specialist, explained:

Originally, I think, people thought there would be in-house [at UCB] secure computers set up where we could access things on our own and it turned out we had to generally, or what happened for us at least, was that we were generally going through intermediaries saying 'we need this kind of information, can you send us something?' There would be a pause and then it would come back but that again is a slow way of doing it.

Traveling to San Diego might have accelerated the retrieval of information but would have increased the cost of the collaboration and disrupted other scheduled activities. The key point is that a number of PMB researchers had initially thought they would only have to walk down the hall to access the benefits of collaboration. Since the interface facility was not built, several people argued that the "seamless interaction" desired by the original instigators has not actually worked out in the way they had hoped.

At the same time, even though communications were sometimes constrained, other faculty members said that their collaborations were better than they initially thought they would be. Russell Jones, PMB Professor, established an individual agreement with TMRI outside the purview of UCB-N. Jones said this individual agreement was not the kind of collaboration that he thought he would do when he signed UCB-N, but

this is what has made this [UCB-N] agreement for me exceptionally beneficial. In that it's drawn me to these people simply because I was forced to be drawn to them. I'm not sure that I would have got involved with the likely people at TMRI if the agreement wasn't in existence.

Confusions

There were two main points of confusion regarding the implementation of UCB-N. The first was whether or not graduate students had to sign the general agreement or if they would be automatically covered under their advisor's signature. This issue was skirted by changing the status of the UCB-N money that came to PMB for graduate stipends to "19900" state graduate student researcher funds disbursed through CNR. This move obviated the need for students to sign confidentiality forms because officially they were not getting any earmarked money from UCB-N, nor were they doing UCB-N related research. This situation changed after their third year in the program when a student

moved to being financially supported by their advisor, at which point it was decided on a case by case basis whether students had to sign any confidentiality agreements.

The second point of confusion surrounded the requirement that all papers for presentation or publication were to be sent to NADI for a 30-day review prior to their public appearance. Even after the agreement had been in operation for two years some people claimed ignorance of this obligation. As late as the middle of 2000 it was reported to us that a faculty member said of a presentation: “I had no idea we were supposed to submit this.” Richard Malkin, PMB Professor and former CNR interim Dean, confirmed this as he recalled, “There was a meeting where this was brought up, and the faculty were very upset. ‘You mean we’re supposed to send something to Novartis before we publish? Oh, I’m not going to do that.’ And I thought these are the people who just signed this agreement.” This quotation points to the disturbing conclusion that either the faculty did not carefully read the UCB-N contract before signing or they were forgetful and unreliable in fulfilling their responsibilities. Those who did submit their presentations generally felt it to be an inconsequential requirement that did not result in delays. Several people simply sent in drafts or outlines of papers and talks and considered the amount of time it took NADI to review them to be similar to delays involved in the publication process. Indeed, some people submitted their manuscript to NADI and a professional journal simultaneously. One positive consequence of this requirement was that more people felt obliged to write their presentations further ahead of time than they would have previously done, although others stayed with their practice of not putting their talk together until the day before presentation.

Funding of Projects

The composition of the Research Committee established to evaluate the faculty proposals and disburse the UCB-N funds concerned many people because it had two representatives from Novartis in addition to the three PMB faculty members. According to those most closely involved in creating the structure of UCB-N, the two Novartis representatives were invited by PMB to be on the research funding committee rather than Novartis demanding their inclusion. Bob Buchanan, PMB Professor, said Novartis was invited in order to get their insight and enable cross-fertilization between industry and university researchers; indeed, it was not unusual and “many government review committees have an industrial member for that reason.”

The Research Committee worked as most of the participants thought it would. The five members worked to reach a consensus based on three criteria about whether to fund the proposals, and if so, at what level. As listed in the research agreement (Appendix B, 30) these criteria were:

- Quality and intellectual merit of the proposed research
- Potential advancement of discovery
- Past and present productivity of the PI

Each of the three PMB members excused themselves from decisions about funding their own proposals. The committee members all received the proposals before they met and each member rated the proposals according to the criteria listed above. These scores were sent to the administrative assistant who entered them all into a spreadsheet and the committee then met to decide how to reconcile their disparate scores. The two NADI members participated by emailing their scores, through telephone conferencing, and on one occasion by a visit to UCB.

No faculty proposal was ever rejected, to the knowledge of one of the committee's members, although there were different levels of support ranging from \$60,000 to \$200,000 each year. Over the course of the five years, the total amount of UCB-N money spent directly on faculty research was \$14,240,000, which is 59 percent of the total amount of the agreement.³⁷ The average annual award from the UCB-N Research Committee was \$120,500. Twenty-five PMB faculty members received money from UCB-N, but two faculty members left PMB during the agreement and therefore did not get funded for all five years. PMB hired another faculty member late into the agreement and he received UCB-N funding for only the last year.³⁸ Table 6 shows the UCB-N funding amount by faculty member per year. (See Appendix A for a list of the project titles)

³⁷ This figure is adjusted for the CRADA reduction of \$1,056,000 bringing the total amount of UCB-N funds to \$23,944,000 over five years.

³⁸ Other faculty members hired by PMB during the period of UCB-N chose not to sign the agreement.

Table 6. UCB-N Funding by Faculty Member per year, Ranked by Total Received in \$1000

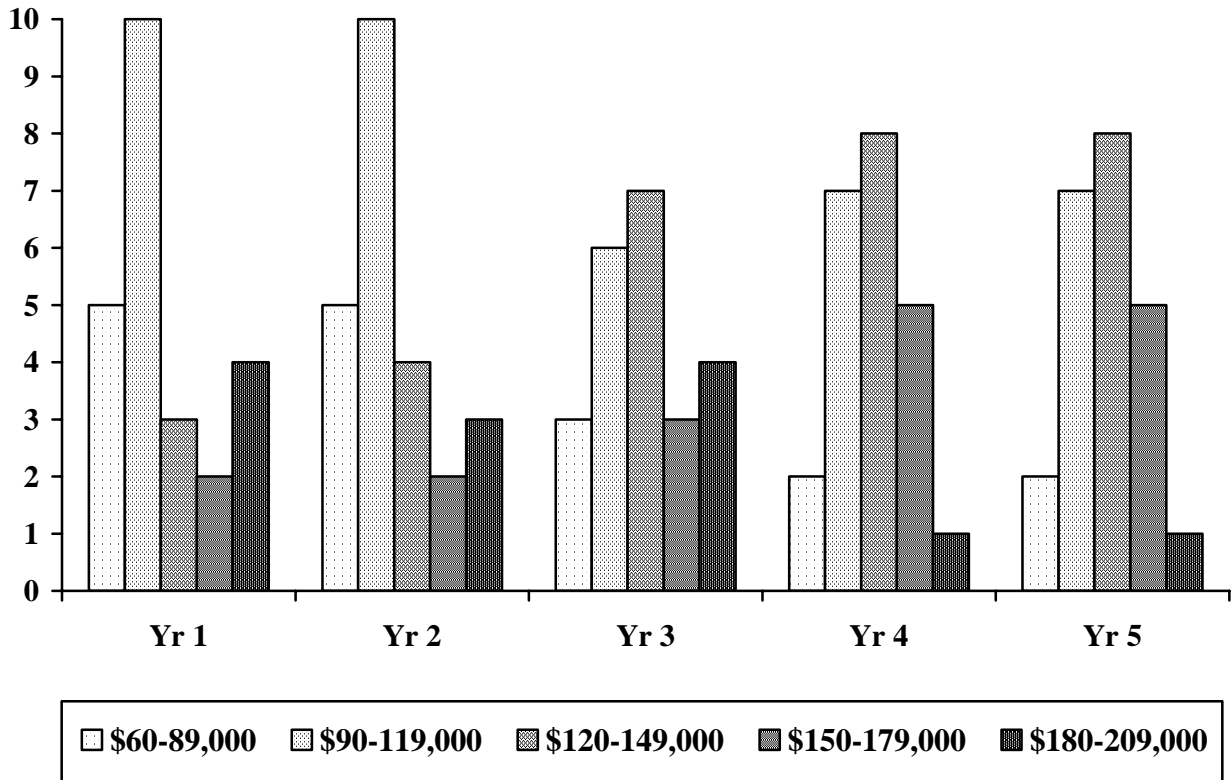
Name	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Bob Buchanan	200	200	200	175	175	950
Michael Freeling	200	200	200	175	175	950
Brian Staskawicz	200	200	200	175	175	950
Sydney Kustu	125	125	200	180	180	810
Patricia Zambryski	150	150	150	140	140	730
Peggy Lemaux	150	150	150	125	125	700
Krishna Niyogi	100	100	150	150	150	650
Peter Quail	125	125	100	150	150	650
Steven Lindow	100	100	125	125	125	575
Sheng Luan	100	100	125	125	125	575
John Taylor	100	100	125	125	125	575
Loy Volkman	100	100	125	125	125	575
W. Zacheus Cande	100	100	120	125	125	570
Andrew Jackson	120	120	120	100	100	560
Louise Glass	100	100	100	125	125	550
Thomas Bruns	100	100	100	100	100	500
Russell Jones	100	100	100	100	100	500
Z. Renee Sung	75	75	100	100	100	450
Lewis Feldman	75	75	75	100	100	425
Antje Hofmeister	100	100	125	100		425
Jay Hollick	60	60	100	100	90	410
Anastasios Melis	75	75	75	75	70	370
Norman Terry	75	75	75	75	70	370
Wilhelm Gruissem	200	120				320
John Coates					100	100
Total	2830	2750	2940	2870	2850	14240

Note: The funding year ran November 23 to November 22.

Figure 1 displays the UCB-N funding per year. There was a specific effort by the UCB-N Research Committee to distribute funding according to merit. As Sydney Kustu, PMB Professor and former member of the Research Committee, said, “Everyone is concerned about the ways in which such undertakings can go off-path. Well, one way to keep them on-path is to be sure that all funding is merit based rather than project based.” Most of the faculty members considered the procedure by which the Research Committee disbursed funds to be clear and peoples’ reactions were further mollified because it was perceived to be distributed to the participating faculty in an egalitarian manner. Some faculty members thought it was far better to have a committee rather than one person, i.e., the PI, disburse the money to reduce the potential for favoritism. It was also considered

to be a good idea to have the Novartis representatives on the Research Committee because it helped to maintain the integration of the two institutions and reinforced the sense that UCB-N was a collaborative endeavor and that everyone was working as a team.

Figure 1. Number of UCB-N Grants Awarded Each Year by Funding Amount³⁹



Source: PMB Data

Benefits of the Agreement

During the negotiation phase and early publicizing of UCB-N through media articles and press releases, a number of benefits from the agreement were touted for various constituents including faculty, students, CNR, and the general public. It is important to look at these claimed benefits and determine what occurred in practice since most of the releases and articles were published prior to the implementation of the agreement and thus dealt with hypothetical positives to a large degree.

³⁹ The number of grants is not constant because two faculty members left and one joined over the course of the agreement.

For Faculty

The PMB faculty had a wide range of things they considered to be benefits stemming directly from their involvement with UCB-N. At least fourteen different items were identified by PMB faculty, in striking comparison to the other stakeholders (see Table 7). However, there were two aspects of the agreement that appear to have been particularly significant for PMB faculty members. First, money, in one form or another, was by far the most positive aspect of UCB-N for PMB faculty members. 38 percent of the benefits noted by PMB faculty in our interviews were seed money for future projects, general funding, and overhead recovery. Second, NADI made available certain proprietary and confidential databases, permitted faculty to use expensive equipment, and provided expertise unavailable from other sources. These accounted for 34 percent of the claimed benefits in our faculty interviews.

Table 7. Number of Passages Coded as Benefits from Entering UCB-N by Interviewee Position

Benefit	PMB faculty	CNR faculty, not PMB	UCB administrator	Total
Overhead	14	6	10	30
Funding	20	3	1	29
Seed money	21	0	4	25
Access to information	21	2	2	25
Access to equipment	21	0	1	22
Benefited graduate program	12	0	8	20
Increased productivity	8	0	2	10
Resources	6	0	3	9
Less effort	5	1	0	8
Connection with real world	3	0	4	7
Lack of deliverables	1	0	4	5
Contacts	4	0	0	4
Unified department	4	0	0	4
Staff positions	3	0	1	4

For Post-doctoral Researchers

Most people said that salary was the greatest beneficial outcome of UCB-N for post-doctoral researchers. With the funding of faculty members' grant proposals from the UCB-N Research Committee came both the need and ability to hire post-doctoral researchers to physically carry out the research. Indeed, of those faculty who employed people to work on UCB-N projects, most preferentially hired post-doctoral researchers over graduate students. At least ten PMB faculty members hired post-doctoral

researchers with funds from their UCB-N projects. While some people were hired to work on one specific project funded by a specific source, others had more autonomy in what they worked on and could be funded simultaneously through multiple grants. This situation makes it very difficult to ascertain whose job is a direct consequence of UCB-N; in many cases the post-doctoral researchers did not know the source(s) of their funding. One former post-doctoral researcher explained,

It's always difficult to say who was directly funded by the agreement, at least in our case. Money came in, several people were hired because there was money available, and now several people have gone because money is *not* available. But we certainly didn't think in terms of 'oh, you're on the Novartis money and you're not.'

One long-time member of PMB estimated that there was a two-fold increase in the numbers of post-doctoral researchers in PMB as a result of UCB-N providing salaries for one or two people for each laboratory. Those post-doctoral researchers who did work on UCB-N projects also had the benefit of access to the same proprietary databases and technologies used by the faculty. One researcher explained that while the technology resources available through UCB-N were also available to other academics, UCB-N had the huge advantage of having them all together so that work could move quicker.

For Graduate Students

The desire to improve PMB graduate student education was one of the reasons given by the PMB faculty for entering the agreement with Novartis. In particular, Wilhelm Gruissem, the originator of the search for industrial partnerships, is credited with this desire as his primary motivation. By and large the benefits from UCB-N for graduate students, as identified by the students themselves, mirrored those of the post-doctoral researchers with money again seen as the primary advantage. PMB graduate students were the beneficiaries of Novartis funds in two ways. First, benefits arrived directly through the \$500,000 annually allocated from the Novartis indirect costs to graduate fellowships. The fellowship money was pooled with other fellowship funds so that no particular fellow was directly supported solely with Novartis funds (Price and Goldman 2002).

However, the \$500,000 was divided evenly between the Plant Biology and Microbial Biology divisions, the latter of which also includes graduate students whose advisors are in other departments such as MCB, or Public Health,⁴⁰ but whose stipend for the first three (later two) years was nonetheless paid by PMB. The amount of the graduate student stipend increased dramatically from \$15,700 in 1998 to \$22,000 in 2003, a rise of 40 percent, indicating an important consequence of UCB-N. However, ESPM stipends also increased by 37 percent to \$17,427, Nutritional Sciences and Toxicology (NST) stipends increased 40 percent to \$21,000, and MCB stipends increased 44 percent to

⁴⁰ In academic year (AY) 2003-2004, 38.5% of students in the Graduate Group in Microbiology had advisors outside PMB.

\$24,500, therefore dispelling the notion that PMB graduate stipends rose purely as a function of UCB-N. The second array of benefits was more indirect, arriving through research assistantships funded by way of the students' laboratory affiliations. Intriguingly, this second route appears to have been negligible as few faculty members reported hiring graduate students with NADI funds, or even having them work on NADI-supported research in a capacity other than as a research assistant.

According to Scott Kroken, a former PMB graduate student, Grussem had especially emphasized the positives of UCB-N for the graduate students. In particular, they were told that a proportion of the funds would be directed specifically for graduate support, "and then we found out what a miniscule proportion that was, and that was one thing that made us quite cynical." Instead, the benefits to graduate students really depended on who their individual advisor was and what the faculty member chose to do with their share of the money. For example, one faculty member bought new computers for all the laboratory staff, post-doctoral researchers, and graduate students when previously they had been sharing computers. For those few graduate students who did receive direct benefits from UCB-N, Kroken said it "turned us around from being completely skeptical to 'no, this is great' because this is really improving our ability to get our work done much more quickly, much more efficiently." However, not all graduate students benefited in the same way because many faculty advisors chose to spend their UCB-N money elsewhere.

In the survey of PMB graduate students conducted in 2000, specific benefits graduate students reported were new laboratory equipment, graduate stipends/fellowships, funds to participate in conferences, and access to Novartis data (MacLachlan 2000). While one graduate student said that she appreciated the use of equipment bought with UCB-N funds, she gently mocked that the agreement's biggest effect for her was the amount of time she has devoted to interviews about UCB-N.

The faculty considered UCB-N to have benefited the graduate program through funding and access to otherwise inaccessible technologies and information. One faculty member said that the NADI funds provided flexibility in his laboratory budget so that students were able to try things that would have been too expensive previously; specifically, almost everything now was sequenced as a first course of action, which gave some interesting results that they would not have revealed otherwise. However, several faculty members said that UCB-N fell short of having as great a positive impact as it might have had. Sydney Kustu, PMB Professor, argued

I think it had potentially enormous value for the department and the university in ways that were not fully tapped. I think in terms of student training and innovation, in terms of student training and development, that, from my perspective at least, I didn't see a lot of investment.... No one thought as deeply or creatively as they might have about how this money could be used to benefit students.

That is, above and beyond the funding for fellowships, Kustu said, “I think there could have been greater benefit derived from the point of view of student training.”

Concerns Regarding the Agreement

Although the overwhelming opinion of UCB-N from PMB staff was positive, they did have a few concerns about the agreement at the beginning of its implementation and with respect to its possible long-term consequences. One concern was the effect of Novartis support on the willingness of other sources, both private and public, to grant research funds. At least one faculty member who participated in UCB-N was convinced that his funding from another private company was pulled because of his involvement with Novartis. However, other faculty members talked about how they used UCB-N as leverage to get additional funds and/or stronger commitments of support from industry. Another issue was how faculty could assure confidentiality of information whilst working on multiple projects and warding off the temptation of a ‘trade secret’ approach. Some faculty dealt with this problem by completely separating personnel and funding for each project; others paid little heed to confidentiality requirements in that within a laboratory everything was discussed openly although there was reticence to discuss these projects with outside people. One senior PMB professor described the prevalent approach as, “The way the lab works is everybody knows what everybody else is doing and people benefit from interacting with one another. There is absolutely no distinction or secrecy when it comes to the project being funded by the Department of Energy (DOE), or being funded by Novartis, or the USDA.”

Four faculty members said that at the start of the agreement they were somewhat concerned that Novartis would be domineering and try to direct the research onto particular questions and/or delay publication. Each of these faculty members said their concerns were not realized. Post-doctoral researchers concurred that while some people were adamant that industry involvement would lead to ruin, UCB-N did not work out that way. One PMB faculty member, Renee Sung, quipped that it probably helped that NADI was so far away and thus unable to directly affect departmental life. Unlike the concerns of people outside PMB, as we shall see later, those within the department were not particularly worried about the scope or scale of the agreement. One faculty member said he was initially anxious about the potential for change in the internal structure of PMB, but that this too turned out to be unfounded.

By and large, the PMB faculty did not have any major concerns regarding UCB-N. This is possibly the case because, unlike other stakeholders, PMB faculty members had the opportunity to read the draft contract and request the alteration of any particular points they disliked. In contrast, some graduate students and post-doctoral researchers expressed dismay at their exclusion from the drafting process. However, these concerns largely dissipated after the agreement was signed.

Consequences of the Agreement

Effects on Research Direction

Due to the benefits most valued by the faculty members (see Table 7), many people argued that the focus of their research moved more quickly in new and emerging directions than would otherwise have been possible. Almost to a person, the faculty of PMB said that primarily the funds from NADI, and secondarily the access to equipment and information, enabled them to explore research questions that they otherwise would have foregone or postponed until they had more initial results to support a government grant proposal. One junior faculty member said, “It [UCB-N] provided me the opportunity to explore some areas that I otherwise wouldn’t have explored, had I not had this money.” Several senior faculty members explained how their UCB-N projects in new areas provided the preliminary results necessary for their successful grant applications to the NSF, NIH, and other funding agencies.

While it was repeatedly emphasized that these shifts in direction were not dictated by Novartis, the faculty clearly acknowledged that many of the changes would not have occurred without UCB-N. One person is applying the new technologies made available by NADI to work he did 15 years ago. This is generating new results, but he said he never would have gone in this direction without UCB-N. A senior faculty member described the research drift as a subtle transformation:

We did have control, it [UCB-N] didn’t change our research; it didn’t force us to change our research interests – certainly it changed, because we had the opportunity to look at the information that Syngenta/TMRI have, and that’s changed a lot of people’s research; there’s no question about that. But it wasn’t, ‘you must work on this area,’ or even, ‘if you want your proposal funded, it’d better be something that TMRI’s interested in.’ That was not the case at all.

Indeed, many faculty members stressed that the research questions in which they are interested did not change *per se* but rather the method of answering those questions changed with access to NADI’s technologies. An assistant professor observed, “Research projects always evolve along the way depending on the availability of the technologies and it’s the same here. Our project wouldn’t be the same if there was no such technology available.” As such there was a tendency for the faculty to shift their choice of model organism to one that was sequenced by NADI, e.g., rice. However, this may not be much different from a similar shift that occurred in the late 1980s when many plant biologists switched to *Arabidopsis* as a model plant.

Productivity

The increased productivity of PMB was one argument used consistently both as justification for entering UCB-N and also as a measure of the agreement’s success. Price and Goldman (2002) examined the participants’ *curricula vitarum* and illustrated this

increase in publications and grants. There are a number of possible reasons for this increase: (1) UCB-N enabled PMB faculty to continue their current productivity with less effort; (2) UCB-N enabled PMB faculty to do more of what they were doing; (3) UCB-N enabled PMB faculty to do what they were doing more rapidly, and that this enabled them to get to the next project in their research program more quickly; and/or (4) UCB-N enabled PMB faculty to do some novel, risky things that they would not otherwise have done. In many cases the results from experiments funded by NADI were successfully used as supporting justification in later grant proposals to government agencies such as NIH and NSF. However, the increase in extramural grants within PMB must be taken in the context of a rapid rise in funding for molecular biology nationwide during the period in question (see next section). Thus, it is unclear how much of the funding increase can be attributed to seed money and other benefits provided by the UCB-N agreement.

While those who were central to the creation of the agreement clearly intended the academic participants to strike out in new directions, to try something risky, at least one faculty member's "major concern is that the research productivity will not be commensurate with the luxury allowed by funding." Indeed, another faculty member said that he did not explore a completely new direction but rather NADI funds accelerated the success of his existing work because he could now hire a post-doctoral researcher directly instead of bootlegging the salary from existing projects.

A difficulty with a quantitative productivity analysis is that, if people are truly moving to new areas, then there might well be a lag in publication. As one faculty member said, "My expectation is that Novartis money will lead to *new* (knock-your-socks-off, not same-old) discovery beginning about now [January 2004], but that overall 'productivity' as measured by pubs reflecting the same-old should go down a bit."

Typically, as faculty research programs have grown, so have the size of their laboratories and NADI funds have been used to pay the salaries of post-doctoral researchers and technicians. These increases in research programs, laboratory facilities, and staff have led to unanticipated restructuring as the faculty are now responsible for securing larger grants, either from competitive sources or additional contracts, in order to maintain their larger laboratories. Alternatively, they must decide which personnel to lay off or programs to drop as their laboratories decrease to their pre-agreement size.

Changes in Funding Patterns

There is little doubt that the extramural funds available to PMB increased markedly after signing of the UCB-Novartis agreement. This is especially true when one compares the average funds received during the four years preceding (1995-1998) with the four years following (1999-2002) receipt of the grant (Table 8). Overall, PMB funding increased by 178% during that period; moreover, even if one excludes industry funding, funding increased by a hefty 112%. Given that the tenured and tenure track faculty full time equivalents did not change over that period, this also represents a 178% increase in funds per full-time equivalent (FTE) faculty member.

Given the similarity in subject matter for PMB with MCB, it is also instructive to compare the two departments. As noted in the table, MCB increased its total funding during that period by 57%. When industry dollars are not included the numbers differ only slightly, as industry funds made up only a small portion of MCB's extramural research portfolio (<1%) as compared to 32% of PMB's portfolio. Here, too, faculty FTEs changed only slightly during this period, so the increase in funds per FTE is also 57%.

Furthermore, in terms of dollars per FTE, the considerable disparity between the two departments in the earlier period has disappeared such that during the latter period MCB funding per FTE was actually slightly lower than that of PMB. In the former period, PMB faculty FTE had only 58% of the funds that MCB faculty had; during the latter period they had 102% as much research support as their MCB colleagues. In short, for all practical purposes we can say that the extramural support per FTE received by the end of the UCB-N agreement was the about same in both departments.

However, to put this into perspective, it is instructive to compare PMB with another plant biology unit. Given ease of access to data, we compared it to Michigan State University's (MSU) Department of Plant Biology.⁴¹ That department, like PMB, does relatively little applied work, and receives relatively little state or university funding for research. There we find that, in part as a result of considerable industry investment (a grant of \$9.5 million to several faculty members in FY 1999), funding in the latter period was up 214%. This works out to a growth per FTE of 265%. Moreover, even when industry funds are not included, funding rose 37% across the two periods – and this in spite of a considerable loss of FTEs. Also worthy of note is that federal grant funding rose significantly across the three time periods in all three cases: 80% for PMB, 50% for MCB, and 66% for MSU's Plant Biology department. In sum, the argument that the Novartis agreement was a necessary condition for enhanced funding of research in plant biology is tenuous given the increased amount of federal and other funds available for work in this area.

⁴¹ As is the case for PMB, this department is a result of reorganization of the biological sciences in recent years.

Table 8. Funds Received by Selected Bioscience Departments, 1995-1998, 1999-2002

	Annual Average 1995-98	Annual Average 1999-2002	% Change
Plant & Microbial Biology			
Federal	\$5,382,299	\$9,704,123	80.3
Industry	\$816,379	\$6,511,325	697.6
Non Federal Governmental	\$99,110	\$115,133	16.2
Not for Profit	\$729,106	\$3,173,600	335.3
University of California	\$201,874	\$571,354	183.0
Total without Industry	\$6,412,390	\$13,564,209	111.5
TOTAL	\$7,228,769	\$20,075,534	177.7
Number FTE	26.0	26.0	
Funds per FTE	\$278,030	\$772,136	177.7
Molecular & Cell Biology			
Federal	\$30,013,700	\$44,965,432	49.8
Industry	\$290,526	\$473,686	63.0
Non Federal Governmental	\$100,911	\$270,278	167.8
Not for Profit	\$2,831,019	\$6,383,044	125.5
University of California	\$635,706	\$639,044	0.5
Total without Industry	\$33,581,336	\$52,257,798	55.6
TOTAL	\$33,871,862	\$52,731,484	55.7
Number FTE	70.5	70.0	
Funds per FTE	\$480,452	\$753,307	56.8
Plant Biology at MSU			
Federal	\$1,365,795	2,262,492	65.7
Industry	\$448,514	2,519,629	461.8
Non Federal Governmental	\$65,952	15,131	-77.1
Not for Profit	\$344,954	150,287	-56.4
Other	\$245,573	328,618	33.8
Total without Industry	\$2,018,673	2,754,777	36.5
TOTAL	\$2,467,186	\$5,274,407	213.8
Number FTE	30.5	24.6	
Funds per FTE	\$80,891	\$214,407	265.1

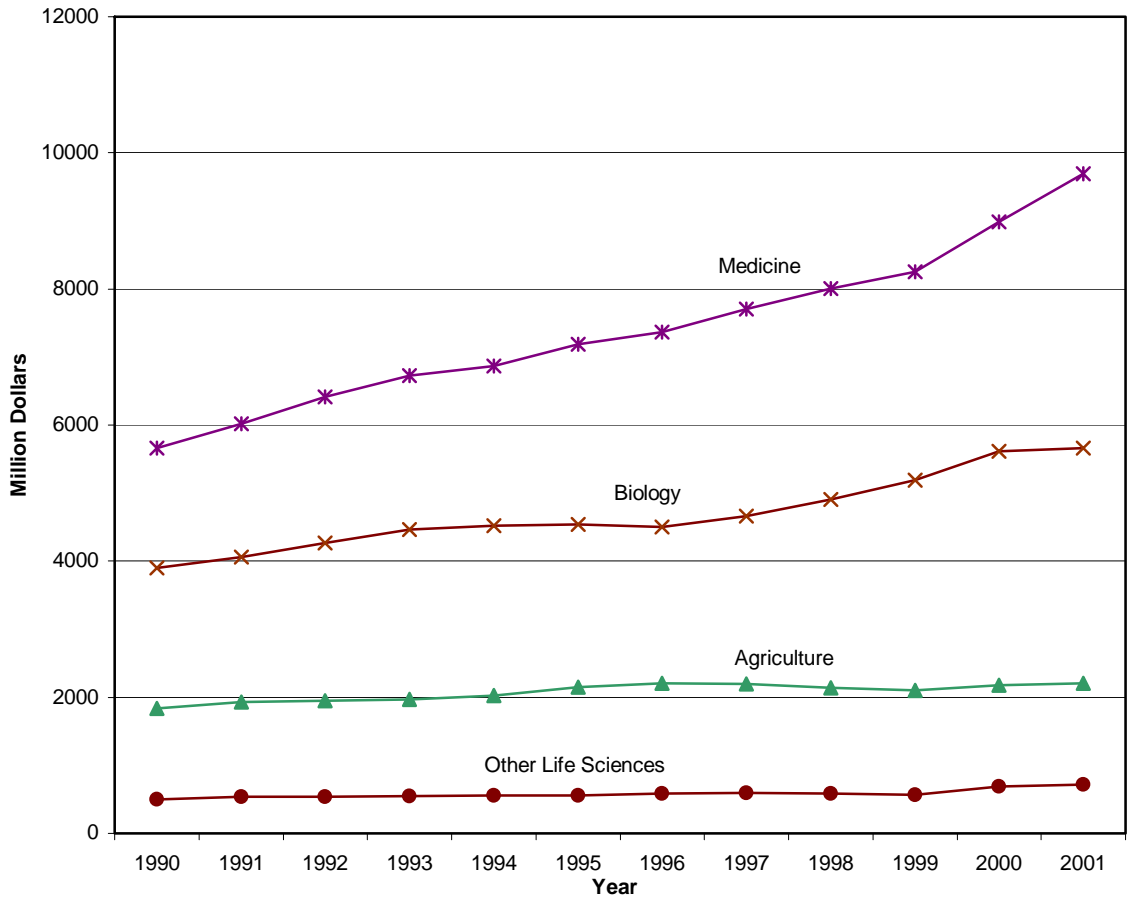
Sources: UCB SPO; MSU, Contracts and Grants Administration.

Furthermore, while PMB faculty and CNR administrators complained of declining public funding opportunities, the data do not quite support that interpretation of the situation. True, the federal *formula* funding received by the Division of Agriculture and Natural Resources (DANR) has been stagnant over the last decade. Similarly, federal extension funding (also based on a formula) has declined. Of course, as was true in many states, the state of California did have its own fiscal crisis in the early 1990s, leading to declining state support of higher education.⁴² The university raised tuition and cut programs as a result of the deficit. But California state funds for research were and remain an insignificant part of PMB's extramural funds. In contrast, other federal funds for academic R&D have actually continued to rise over the entire postwar period (with a few short-term declines). When one looks more carefully at funds for Life Sciences research, one finds a similar situation.

As Figure 2 shows, although government support for biological research has not received the largesse poured down on the medical sciences, federally financed biological research has gone up dramatically over the last decade from about \$4 billion to about \$6 billion. This represents a 50% increase in funding in constant dollars. It might be argued that such figures are inappropriate, as the research performed in PMB is agricultural in nature. Indeed, federal support for agricultural research has increased much more slowly. But PMB faculty frequently noted in interviews that their research was not directly connected to agriculture. They stressed that they engaged in basic research in biology, far removed from the applied work of their colleagues at UCD and UCR. If that is the case, then the national biological research funding trend is the most appropriate for consideration when examining PMB. It in no way suggests a funding shortage.

⁴² The American Council on Education reported that two-thirds of public research universities made substantial program cuts in the early 1990s (Barrow 1996).

Figure 2. Expenditures for Life Science Academic R&D, 1990-2001, Millions Constant Dollars



Source: NSF, 2004. Deflators from National Research Council, 2002.

Graduate Student Effects

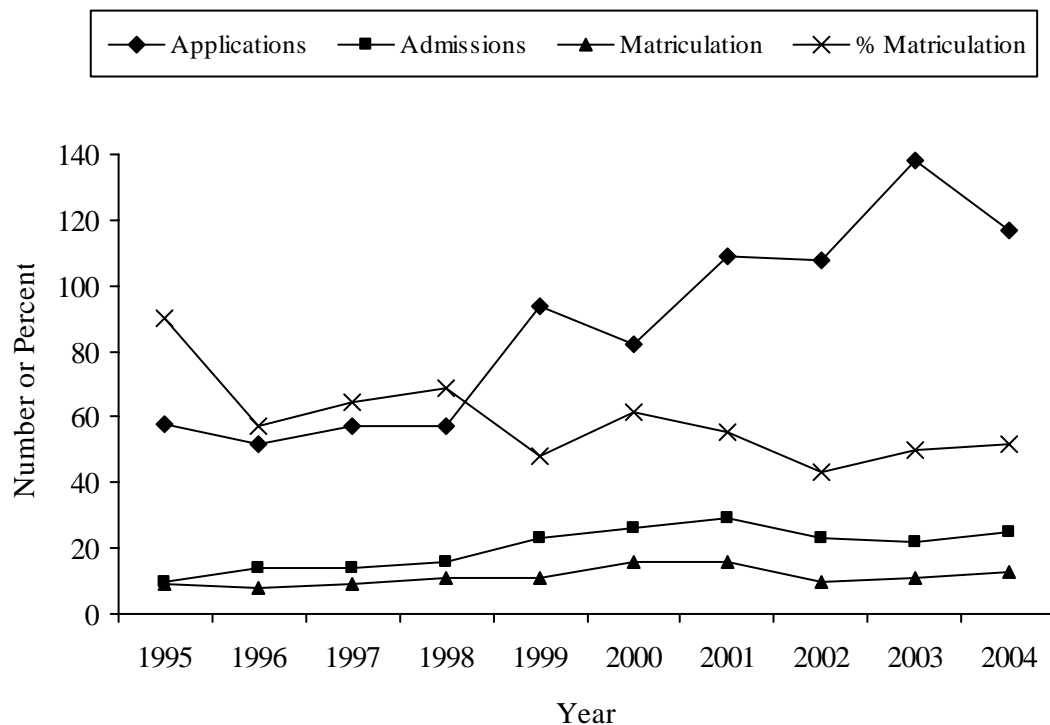
Many faculty at UCB were concerned about the potential effects that UCB-N might have on graduate student education in PMB. However, the direction of graduate student research appears not to have been altered by UCB-N and 60 percent of students surveyed had a positive assessment of the agreement itself and the attendant resources (MacLachlan 2000). The views held by graduate students on the negotiation and implementation of UCB-N have already been discussed in the relevant subsections above. In this section we will discuss the effects of UCB-N on the size of the graduate student cohort, on support for graduate students, and on internal relations.

The most significant consequence of the agreement for the students of PMB is that it enabled the graduate program to increase in cohort size and annual stipend. PMB was able to double the size of its graduate program. It appears to have proved attractive to

potential graduate students: The number of applications for admission, acceptances by the department, and enrollees all increased. It is less clear whether PMB has become more attractive as a graduate department, relative to other molecular biology departments. On the one hand, the number of applications increased by over 100 percent in three or four years (see Figure 3); this suggests that some potential students were applying to PMB who would not previously have done so. However, the percentage of applicants accepted by the department who then chose to enroll in PMB has not increased (see Appendix B for the raw numbers). This challenges the argument that UCB-N has enabled PMB to attract graduate students who otherwise might have chosen (rather than been forced to enter) a different program.

Similar to the problems attendant with larger laboratories, discussed earlier, are the unanticipated consequences of increasing the size of the graduate program. For the entering cohorts that corresponded to the first four years of the agreement, PMB, as a department, promised to support the first three years of each graduate student's stipend. However, with the removal of Novartis funds, departmental support has decreased to the first two years leaving the faculty and/or student to fund the remainder.

Figure 3. PMB Graduate Student Applications, Admissions, Matriculation, 1995 2004.



Source: PMB enrollment statistics.

There is a marked distinction with respect to feelings about UCB-N between PMB graduate students who were enrolled in the program before or during the UCB-N

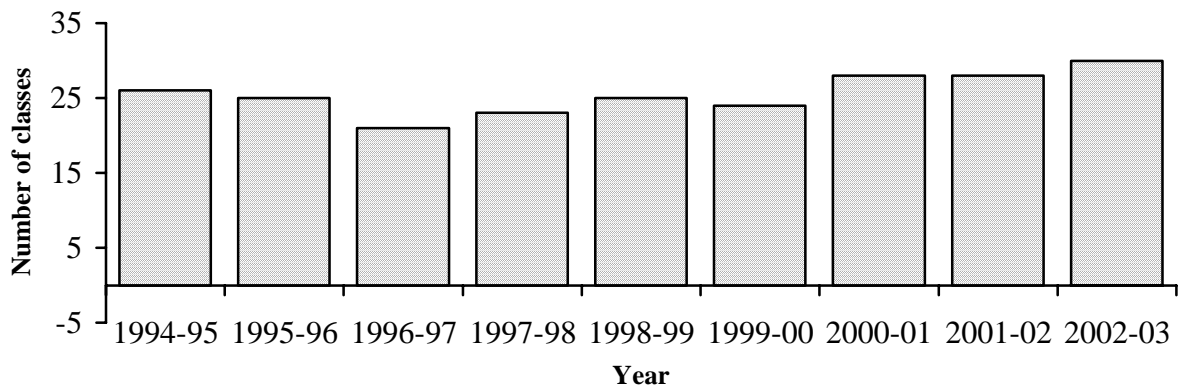
negotiations and those graduate students who came to campus after 1998 (MacLachlan 2000; Price and Goldman 2002). The latter were far less concerned with both the lack of graduate student involvement in negotiations and the existence of the agreement. This split may indicate a normalization of university-industry relations in that the benefits and consequences of such relations are now less subject to question. One PMB graduate student describes this position most succinctly, “It is a pretty reasonable agreement given that the university would end up selling commercial inventions and discoveries anyway. Everyone signs patent agreements anyway, details don’t matter so much” (quoted. in MacLachlan 2000, 5).

Alternatively, the distinction between pre- and post-UCB-N cohorts might be for reasons of self-selection in that the incoming cohort pursued the program at least in part *because* of the agreement while cohorts there during negotiations did not. The internal review of UCB-N conducted by the office of the Vice Chancellor for Research also noted the split between PMB graduate students who were present and those who were not present during the negotiations of UCB-N: “New graduate students appear to have only the faintest idea about the Novartis Agreement, indicating that it is not a major matter of discussion within PMB” (Price and Goldman 2002, 38). Since many of today’s graduate students are (hopefully) tomorrow’s professors, this shift in expectations is especially important. How graduate students are professionalized has a direct bearing on their actions as professors.

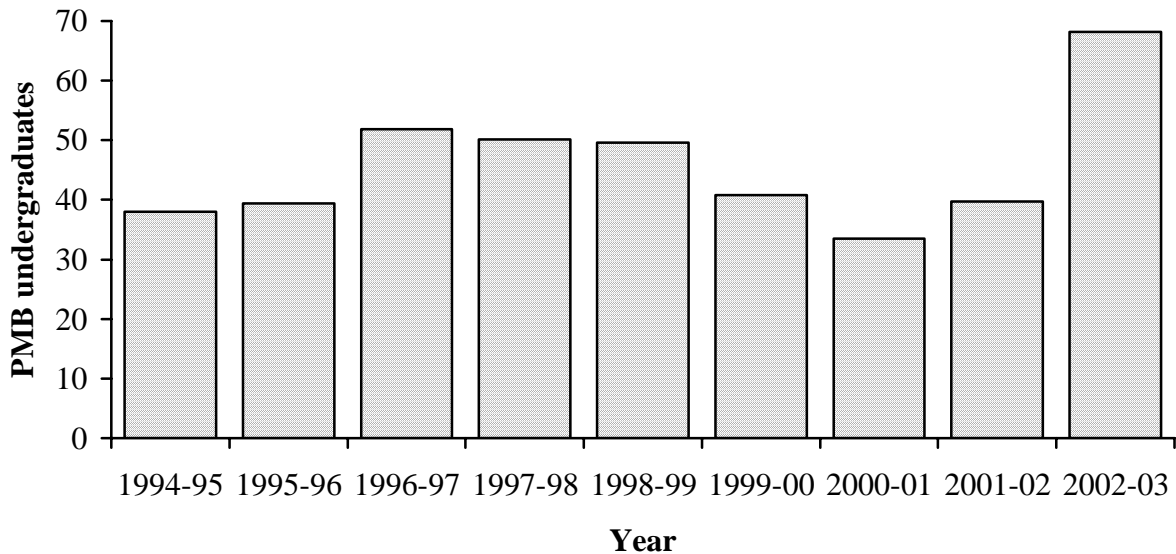
Undergraduate Education

It is very difficult to compare the teaching responsibilities of individuals across campus. A campus-wide audit is currently taking place in an effort to provide comparisons of the teaching loads of ladder-rank faculty. In the meantime it is possible to examine the number of students who have declared PMB as their major and the number of regularly scheduled classes offered by PMB over time (see Figures 4 and 5).

Figure 4. Number of Regularly Scheduled Undergraduate PMB Classes, by AY



Source: Office of Planning and Analysis (2004)

Figure 5. Number of PMB Undergraduate Majors, by AY

Source: Office of Planning and Analysis (2004)

UCB-N was signed into existence almost halfway through the 1998-99 academic year. If this year is removed from the calculations, then in the five academic years prior to UCB-N PMB offered an average of 23.75 classes per year. The five academic years after UCB-N have an average of 27.5 classes per year. Of course, these classes were not all taught by ladder-rank faculty members and include those classes taught by adjunct faculty and temporary lecturers. When the same calculations are done for the number of declared undergraduate majors in PMB, we see that prior to the agreement an average of 45 undergraduates were majors each year. Immediately after UCB-N was signed, and possibly reflecting the amount of negative on-campus media attention, the number of majors declined, although it then dramatically increased three years later such that on average the number of PMB majors over this period is 45. A similar decline in the number of majors is not found in the other departments in CNR, nor in MCB (see Appendix C for comparative charts). This suggests that the publicity surrounding UCB-N did have the temporary effect of depressing the number of undergraduates who chose to major in PMB.

One of the concerns of the Academic Senate was that PMB faculty members would use the Novartis grant funds to buy out their teaching commitments. This does not appear to have happened. Zacheus Cande, an MCB faculty member with a joint appointment in PMB, explained that the disparate teaching loads are a point of tension between PMB and MCB. MCB faculty members “have more teaching responsibilities than we can necessarily dredge up faculty members for; whereas plant biology [PMB] has just the opposite problem – they have more FTE than the amount of teaching would justify.” In Cande’s opinion, PMB has a small number of undergraduate majors because the pre-med students have a prejudice against plants, see them as irrelevant to their medical career, and thus choose to major in MCB instead of PMB. Since the teaching budget is

distributed according to how many students are enrolled in departmental classes, one consequence is that only a small portion of the PMB budget is supported from university general funds.

When asked about the benefits of UCB-N for PMB undergraduate students, PMB faculty members were hard-pressed to come up with any. The majority of faculty members said that they do not use the information from the Novartis databases or the equipment bought with Novartis funds in teaching undergraduates, although several faculty members said they referred to Novartis's equipment and information as current examples of what could be done. The most direct benefit for undergraduate students from UCB-N is in Sydney Kustu's laboratory where she teaches undergraduates how to do *E. coli* arrays. Kustu is able to do this because UCB-N funded her to do genomic arrays in her own laboratory rather than send the samples elsewhere for analysis. Although the benefits are minor, no one was able to identify any negative effects on undergraduate education.

Effect on Internal and External Relations

PMB faculty members reported that collegiality had been enhanced at least somewhat within the department. For example, annual retreats with NADI brought nearly all the PMB faculty together, where previously there was little interaction between the plant and microbial divisions within the department. However, if these annual retreats acted as a proxy for departmental efforts to increase interaction, then those who were not part of the agreement lost out on opportunities for collegial association. There is no consensus regarding the effect of UCB-N on collegiality within CNR because some people see the agreement as a divisive lightning rod that exacerbated pre-existing conflicts, while other people do not see any residual tension. Several faculty members recalled their colleagues at other universities asking questions about the agreement when they met at professional conferences. However, the PMB faculty mostly perceived the questions regarding UCB-N to be motivated by envy rather than condemnation.

Along similar lines, the reputation of PMB appears not to have been negatively affected. However, people seem to make a distinction between issues of reputation and being unbiased. That is, while the reputation of individuals or the department may not be marred, the perception that research coming from PMB is unbiased is negatively affected. We will return to this point for UCB as a whole in a later section. One PMB faculty member was particularly clear about this distinction and said that while he thinks personal reputations have not been hurt, he cannot control how other people view ties with industry and as such this "loss of perceived purity" is the worst consequence of industrial funding. Some graduate students also believed that UCB-N had negative consequences for the perceived objectivity of their research. One PMB graduate student said, "[I] don't think it's such a bad deal, except in terms of the public perception, which might be detrimental to the department as well as public opinion about science. The public thinks that the department has sold out" (quoted in MacLachlan 2000, 4). However, although it is interesting to know the perceptions of those involved with the

agreement, we have no evidence, one way or the other, with respect to how other publics view research from PMB, CNR, and UCB.

Intellectual Property Rights

Although IPR are mentioned specifically in the U.S. Constitution, there was widespread agreement through the late nineteenth century as to their inapplicability to plants and animals. Bacteria and other microorganisms were considered patentable, but there was a general agreement that higher plants and their component parts were not the subject of utility patents. The objection was based on the requirements for a utility patent: novelty, non-obviousness, utility, and specification.⁴³

In legal terms novelty is usually taken to mean a novel composition of matter. Thus, discoveries are normally not patentable as they exist already and are merely made known by the discoverer. In practice, the demonstration of novelty is usually met by noting that the object in question has not been patented before, is not in general use already, and is not easily produced by someone already skilled in that particular art. Non-obviousness refers to the requirement that the thing to be patented requires some inventive step beyond what skilled practitioners usually do. Utility is broadly interpreted as the demonstration of some public benefit to be had by the invention. Finally, specification involves a written description of the item that could be employed by anyone knowledgeable in the field to create the object to be patented.

Plant materials were excluded from utility patents on several grounds including (1) the impossibility of providing an adequate specification, (2) the lack of invention (i.e., the claim that novel plant materials were essentially a discovery), and (3) the lack of novelty (i.e., anyone skilled in the art could produce the item in question). Together, these objections were sufficient to keep plant matter from receiving utility patents.

As a result, private investment in plant improvement was relatively unprofitable. After all, since seeds are self-replicating, they could be copied and freely grown by (1) farmers, (2) other seed companies, or (3) public sector research institutions such as LGUs. In fact, all three of these were more than possibilities well into the twentieth century. Therefore, seed prices remained only slightly above grain prices (Kloppenborg 1988).

Hybrids, developed in the 1930s, presented a partial solution to the problem for seed companies by creating the biological equivalent of a patent. Since the progeny of a hybrid plant had little or no yield when planted, farmers had to return each year for more seed. Since seeds were a relatively small portion of the total cost of farming, they were willing to pay the higher price to obtain other characteristics including improved yield. The hybrid seed business soon boomed, although for technical reasons it was limited largely to hybrid corn.

⁴³ For a detailed discussion of the growth of intellectual property rights in plants, see Busch et al. (1995).

The Plant Patent Act (PPA) of 1930 (35 U.S.C. §§ 161-164), championed by Luther Burbank and of particular interest to flower and fruit growers, was the first attempt to provide patent protection for plant matter. PPA permitted the patenting of clonally reproduced plants (i.e., reproduced from cuttings and tubers). Unlike the more stringent requirements for utility patents, filers of Plant Patents did not have to show how to produce the specific variety. They only needed to file a description that was “as complete as possible.” Moreover, since creating a plant *de novo* from other matter was and remains impossible, those wishing Plant Patents were required to submit a sample to a public repository. Finally, the scope of the claim was limited to the variety. In addition, plants produced outside the U.S. using the same plant matter could be imported without infringing the rights of the patent holder. In sum, PPA provided certain protections to “inventors,” but it was more limited in scope than utility patents.

For the next 40 years, little change in IPR concerning plants occurred. Then, in response to considerable pressure from the seed industry, Congress passed the Plant Variety Protection Act (PVPA) (7 USC § 2321 et seq.). The argument for the Act was based on the highly debatable notion of “Plant Breeders Rights.” In point of fact, by 1970 there were few if any independent plant breeders in the U.S.; most were employees either of State Agricultural Experiment Stations (SAES) or of private seed companies. At the time, most public breeders were opposed to the new law, seeing it as the privatization of a public good (Fejer 1966).

The new law extended patent-like protection to most sexually-propagated plants provided that they met the three criteria of novelty, uniformity, and stability. In other words, they had to have novel characteristics as compared to other plants of the same species, they had to express that novelty uniformly over space, and they had to be stable through time (i.e., they had to breed true). Unlike utility patents, PVPA did not limit novelty to useful differences; until later amendments in 1991, minor cosmetic differences were sufficient to permit the granting of a certificate. In addition, unlike utility patents, PVP certificates could be issued even if someone skilled in the art was also able to produce the new variety. Finally, the PVP certificate was issued for the concrete object, not for the idea behind it. Those granted a certificate could bar others from selling the variety for a period of twenty years.

For the next ten years little else happened. Then, a 1980 Supreme Court decision in the case of *Diamond v. Chakrabarty* (447 U.S. 303) opened the door to utility patents for plants. The government argued that the very existence of PPA and PVPA demonstrated clearly the inapplicability of utility patents to life forms. It noted that life forms were not created by people but were found in nature. UC filed a brief in support of extending patents to life forms arguing that

Whether the University has the right to patent its own newly manufactured microorganisms will depend directly on the disposition that is made in this case. In turn, this will govern whether the University receives income from these inventions, to be significantly shared with its inventors and to

use, *inter alia*, in supporting new research. Indeed, if no patents issue, the health care industry may well elect not to commercialize these important inventions because of its avowed belief that absent the protection a patent affords, the time an experimental work requisite to obtaining government clearances cannot be justified (Brief dated January 28, 1980, *Diamond v. Chakrabarty*, 447 U.S. 303, 1980).

In essence, the court ruled that life forms could be patented if they were human-made. Although the case involved a microorganism, it was soon applied to all life forms. Soon after, the Patent Office began to issue patents for plants. Within biotechnology, an expanded range of IP may now be protected, including genes, promoters, transformation processes, plant germplasm, and new plant varieties. In 2001, the Supreme Court clarified the distinction between utility patents and the PVPA for agricultural seeds. The Court explained:

Because it is harder to qualify for a utility patent than for a Plant Variety Protection (PVP) certificate, it only makes sense that utility patents would confer a greater scope of protection.... The PVPA...contains exemptions for saving seed and for research. A farmer who legally purchases and plants a protected variety can save the seed from these plants for replanting on his own farm.... In addition, a protected variety may be used for research.... The utility patent statute does not contain similar exemptions (*J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred International, Inc.*, 213 and 215).

In sum, in approximately half a century, U.S. law went from a complete prohibition on utility patents for plants, to measures that encouraged the creation of such patents. This had a profound effect on the seed industry as well as on universities. Private sector breeding of major crops increased dramatically, while public sector breeding declined. As breeders retired they were replaced by plant biologists with training in the use and development of the new biotechnologies (Frey 1996; Knight 2003).

With the cultivation of IPR, companies captured commercial value from the new science. Firms may use several different techniques to capture both codified and tacit knowledge necessary to exploit scientific discovery (Quintella 1993). Companies may apply for a patent based on the results of internal R&D. However, a patent is no guarantee that an exclusive position can be maintained. A firm must have the financial reserves to sustain an active R&D program, the ability to continue filing and prosecuting patents in a fast moving field, and significant financial resources to defend their patent rights through litigation if necessary. In addition, companies may need to acquire IP by licensing technology from third parties. A company may obtain IP by licensing it from another company or university. When two or more parties have IP of interest, cross licensing of patents may be needed for each participant to have freedom to practice the new technology. DuPont and Monsanto, for example, reached cross-licensing agreements for biotechnology products in corn, canola, and soybeans in 2002 (Thayer 2002). Merging with or acquiring a firm already owning IP are additional strategies. To be effective,

strategic decisions must also reach beyond patent protection to consider the availability of know-how, trade secrets, market access, and tangible assets.

Inserting the management of IPR into academic administration has been a work-in-process for over 90 years. The formal story of university technology transfer begins with UCB chemistry Professor Frederick Gardner Cottrell's interest in commercializing technology for the electrostatic precipitation of fine particulate materials. Unable to encourage university administrators to assist directly, Cottrell labored to develop an independent organization. This effort led to the establishment of the Research Corporation in 1912. Similarly, the University of Wisconsin also chose to develop an independent organization to manage IPR. The Wisconsin Alumni Research Foundation (WARF) was formed in 1925 (Marcy 1978).

Despite noteworthy successes by the Research Corporation and WARF, universities moved slowly to capture IPR. UC did make the assignment of faculty inventions mandatory in 1963 (Owens 1978), but the process of technology transfer at universities remained slow and halting until the Patent and Trademark Laws Amendments of 1980, which included the Bayh-Dole Act (Bremer 2001). The Act streamlined the process by which universities, as well as other non-profits, small businesses, and contractors operating government laboratories may retain title to inventions funded by the federal government. The importance of University IPR in the field of biotechnology became clear in 1981 with the nonexclusive licensing by Stanford University of the Cohen and Boyer patents (U.S. Patent No. 4,237,224; 4,468,464; and 4,740,470 all filed on November 4, 1974). Even with this activity, most universities did not have separate offices to handle technology transfer until the 1990s. Equity transactions have an even shorter history. UC, for example, released its *University Policy on Accepting Equity when Licensing University Technology* in February of 1996. University policy and practice regarding technology transfer of university-owned IPR continue to evolve through an active process of learning-by-doing.

Within the university setting, technology transfer offices are responsible for processing invention disclosures received from university researchers. This available pool is assessed for patentability and for its value if successfully licensed. The tangible output of a technology transfer office includes a number of standard agreements crafted to define and manage IPR, such as:

1. Confidential Disclosure Agreements, also known as Non-Disclosure Agreements or Secrecy Agreements;
2. Material Transfer Agreements (defining rights to tangible property transferred between two parties);
3. Research Agreements;
4. Option Agreements;
5. License Agreements; and
6. Inter-Institutional Agreements.

IP agreements are critical points of contact between universities and industry. Numerous tutorials assist practitioners in bridging the gap between universities and business (e.g., Berneman 1995; American Council on Education and the National Alliance of Business 2001). In preparing these agreements, the technology transfer office tries to strike a balance between the multiple missions of an LGU relative to IP. At UCB the decisions are guided by established policies, including:

1. Patent Policy;
2. Copyright Policy;
3. Policy on Accepting Equity when Licensing University Technology;
4. Guidelines on University-Industry Relations;
5. Guidelines on Licensing; and
6. Conflict of Commitment and Outside Activities of Faculty Members.

Broader policy, such as codes of conduct, may also serve to regulate technology transfer activity.

With successful commercialization of technology protected by IPR, monopoly rents may be legally collected.⁴⁴ The sale of products and services return money through rents only after clearing legal and regulatory hurdles. To profit from research generated and IPR, licensees of the new technology must work out an internal and/or external manufacturing and distribution system to reach the end user. The licensee can set a higher price for its goods based on market conditions and the strength of its IPR and related assets. With this accomplished, rents filter up through the distribution channels to the private-sector licensee. Assuming the new technology may be produced at or below the cost of competitive products, monopoly rents may be used to deliver profits for shareholders and support R&D for future product introductions. Licensees of these patents provide scale-up of the discovery, combine them with other IPR, conduct field trials, seek regulatory approvals, and distribute and market the product to end users.

The licensee of university-owned technology returns a royalty based on revenue generated from its rents. The university will reinvest a portion of these funds into additional research of its choosing. Faculty members could also benefit directly. Individual researchers may keep a share of the proceeds, but may also divert some or all revenues back to research. Proceeds may also flow to a start-up company. Money from these firms may then transfer to the benefit of venture capitalists with a portion due the university for technologies licensed. Again, the faculty member may benefit directly from the start-up's share. In other instances, the start-up company may already have been acquired by the time a commercial product is generating income. In this case, the venture capitalists may have already cashed out returning money to their investors. Finally, compensation may be due the faculty member from the university based on its patent policy.

⁴⁴ See Gaisford et al. (2001) for a discussion of intellectual property rents.

The Association of University Technology Managers, Inc. has conducted national surveys since 1991 on patenting, licensing, research, and other aspects of technology transfer for American and Canadian universities, research centers and hospitals.⁴⁵ The number of invention disclosures, patent applications filed, and patents issued all significantly increased throughout the 1990s. In line with national trends, technology transfer at UC consistently expanded throughout the 1990s. UC experienced increases in the number of inventions reported, patents filed, and patents issued. The number of inventions reported by UC rose from 500 in 1992 to 957 in 2001, an increase of 91 percent.

UC is one of the leaders in technology transfer. In 2001, UC produced more inventions, had more patents granted to it, and more successfully commercialized inventions than any other university. No institution has a longer or more successful track record in technology transfer than UC. A recent UC (2002, 13) report finds that the “University technology transfer program continues to expand and flourish” and sums up its performance as follows:

In 2001, 957 inventions were disclosed, a 45% increase over the 661 inventions disclosed in 1996. Over the same five-year period, the total number of active U.S. patents increased by 100 percent and the overall portfolio of patents by 75 percent. Total licenses and options held by The Regents increased by 65 percent. Since 1996 the University has earned almost \$632 million in income from royalties and fees.

Moreover, *Technology Review*'s University Research Scorecard for 2001 ranked UC number one for the strength of its patent portfolio. The remainder of the top ten for 2001 were MIT, Stanford, Caltech, University of Texas, University of Washington, University of Wisconsin, Columbia University, University of Michigan, and Johns Hopkins University (Brody 2001). Similar to UC system, the Berkeley campus saw significant increases in its technology transfer program. The number of inventions, patent applications and issued patents per year all significantly increased. For FY 2001, UCB OTL and its faculty inventors netted \$4.3 million after payments to joint IPR owners and legal expenses. While substantial, this may be compared to total UCB expenditures in the same year of \$1.3 billion and a campus endowment of nearly \$2 billion.

Perhaps the most ironic twist with respect to the growth in IP on university campuses is the recent series of court decisions in *John M. J. Madey v. Duke University*. The details of this case need not concern us here. What is relevant is that Duke University claimed that it had used a particular patented instrument solely for academic non-commercial research and that therefore it did not need to pay royalties to the inventor. Federal Circuit Court of Appeals ruled against Duke and for the plaintiff.

⁴⁵(AUTM 1995, 1996; 1997, 1998, 1999, 2000, 2001, 2002, 2003)

In making its decision the court noted that:

... major research universities... often sanction and fund research projects with arguably no commercial application whatsoever. However, these projects unmistakably further the institution's legitimate business objectives, including educating and enlightening students and faculty participating in these projects. These projects also serve, for example, to increase the status of the institution and lure lucrative research grants, students and faculty.

In short, regardless of whether a particular institution or entity is engaged in an endeavor for commercial gain, so long as the act is in furtherance of the alleged infringer's legitimate business and is not solely for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry, the act does not qualify for the very narrow and strictly limited experimental use defense. Moreover, the profit or non-profit status of the user is not determinative (307 F.3d 1351; 2002 U.S. App. LEXIS 20823; 64 U.S.P.Q.2D [BNA] 1737: 33-34).

When appealed to the U.S. Supreme Court, UC was party to an Amicus Curiae brief filed by the Association of American Medical Colleges. The brief explained: "Universities will be forced to bear substantial administrative and financial costs to cover patent searches, infringement options, licensing agreements, and the inevitable litigation that will be engendered by the Federal Court's new rule of patent law" (Keyes and Jones 2001).

Despite the briefs, the Supreme Court appeal was rejected. While Duke University is appealing the case on other grounds, it is likely that in the future universities will incur new costs for the use of patented products in research – costs that will undoubtedly offset many of the financial benefits provided by university-owned patents.

Expectations with respect to the generation of IP by PMB have, to date, remained unfulfilled. Few or no benefits, in terms of patent rights or income, to either UCB or Novartis have emerged as of yet from research conducted during the term of the agreement.⁴⁶ Of the 51 disclosures made by PMB faculty during the period 11/23/98 to 11/23/03, 20 were patented. Ten of these patents were on disclosures funded through UCB-N, at least partially, and NADI optioned three of the patents. However, no options to negotiate an exclusive license remain active today.

Regarding potential licensing activity, TMRI apparently took the greatest interest in work on allergens. For example, one patented technology suggests possible allergy treatments, including those triggered by ragweed pollen, with reduced side effects (e.g., anaphylactic

⁴⁶ By May 2004, UCB had received option agreement fees of \$60,000 from Novartis and patent cost reimbursements totaling \$67,995 for patent filings, of which PMB received \$5,397.

reactions).⁴⁷ While challenging science, this is also an area of immediate commercial application. In the March 14, 1996 issue of the *New England Journal of Medicine*, researchers at the University of Nebraska, University of Wisconsin, and Pioneer Hi-Bred International, Inc. found that an attempt to transport the higher protein value of the Brazil nut to the soybean resulted in the transfer of the nut's allergenic characteristics. The Pioneer-funded research came to the following conclusion: "Our study shows that an allergen from a food known to be allergenic can be transferred into another food by genetic engineering" (Nordlee et al. 1996 688). Bob Buchanan (2001, 5) as a researcher under the UCB-N agreements wrote in the journal *Plant Physiology* of the ensuing growth in the research agenda related to allergies:

The development and commercialization of a variety of food crops with transgenes has thrust the allergy issue onto a public stage and given the field unprecedented exposure worldwide.... The increased public awareness of food allergy has arisen from a combination of three factors: reasoned concern, fear through ignorance, and political motivation.

Buchanan's essay (2001, 7) spans the boundaries between scientific research, corporate interests, and regulatory policy:

One precautionary note seems in order. While proceeding with allergy testing, we must be careful not to overregulate and impose undue restrictions to stifle innovation. Rather, we should seek to formulate a balanced policy that insures food safety without hindering product development.... I am confident that, with progress now being made, one or more reliable animal models will soon be available to serve as an indicator of allergens in human[s] and that a safe but reasonable testing policy will be formulated. Once such testing capability is in hand, the public will respond in a positive manner. In the long term, the food allergy and technology fields will likely benefit, rather than suffer, from this pause in their development.

Buchanan was involved with this line of research well before the UCB-N agreement with patent filings dating back to 1991, so it appears that the agreement reinforced rather than altered the research agenda in this instance. Over the years, funding sources for this line of research at Berkeley included NSF, Public Health Service, USDA, the BioSTAR Program, Applied Phytologies, Inc., Coors Brewing Co., Novartis, Inc., Syngenta, Inc., and a gift from Cargill Incorporated (Hartman et al. 1993; Cho et al. 1999; Besse et al. 1996; Buchanan et al. 1997; Yano et al. 2001).

⁴⁷ U.S. Patent No. 6,677,422 issued on January 13, 2004 "Stabilization of Hypoallergenic, Hyperdigestible Previously Reduced Proteins" by Bob B. Buchanan, Susumu Morigasaki, Gregorio del Val, and Oscar L. Frick filed February 7, 2001. See also U.S. Patent No. 6,555,116 issued on April 29, 2003 "Alleviation of the Allergenic Potential of Airborne and Contact Allergens by Thioredoxin" by Bob B. Buchanan, Gregorio del Val; Rosa M. Lozano, Joshua H. Wong; Boihon C. Yee, Oscar L. Frick. Filed on January 27, 1999 (the patent relates to patent applications dating back to October 12, 1991), and U.S. Patent Applications: Publication Numbers 20020098277 and 20030170763.

One feature of UCB-N that constantly came up in the interviews as a widespread concern was the scope of the IP to which Novartis had access. From within PMB to members of agricultural commodity groups, a significant number of people expressed uneasiness with the aspect of UCB-N that gave Novartis the ability to review all of the non-privately funded research conducted by anybody in PMB and the option to negotiate a license for up to approximately one-third of those discoveries annually.

Many people argued that this point was at the heart of UCB-N's novelty and potentially had the greatest ramifications because it expanded the scope of research beyond the usual situation that allows companies only to negotiate licenses for that which they paid for directly. Indeed, in comparison to gifts and individual faculty contracts, as the two normal ways in which industry disburses money to public academics, UCB-N is extraordinary in giving one donor more rights to the activities of one department than is the case under either of the two usual relations.

Even the interim Dean of CNR, who is also a PMB faculty member, Richard Malkin, expressed astonishment over UCB-N's scope:

There are aspects of the agreement that I think are bizarre; it's the only word I can use. That Novartis can come into a laboratory and they have access to things, results, and anything that isn't supported by Novartis money. I don't understand how the university could sign off on that. That is, I have an NIH grant, and I'm working on a project, and then I have Novartis money, and Novartis can come in and say, 'Well, you know, that project over there is pretty interesting. We claim intellectual rights over that.' When I first heard that at a meeting, I thought, 'well, this just isn't right and it can't be something that everybody agrees to,' but it was.

Another point related to the IP scope of UCB-N was mentioned by few people, but is still an important claim. Specifically, while Novartis's access was limited to a proportion of the discoveries commensurate with their proportion of departmental funding, the company did not have to specify what IP they were going to pursue until the end of each year, rather than as each discovery was disclosed. In addition, the first three years of the contract were collapsed into one period from which Novartis could choose. This point was stated most clearly by a senior scientist at PGEC who said,

I mean, if you think about it, if you have ten patents, all ten patents cannot be equal. Even if somebody says 'I'm only going to take ten percent' they're going to take the best out of the ten patents; in other words, that best out of the ten patents is probably equal [in value] to 99 percent. So essentially it's an agreement that pretty much says they're going to take the best.

This perception squares with a recent study of patenting at 62 research universities which notes that the top five inventions accounted for 76% of licensing revenues (Thursby et al. 2001).

Once again, how things worked out in practice differed from the concerns prior to the implementation of the agreement. PMB faculty generally reported that they did not see anything especially advantageous to Novartis from the “peeking rights” to their disclosures. One associate professor described the process in this way: “as a first step OTL asks Novartis if they’re interested. If they’re not, then they ask everybody; instead of just asking everybody right off the bat.” Although there was some apprehension that with Novartis’s purported focus on IPR there would be a change in how PMB faculty members conceived of and pursued their research, this worry appears unfounded. A junior faculty member, presumably among those most likely to change their activities, said

But still, you know, patenting is not the thing that’s on the top of my mind with any of the research we do. If there is a potential application, I would like to see someone develop it and see whether it really is going to be a useful application of some basic research. But I certainly don’t think about it on a daily basis nor gear my research towards patenting things or anything like that.

In broader terms, Paul Ludden, current CNR Dean and also a PMB faculty member, argued that even though administrators may push for faculty members to disclose inventions and patent whenever possible, there is no provision in the tenure process that explicitly gives extra weight to how much IP a person has patented; therefore this trend is unimportant because it has not been incorporated into faculties’ duties. Despite this argument patents are important enough as intellectual credentials to be listed on a person’s curriculum vitae; therefore, any change in this area is worthy of deliberation.

In addition, two senior employees of Syngenta said that while securing new IP was important, because the company is always looking to increase its patent portfolio, it was not the primary motivation for entering UCB-N. Indeed they recalled that there were often discrepancies between what PMB faculty thought was worthy of patenting and what Syngenta thought was worth paying the thousands of dollars to patent. Another problem with patenting at such an early stage is that any discoveries would have to be policed in order to defend the patent, which is often not worthwhile when any commercial application is 10-15 years away. In addition, over the five years of UCB-N, the U.S. Patent Office has changed the rules about when it issues new patents and is now much stricter about demonstrating commercial utility as part of the patent process (Busch 2002). Given these changes, Simon Bright, Head of Technology Interaction for Syngenta, said that although there have been very few discoveries taken through the patenting process, “I think that if we were setting out to say ‘okay we want to patent in a certain area’, then you just wouldn’t do like this. In that sense what you’re trying to do is

give smart people the money and see what comes out and sometimes what comes out is inspiration rather than IP.”

As the five-year agreement has now come to an end, and all the claims that either Novartis or Syngenta could make have been filed, it appears unlikely that any significant IP has emerged, although one “winner” could change this situation and result in the generation of significant income for UCB as it moves into commercial application.

As noted earlier, the Bayh-Dole Act of 1980 (P.L. 96-517) streamlined numerous government procedures on IP. It provided eligible institutions considerable discretion and does not mandate participation by universities. For example, universities are free to elect or not elect title to each invention arising from federal funds. When licensing IP, the Act does call for a small-business preference, but universities are free to license to large firms when they are co-sponsors of research. Under the Act, universities must have written arrangements that include financial incentives for campus inventors. Universities control the specific terms of these incentives, as long as income received by the institution is returned to educational or research purposes.

We did not find that PMB faculty involved in the agreement expressed great interest in future royalties or equity income. On the other hand, the need for new research funding was a consistent theme among scientists and administrators. The expressed financial incentive to work with industry was driven less by the possibility of future returns from IPR, than by the financial needs stemming from a perceived lack of preferred government research support. Bayh-Dole does not include industry-sponsored research directly, but the Act enhances the prospects for for-profit firms sponsoring research on campus. As in the UCB-N agreement, companies can leverage their own funding by licensing the intellectual output of both their funds and government funds. One of many business promotion strategies of the 1980s and 1990s, the Act had been law for 16 years before the UCB-N agreement. It does not appear to have been a trigger or central cause of the controversy surrounding the agreement.

Indeed, Richard Nelson (2001) has argued that Bayh-Dole merely reinforced trends that began long before the act was passed. Consider, for example, the impact of the changes in patenting of plants and plant parts brought about by both positive law and case law noted above. Moreover, as he rightly notes, its existence may serve to (1) gradually shift faculty interest from publication to patents, thereby undermining a central value of academic science, and (2) give the public an erroneous view that universities are in business to make money rather than to engage in public science and education. Moreover, the shift in the role of IP and the controversy engendered in part by it does demonstrate a need to more carefully formulate university policies and to better communicate the nature and approach of IP management within UCB and among the general public.

Surrounding Controversy

Perceptions of Controversy

The majority of PMB faculty thought that the controversy surrounding UCB-N stemmed from the pre-existing division in CNR between those whose research focuses on molecular phenomena and those whose work concentrates on ecological phenomena. Added to this division was Rausser's extension of the agreement to CNR and general perceptions regarding the lack of transparency, which PMB faculty felt combined to exacerbate the controversy. If the agreement had been restricted in name as well as practice to PMB, then faculty members believed there would have been little criticism because individuals would say that to enter PMB-N was within their purview to do whatever s/he thought was in the best interests of her/his laboratory and the university's mission. As one senior faculty member stated, "I would say, 'it's none of your damned business; go get lost; I do whatever I like to support my research'... and it would have ended there." Instead, people outside PMB were associated with UCB-N without being involved in the decision-making process. Former CNR interim Dean, Richard Malkin, explained:

Now, if you go outside the department to the other faculty in the college, to other departments, to other people, I think the extent of consultation was little. I think the department moved very quickly along. And then when it appeared an agreement was going to be reached, all of a sudden, you know, the remaining faculty were brought in not to agree with it, because basically by that time it had been done. And this is why, this is why there's so much rancor among the faculty outside the department. I mean because they feel they were not brought into this at an early time, and I think they are probably correct.... Now, you know, there are questions which this department says is not anybody else's business. And people in the department are very offended that somebody else would deign to come and tell this department that they cannot enter into this deal, you know, into an agreement like this. So this has left a lot of bad feeling.

Most people in PMB understand why CNR members resented their whole college being dragged into something they thought was wrong; especially when CNR as a whole was prevented from participating in the negotiations and did not have access to the same benefits. If the agreement had remained PMB-N then, in the mind of many PMB faculty members, there would have been no controversy. This is because the agreement would not have threatened the reputation or standing of the other CNR faculty members. However, as discussed above, the high degree of contention over PCB-N was also the outcome of other concerns, such as the role of industry in the university, and, to a lesser degree, biotechnology. Thus, it is likely there the agreement would have still been the subject of at least some derision.

Another reason given by PMB faculty members for the degree and extent of controversy was the perception that much of the opposition was based on ignorance of the details and specific terms of UCB-N. Sydney Kustu argued the opponents “comment on what they believe to be the content of the document, rather than feeling compelled to read the document before making comment.” A handful of faculty members also believed that the controversy was due to the opponents’ fundamental opposition to any industry involvement with academia, particularly in a scientific arena as contentious as biotechnology.

Reactions to Controversy

Within PMB there were various reactions to the negative media and discussions regarding UCB-N. Some saw it simply as being part of UCB. That is, that the campus has a long history of being a magnet for vocal opposition to a number of things and UCB-N is merely one recent example. Some PMB members responded by writing their own articles about UCB-N, presenting the agreement from an advocate’s position. In direct response to the charge that the process was not transparent, and the perception that the opponents misunderstood the terms of the agreement, PMB established a new webpage linked to its departmental site (<http://plantbio.berkeley.edu:16080/~pmbtmri>) to disseminate aspects of the history of UCB-N and details of the contract’s specific terms. According to John Taylor, he and other PMB faculty did not have a concerted, organized response to the controversy because they felt they had control of the process and there simply would be no problems.

Conclusions

In conclusion, our analysis of the information we have obtained suggests that UCB-N has resulted in modest benefit and very little harm to the PMB department. A handful of faculty have benefited from the temporary access to proprietary data and advanced research technology. The majority of people in PMB benefited only to the extent that a significant amount of money (\$60,000-\$200,000 per annum) was made more easily available to them, in contrast to the more arduous route of governmental competitive grants. The graduate students who started their program in 1998-2002 benefited the most from the temporary increase in departmental financial support, but appear to have experienced no other benefit from the agreement. It seems that graduate students also suffered no obvious harm; whether their socialization to more permissive university-industry relations represents a decline in their moral and ethical consciousness, we will leave for a later discussion.

The experience with UCB-N was viewed by most PMB faculty as enhancing their academic freedom rather than restricting it, as opponents of the agreement had argued. In some sense, it might be argued that both are right since they view academic freedom quite differently. Proponents tend to stress the relatively unfettered character of the research conducted using UCB-N funds. But critics point to the incentives that the funds provided to work on a circumscribed set of topics using certain equipment and datasets.

VII. Impact and Significance of the University of California, Berkeley -- Novartis Agreement on the College of Natural Resources and the University of California, Berkeley as an Institution of Higher Education, Research and Outreach

The direct impacts of UCB-N on the university as a whole have been minimal thus far. The agreement has not produced the major changes that many feared it would. However, this is not to say that things have remained the same. First, the agreement brought to the surface a number of long simmering tensions at UCB. Second, the agreement highlighted the crisis-ridden state of contemporary public higher education in California, in Land Grant institutions, and across the country. Much of the ongoing debate over UCB-N and its impacts reflects this crisis of higher education – defunding, disinvestment, corporatization, and incessant auditing. Looking at UCB-N specifically, this section examines some of the points of contention facing universities, their faculties, and their constituencies. In particular, we examine the central principles of the university, the continued legitimacy of UCB and its faculty to both the scientific world and to the public, and the dual missions – public and Land Grant – of UCB.

The University of California and the College of Natural Resources at the University of California Berkeley

The tripartite California system of higher education – with the UC campuses at the top – is fundamentally a part of the Progressive legacy.

The Progressive movement transformed the relationship of California and higher education. Determined to break both the power of the Southern Pacific Railroad and rampant political corruption, California's progressives took inspiration from 'the Wisconsin idea' that made higher education a central ingredient in modernizing the state. In 1907, they initiated the first state support for junior colleges, a decade before any other state did so. Progressive education leaders envisioned an integrated tripartite state system consisting of the junior colleges, normal schools, and Berkeley. Although the Progressives' power declined after 1912, their legacy was permanent (Leslie 2001, 997).

In this way, the University has effectively sought to bring intellectual, academic and scientific excellence to the Progressive interpretation of the dual Enlightenment goals for universities – the development of objective science and informed citizens. However, the complexity of the coordination of the development and expansion of three tiers of educational institution was more than could be rationalized during the highly sectional battles for the development of California during the first third of the 20th century. Deepening this struggle was the devastating economic and fiscal effect of the Great Depression.

However, during the New Deal the “California Idea” initially formulated by Progressives such as Hiram Johnson became associated with the Carnegie Foundation – a core institution in the promotion of standardized, rationalized and efficient planning of higher education and its expansion (Douglass 2000). However, the “gospel of efficiency” (Hays 1959) at the heart of Progressivism has always fractured the academy along the lines of an emphasis on the institutional advancement of objective science and the role of the university in social reform, or progress. Historically, the former concern, that of disinterested scientific advancement, has tended to sequester the academy away from the interested vagaries of politics and society. The latter concern, that of public-mindedness and social reform, has historically tended to be more directly engaged with the manifold and, often contradictory, interests of diverse social and political groups.

In this context, and stated without nuance, the science-citizen split at the heart of the idea of the University can be overlaid onto the disciplinary distinctions between the natural sciences and the humanities – with the social sciences operating in the middle ground between the two (Becher and Trowler 2001; Readings 1996; Snow 1959). This two-sidedness at the heart of the University is clear in the history of the CNR where the tension is most often translated into the language of agriculture/agrarianism – into the language of progressive as opposed to populist tendencies within LGUs. Here, the Progressive legacy of U.S. is seen as part and parcel of agrarian struggles over the appropriate form of agriculture in the United States (Bonanno et al. 1994; Buttel and Newby 1980; Buttel et al. 1990; Friedland et al. 1991; Mooney and Majka 1995). In short, the populist legitimation of the Land Grant system unevenly embraced by members of CNR and its forerunners places the College in a different but similar location to that of the social sciences between the science-oriented and citizen-oriented character of the University. However, in the case of CNR the split – particularly following the Great Depression – is between service to smaller, independent farmers as opposed to larger and corporate growers. More recently the split is also between service to farmers *v.* support of the research agenda of the much larger input suppliers. This dynamic increasingly plays itself out in the present as a struggle over basic versus applied research.

This contest between progressive and populist tendencies has come to the fore at different times and in different ways. In the context of this project, however, key players in the history of UCB and CNR are worth noting. Paul Taylor, an Agricultural Economist active from the 1930s through the 1980s, all but initiated the study of migratory agricultural labor in the 1920s and 30s – a period during which an agricultural depression preceded the industrial and financial crash of 1929 by a decade. At the behest of the Department of Interior’s Bureau of Reclamation, Taylor, along with Marion Clawson of the USDA’s populist Bureau of Agricultural Economics, designed Walter Goldschmidt’s (1978 [1946]) landmark study, *As You Sow*, which compared the character of two communities in California’s Central Valley; one dominated by a large, effectively capitalist, agricultural concern, the other structured around a number of smaller, independent units. As a result of this and other populist studies, the Bureau of Agricultural Economics became a target for those who preferred a government agency that supported business interests but did not raise embarrassing questions about the status

quo (Kirkendall 1966). The powerful House Agriculture Committee simply defunded the entire Bureau. Moreover, soon after publication of the report, Goldschmidt became an Africanist rather than continuing to pursue his critical agrarian research. *As You Sow*, to this day, is praised or despised as a comparison of agriculture on populist *v.* progressive bases.

Indeed, the agricultural sciences have a long history of censorship and suppression of alternative or critical research (Busch and Lacy 1983; Hardin 1955). Historically, LGUs have had close relations with commodity groups and agribusiness (Hightower 1973). As a result of these relations, “dissident” or “activist” kinds of research have been discouraged – either directly or indirectly – and, at times, faculty engaged in such research have been subject to intense external pressure.

These developments a half century ago would seem to be of little note in the late 20th and early 21st century. However, academic and non-governmental organization critics of UCB-N regularly view contemporary developments such as the agreement through lenses tinted by these struggles. Similarly, critics of the agreement view the corporate penetration of the university as part of moving, or increasing the tilt of, the College and University away from its traditional role serving the public interest. Iconic for many critics in the history of UC’s service to California’s public is Clark Kerr who, as the first Chancellor of UCB defended faculty who refused to sign loyalty oaths in the 1950s and who, as President of the University, developed non-aggressive responses to the Berkeley Free Speech movement and subsequent unrest on UC campuses across the state. This strategy is widely believed to have led to his removal from office by the UC Regents during Ronald Reagan’s tenure as Governor (Taylor 1988).

More importantly for a study of UCB-N, perhaps, Taylor was Clark Kerr’s dissertation advisor, as both men studied labor relations. While quite different in their eventual acceptance of large agricultural units, both men are widely seen as advocates of the populist and citizen/public interest traditions within CNR, UCB, and the UC system. As his career developed, Taylor moved increasingly into environmental issues, regularly arguing in favor of the greater ecological soundness of small farming units of agricultural production relative to larger corporate farms. This position, correct or not, is gospel within the environmental movement and is advanced by populist historians and activists from Donald Worster (1979, 1985) to Donald Pisani (1984, 1996), from Marc Reisner (1986; Reisner and Bates 1990) to Robert Gottlieb (1988; Gottlieb and FitzSimmons 1991) and Mike Davis (1992, 1998). Similarly, Grant McConnell was assigned to work with Taylor by Kerr before writing his dissertation, *The Decline of Agrarian Democracy* (McConnell 1953), with Peter Odegaard.

Most immediately, in terms of the populist *v.* progressive history of CNR, the period during which Kerr’s tenure as President came to an end was also the time when some faculty within the Entomology Department rejected what they saw as the social and ecological consequences of conventional pesticide usage – and the inappropriateness of UCB faculty testing pesticides for chemical companies – and carved out the Division of

Biological Control. Within the sustainable agriculture community – a community that is populist to the core [however contradictory that position may be at times (Allen and Van Dusen 1990; Allen and Sachs 1991; Allen et al. 1991; Allen 1994) – the Division of Biological Control is often seen as one of the first footholds sustainable agricultural science was able to gain within the LGU system. The faculty within and graduates of the Division have developed core texts and techniques in agroecological research. Whether in California, across the U.S., or throughout the world that research has imbued the Division, and CNR, with great importance to the sustainable agriculture movement.

Not surprisingly, given the populist politics and agroecological practices advanced within the sustainable agriculture community, the reorganization of the College of Natural Resources, the appearance of an institutional preference for biotechnological research, and the infusion of corporate money into CNR is seen as a threat to the reproduction of agroecological research within the community – whether on or off campus. All of this is to say that, for its critics, the agreement between UCB and Novartis stands for a great deal more than the agreement itself contains. For many critics, the soul and history of CNR is at stake in developments like UCB-N. They recognize, and have more or less come to accept, that the majority of the work done within CNR is focused on non-populist themes, but they also see a long tradition of populist activity perhaps being threatened by recent developments. Irrespective of their accuracy, these threats are then read into events like UCB-N. This suggests that former Harvard president, Derek Bok (2003), is correct in arguing that while the Novartis agreement is not particularly important in itself, if such agreements were to become commonplace, they would change the path of biological research in ways that might not be compatible with the goals of the university.

The Agricultural Sciences and the College of Natural Resources at the University of California, Berkeley

Before examining the specific impacts that UCB-N had for UCB, it is necessary to provide some history and context. The placement of UCB-N within the agricultural sciences and of PMB within CNR shaped both the agreement and its consequences.

Agricultural Sciences

As noted above, at the heart of the agricultural sciences in public research institutions has always been the struggle between populist and progressive forces – with the two tendencies appearing to be one in many times and places. To overstate the case, populist tendencies have historically struggled to support smaller, Jeffersonian forms of farming and the communities and ecologies with which they are assumed to be correlated. Progressive tendencies have historically sought to promote productivity and profitability – generally abstracted from social and ecological conditions (Beus and Dunlap 1990; Buttel 1985; Lyson 1998). Where the two tendencies have come together is in the arena where productivity increases have been seen as the necessary foundation for the reproduction of all kinds of farming oriented to the market. Where they have diverged most powerfully over the last thirty years is in their respective approaches to

sustainability, whether agricultural, social or ecological. In this context, most sociologists of agriculture agree with Beus and Dunlap (1990, 591) who argue that the Progressive/Populist divide “represents a conflict of fundamentally divergent paradigms.” Each “paradigm” holds a different vision of what constitutes “good” agriculture and how best to achieve it, and, as such, are often at odds.

Progressive, productivist science has long dominated LGU research programs and has been tremendously successful in generating efficiency increases in the agrifood system. Further, the divide in research between conventional and alternative forms of agriculture tends to follow disciplinary boundaries. There are a few exceptions where disciplines themselves are divided between the two kinds of research, most notably rural sociology and entomology (Buttel 1985). Today, in response to the emergence of back-to-the-land movements in the 1960s, mainstream environmentalism in the 1970s, the farm crisis of the 1980s, agricultural biotechnology in the 1990s, and the fiscal crises of public universities over the last twenty years, a pivotal axis of these debates has been between the participants and supporters of Progressive biotechnology research and the proponents and movements seeking sustainable, agroecological and/or organic agriculture production systems.

Buttel (1985, 85) argues that disciplines that are primarily engaged in research associated with conventional agriculture “tend to be most accepting of prevailing institutions... for the generation, development, and diffusion of technological knowledge.” These disciplines (e.g., agronomy, crops/soils, horticulture, plant pathology, and animal science) are the most central to the Progressive mission of LGUs – to enhance productivity. In addition, scientists primarily concerned with increased productivity “tend to see ‘externalities’ or ‘social problems’ resulting from technological change as being irrelevant or unfortunate, and as a set of disturbances in executing the task of more efficiently utilizing agricultural resources” (Buttel 1985, 85). For example, in a classic article on “The Morality of Agronomy,” agronomist Boysie Day (1978) argued that “I fear that when his [i.e., the agronomist’s] values come in conflict with questions of political expediency, social justice, and equity, the production ethic takes precedence. Such is the stuff of revolutions.”

In contrast, the focal concern of alternative agriculture faculty is the generation of environmental, economic, and social well being for producers, rural communities, and consumers (Crouch 1990). These scientists tend to focus on the externalities or social problems that conventional scientists often dismiss or ignore. Faculty who do research on alternative agriculture tend to also focus on agricultural practices and processes, rather than inventions, and thus are less interested in intellectual property rights. Rather, they seek to disseminate their research findings as widely as possible. Consequently, they tend to be active in alternative networks, such as farmer-to-farmer and farmer-to-consumer networks (Hassanein 2000).

Where debates get most intense is in the shifting terrain of exchanges over biotechnology and sustainable agriculture. On the one hand, biotechnological research has a tendency to

operate in departments more concerned with “basic” scientific innovations that are effectively intended to be “applied” by commercial enterprises – most of which have successfully sought to fund basic biotechnological research at public universities in the first place. This basic research – whether in the case of herbicide-resistant varieties of cotton or soybeans, in the development of drought-resistant varieties of any number of crops, or in the genetic modification of staple crops to increase their nutritional content – intends to address the ecologically destructive nature of pesticides, the overweening cost of constructing irrigation systems in arid regions, and/or the social devastation of malnutrition in areas with rampant hunger.

On the other hand, sustainable agricultural research has a tendency to operate in departments more concerned with applied technological innovations intended to be provided effectively free of charge to farmers – farmers who generally have insufficient funds to sponsor research in their own interest. This applied research tends to pursue an understanding of agroecological conditions such that natural predators, soil flora and fauna, and species diversity work to reduce the impact of pests, to hold water and nutrients in the soil, and to produce more nutritious and tasty varieties in the process.

Sustainable agriculture research contains within itself a normative commitment to populist principles and social assumptions about the productive and market relations tied to alternative agriculture. As such, a number of social scientists with similar social and agroecological commitments have long collaborated with and been supportive of their more production-oriented colleagues. These scholars, often quite critical of the social and ecological consequences of conventional commitments to increased productivity, counter arguments by biotechnologists as to the ecological and nutritive value of genetically modified crops with analyses of the social impediments to and contradictions of pursuing sustainable agriculture and/or solving hunger problems with biotechnology – particularly commercial biotechnology. Biotechnologists, then, find themselves under attack from their historically less powerful alternative agriculture natural science colleagues and from similarly situated social science faculty in addition to members and representatives of social movements that support alternative agrifood systems.

The College of Natural Resources at the University of California, Berkeley

The origins of CNR date back to 1868 when the California legislature established UC and made the creation of the College of Agriculture the first duty of the Board of Regents (CNR 2004). For much of the College’s existence faculty have conducted research on agricultural production, taught courses on farming, and have been active in extension efforts. CNR has long been known as one of the leading agricultural and environmental research centers in world. It is also known for its multiple, often conflicting, research orientations.

On the one hand, it had a strong commitment to increasing agricultural production and productivity (i.e., conventional agriculture). On the other hand, it also had a core group of faculty who challenged the industrialist and productivist orientations and tendencies of California agriculture through their research on alternative agriculture. Thus, a trademark

of CNR was a dynamic tension between competing visions of the kind of agriculture that a LGU ought to foster. The dynamic tension between these distinct and largely incommensurable visions served CNR exceptionally well as it became internationally known for – among other things – its commitment to both progressive research seeking to increase the productive efficiency of California agriculture *and* populist/environmentalist research into alternative agricultural practices and natural resource studies that focused more on sustainability and community than on productivity and profitability.

However, with the urbanization of the Bay Area and the growth of the UCB campus, a number of teaching, research and extension activities in the agricultural sciences were transferred to the UCD and University of California, Riverside (UCR) campuses. The result was that research in the agricultural sciences at Berkeley became more and more basic. For example, the UC-wide academic plan of 1961 stated that the program in agriculture at UCB “should continue to emphasize teaching and Experiment Station research in the basic physical, biological, and social sciences, taking advantage of the vast array of scientific resources on that campus to add to the pool of fundamental knowledge upon which advances in agricultural technology depend” (University of California 2004). This tension between applied and basic research and the kind of agricultural research appropriate at UCB versus UCD or UCR is a tension that remains today. For example, in times of fiscal crisis, proposals to shift faculty in the agricultural sciences and Agricultural Experiment Station support from UCB to UCD and/or UCR tend to emerge (Barinaga 1994).

The declining relevance of agricultural issues at UCB, coupled with the increasing significance of environmental issues, led to the merger of the College of Agriculture and the School of Forestry to form CNR in 1974. As the name implies, the focus of CNR was much broader than just that of agriculture sciences. Then Chancellor of Berkeley, Albert H. Bowker, stated that “the central concern of the college will be the renewable resources of all non-urban lands of the state” (quoted in Stelljes 2004).

In the late 1980s, a campus wide reorganization of biology led to a partial reorganization of CNR (Trow 2004). In 1989 the Department of Plant Biology (PB) was established (the first part of what would later become PMB). PB brought together faculty from several departments, including botany, genetics, and molecular plant biology.

The reorganization of biology at UCB was largely driven by a perception that the reputation of the biological sciences at Berkeley was slipping. A number of key biologists at UCB felt that UCB was no longer attracting the best graduate students and faculty because the organizational structure of the biological sciences constrained the ability of UCB to develop strong faculty groups in the newly emerging areas and because UCB’s biological facilities were woefully outdated (Trow 2004). The outcome of the reorganization was the consolidation of biology at UCB into two departments in the College of Letters and Science (MCB and Integrative Biology), and the consolidation of molecular/cell research in CNR into a single department (PB).

It needs to be noted that the reorganization of biology at UCB fits with larger changes that were taking place in the organization of the biological science throughout U.S. universities at the time. The biological sciences have been largely reorganized from taxon-oriented divisions, such as zoology versus botany, to being divided by level of analysis (i.e., molecule and cell versus organism and ecosystem) (Roush 1997).

In 1992 CNR was further reorganized. Facing impending budget cuts, the departments of Conservation and Resource Studies, Soils, Forest and Resource Management, Entomology, and Plant Pathology were combined into a single department, ESPM (Stelljes 2004). The reorganization was contested by a number of faculty who were moved into the new department. They felt that faculty with little in common were being tossed together in a single department. Additionally, several faculty in ESPM commented in interviews that the department has been largely dysfunctional since its inception because of its diversity and size.

The 1992 reorganization gave CNR four departments: Agricultural and Resource Economics (ARE), ESPM, NST, and PB. These four departments remain today, with the addition of microbial biology to PB. The Division of Microbial Biology was added to PB in 1996. Previously, microbial biologists were scattered across the various biology departments on campus. Today, CNR has approximately 120 faculty members directing programs in ARE, environmental science, policy and management; plant and microbial biology; and nutritional sciences and toxicology. The College sees the intersection of these disciplines as positioning it to meet societal demands for environmental quality, sustainability of natural resources, food safety, nutrition and economic development.

The recent restructurings of CNR have been interpreted by a number of CNR faculty and some administrators as an attempt to make CNR both more competitive and comparable. As one UCB administrator argued, to be a viable department at UCB, you have to be one of the top 5 departments in the world. Otherwise, “there is going to be serious oversight and an attempt to restructure.” Consequently, departments in CNR face much competitive pressure from both other colleges at UCB, most of which are highly rated at the national level, and other universities, Land Grant and non-Land Grant. For example, PMB is often evaluated against MCB and other top biology programs, such as that at Stanford, which tend not to be at LGUs.

While the various departments in CNR tend to have good reputations, many did not have comparable departments, or comparable departments that mattered. In other words, if comparable departments were located largely at second or third tier universities, and not a first tier university, as is the case for the majority of departments at UCB, then such comparisons were not highly valued, even if the department at UCB was at or near the top. Many of the faculty in departments that have been restructured or cut altogether view the recent restructurings of CNR as privileging progressive and/or basic research over populist/applied forms of research.

Conclusion

Both the history of agricultural sciences generally and the history of CNR have affected the way the agreement has been perceived and the effects that it has had. The divide between faculty engaged in conventional research and those who are supporters of alternative agriculture, including actors outside of the university, has figured prominently into the agreement itself and its implications. As is illustrated below, critics of the agreement tended to be faculty and agricultural/environmental organizations that were committed to a populist vision of agriculture and rurality. To the extent that they are concerned with food, agriculture, and natural resources at all, faculty in PMB tend to hold to the progressive model. Thus, many of the issues that have been brought to the forefront by UCB-N are in fact not new to faculty in CNR or, more generally, in the agricultural sciences.

Academic Freedom and Diversity

In its first statement on academic freedom, the then fledgling American Association of University Professors (1990 [1915], 393) noted that “Academic freedom... comprises three elements: freedom of inquiry and research; freedom of teaching within the university or college; and freedom of extra-mural utterance and action.” In our inquiry we found no direct evidence of the first or second of these, but some concerns about the third.

The agreement with Novartis has produced few or no effects on the freedom of faculty to engage in research and teaching. Moreover, there also seem to have been few direct negative repercussions for faculty and graduate students who opposed the agreement. However, one faculty member in CNR who publicly opposed the agreement claims that his funding was reduced and he was pressured into moving into a smaller laboratory space because of his opposition to the agreement. While such actions are of great concern, there is little evidence indicating that faculty academic freedom was constrained in such palpable ways.

More significant for Berkeley and its future is the question of whether UCB-N, and relations with industry more generally, are transforming research orientations in ways such that the academic freedom of certain faculty is threatened. This question was only pertinent for CNR, and not the whole university, as UCB-N has had no known direct effects on research outside of CNR. Many faculty who were opposed to the agreement argued that research critical of conventional agriculture was increasingly being pushed to the margins and not rewarded by the administration. In the opinion of these faculty, this marginalization and devaluation was happening because of the increasing stress on entrepreneurialism by the administration, and concurrent growth in relations with industry. For them, the agreement with Novartis was the latest step in the restructuring of CNR along these lines.

A number of faculty, most of whom are located in CNR but not PMB, argue that UCB-N is indicative of a larger set of changes in the kinds of research that are considered appropriate and rewarded at Berkeley. These changes are described in a number of different ways by faculty in CNR. One dimension is that of biological holism versus molecular reductionism.⁴⁸ While it is debatable if biological holism was ever that prominent at UCB, and whether it is in fact disappearing altogether as a field of study, there is a perception by some faculty in ESPM that all new positions in the biological sciences are molecular positions. At the same time, a number of proponents of the agreement have claimed that much of the opposition to UCB-N came from a small group of faculty that do some form of ecological or organismal biology. Second, the divide has been described as between those that work with and develop biotechnologies and those who are critical of current technoscientific tendencies generally and genetic engineering specifically. Some critics argued that research that was critical of new technologies and novel technoscience was increasingly being marginalized, while research that sought to generate new technologies and forms of technoscience, such as genetic engineering, was being embraced and promoted by UCB. A third dimension is between the “haves” versus the “have-nots.” The “haves” are practitioners of “big science” with expensive facilities and large extramural grants, who tended to support the agreement, while the “have-nots” are faculty who conduct their scholarship with simple equipment and relatively small grants, and who were largely opposed to the agreement. The multiple understandings of this transformation illustrate its complex character and the different issues at stake, but also the positions of different actors.

In each instance, the faction that was critical of the agreement, the ecologists, those critical of biotechnology, the have-nots, or faculty engaged in research on alternative agriculture feel that the administration viewed them and the work they do to be of less importance to the missions of the university. They believe that Berkeley is increasingly promoting work that produces large grants or gains the university public prestige, while work that is critical of the current social, economic, political, or scientific order and/or does not generate much external funding is being marginalized. The consequence is a feeling of disenfranchisement by a significant number of faculty in CNR.

For some, particularly advocates of sustainable agriculture, the rise of biotechnology in agriculture is viewed as synonymous with increasing industry involvement in university research. While industrial involvement in the agricultural sciences is nothing new, the character of industrial involvement has changed with the emergence of biotechnology (Kloppenburg 1988; Krimsky 2003). For example, the pesticide testing of the 1960s was more a service/extension function than form of research. Faculty would be paid by a private firm to test a specified pesticide. With biotechnology the interpenetration of corporations into universities is greater. Biotechnology firms seek to enroll university scientists to develop new technologies – to do research on their behalf – and not just test developed products. Many critics of the agreement in CNR argued that industry

⁴⁸ It should be noted that acrimonious debates on this issue have been prominent in biology for some time. At Yale University it resulted in the division of the biology department into two distinct departments (Roush 1997).

involvement has skewed funding and stature towards research in biotechnology. For example, some participants argued that there are natural affinities between the interests of industry and certain kinds of research. Faculty who work in the area of biotechnology were viewed as having a lot in common with industry and thus as able to get industrial funding with greater ease. Consequently, many critics of the agreement argued that ties with industry, such as UCB-N, are tilting CNR towards molecular and genetic research and away from research on the social and environmental implications of modern agriculture.

The treatment of the Gill Tract proposal and, particularly, the ensuing controversies stemming from Quist and Chapela's article are indicative of the conflicts in CNR regarding academic diversity and freedom. Consider the Gill Tract, the largest continuous stretch of agricultural land in the East Bay Area. It is owned by the California Agricultural Experiment Station, and is the former home of the Division of Biological Control. In 1997, at about the same time that the UCB-N was under negotiation, a proposal to make the Gill Tract into an urban agricultural research center was proposed by a coalition of sustainable agriculture faculty at Berkeley and the Bay Area Coalition for Urban Agriculture. It was argued that the development of the Gill Tract as an urban agricultural center would have enabled UCB to fulfill its Land Grant mission within its urban setting.

Faculty involved with the Gill Tract proposal and Bay Area Coalition for Urban Agriculture argue that the Dean at the time, Gordon Rausser, and the CNR administration, never seriously considered the proposal. For many, both inside and outside UCB, the disparity in treatment between the Gill Tract proposal and UCB-N heightened awareness about the divergent directions of public research on agriculture. Supporters of the urban agriculture project argue that when given the choice between entering an alliance with the community or a private industry, it is quite clear which option UCB chose. In June of 2000, the urban agriculture project was rejected. The future of the Gill Tract remains undetermined.

The recently revised University guidelines on academic freedom theoretically allow for faculty to be committed to definite points of view. The revised guidelines, which went into effect September of 2003, state, "Although competent scholarship requires the exercise of reason, this does not mean that faculty are unprofessional if they are committed to a definite point of view" (University of California 2003, APM-010). However, in practice, not all points of view have been treated equally by the administration of UCB. For a number of reasons, the UC system and UCB administration have committed themselves to certain areas of research more than other areas, and to greater relations with industry. While such commitments potentially increase the academic freedom of some, they may reduce the academic freedom of others. For many faculty, students and activists a decreasing emphasis on agroecological sustainability is a notable threat to the diversity of views in academic research and teaching within the UC system.

Collegiality

The tension between faculty with different research orientations is perhaps most visible in the poor collegial relations that are typical throughout much of CNR. UCB-N did not create these tensions and differences, but it did bring them into the limelight. Without question, it has also exacerbated them.

The poor collegial relations between departments in CNR can partially be attributed to the different worldviews and political commitments of the faculty. The departments and divisions of CNR are only loosely connected in that they all focus on some dimension of food, agriculture, and/or the natural environment. The most visible divide is between faculty who do research on sustainable agriculture and those who do work related to biotechnology. This divide is particularly evident in differences between PMB and ESPM. Both are interested in similar problems, but understand and approach them from different perspectives. For example, two faculty members, one in ESPM and one in PMB, separately noted that faculty in PMB believe that the world can be engineered to be a better place. In contrast, faculty in ESPM believe natural systems are best, and that humans should adapt to nature. While this is in all likelihood oversimplified, it does illustrate that there are significant differences in the ideologies that underpin the two departments.

While several interviewees noted that collegiality has improved recently with changes in the administration of CNR, most interviewees still saw serious divides among faculty in CNR. When asked about collegiality, faculty and graduate students in CNR often responded with comments like the following: “the college is poisoned;” “we have a fractured community;” there is little interaction, relations are “adversarial;” “you can’t trust people anymore;” and there is “friction between graduate students.” Members of the central administration largely concurred with the view of the faculty and graduate students, remarking that the college is somewhat polarized. A number of ESPM graduate students also noted that UCB-N and the ensuing controversies have made cross-disciplinary discussions on biotechnology and sustainability nearly impossible.

In sum, our findings indicate that relations among faculty in CNR continue to be a serious problem. Such a poor state of collegiality hinders the productive capacity of the college as a whole and the quality of education that it is able to provide, especially at the graduate level. In an era in which both social and environmental problems often require multidisciplinary efforts, disciplinary boundaries are becoming re-entrenched in CNR.

It is also important to note a separation between public concerns as articulated by the popular press and Berkeley’s internal debate over academic freedom. Media attention gravitated toward topics of Pandora’s Box or technology out of control. Members of the public are reported as seeking an unbiased accounting of issues of food safety and environmental protection. Yet further removing industrial influences to protect academic freedom, as some participants in the UCB-N debate might prescribe, does not automatically answer these concerns. Classical expressions of academic freedom in the natural sciences discount any targeted research. This would include research to achieve

clarity on safety or regulatory issues. Moreover, one does not sense a widespread enthusiasm on campus to exchange the yoke of an industrial patron with that of a government patron seeking a highly applied agenda. On the other hand, those scientists holding such an interest would likely need to venture out to convince appropriate patrons of the value of a new or expanded research program. As with Novartis, this pursuit of a patron with definitive objectives meanders beyond the strict ideals of pure science and academic freedom. Given these realities, the scholarly debate on campus may have matured in a way that does not resolve the reported friction between the public and their scientific advisors.

Reputation

The effect that UCB-N has had on the reputation of Berkeley is disputed. Both proponents and opponents of the agreement largely agree that the initial controversy generated negative public relations for the university. However, proponents of the agreement tend to argue that in the long-run UCB-N has not negatively affected the reputation of the university. One argument put forth supporting this position is that the ‘good’ reputations of Berkeley and Novartis mooted any negative public relations that resulted from the controversy that UCB-N produced. In other words, because Berkeley is an “honorable institution” known for its academic values and Novartis is a “reputable company,” it was argued that neither would enter into an agreement that would negatively impact UCB.

One must also ask to what degree UCB-N was of interest to persons not at Berkeley or in the UC system, in the biotechnology sector, concerned with agricultural sustainability, or in higher education. As the media analysis has indicated, contrary to what many of those concerned with UCB-N thought, the agreement and the controversy it generated was hardly headline making news at the national level. Additionally, in examining the conventional agriculture sector in California, we found very few persons who expressed concern, let alone anything more than peripheral knowledge, regarding UCB-N. Further supporting this position is that external funding seems to have been minimally affected, if at all. Donald McQuade, Vice Chancellor of University Relations at UCB, argued that UCB-N is “not something that comes up with respect to the campus’ relationships with corporate and foundation donors.”

In contrast, opponents both inside and outside of the university tend to view the agreement and the ensuing controversies as negatively impacting the reputation of the university. For them, UCB-N jeopardized Berkeley’s reputation as a public university. For example, faculty and graduate students repeatedly described UCB-N as “tainting” or “tarnishing” Berkeley’s reputation, while Peter Rosset, Co-Director of Food First, argued that UCB-N has “been a lasting smudge on the university’s reputation.” Furthermore, for many faculty in CNR, the extension of UCB-N to CNR directly connected them and their research to the agreement, despite their non-participation in the formulation and execution of the agreement. The effect, one graduate student in ESPM argued, was that some people referred to CNR as “the college that’s funded by Novartis.”

For those who viewed UCB-N as having a negative impact on Berkeley's reputation, a primary concern was the legitimacy of Berkeley and research done under its auspices. Some faculty argued that research findings from Berkeley would no longer be of use in certain policymaking circles, because they could no longer be considered "objective." More specifically, it was argued that the credibility of Berkeley and the ability of faculty to be impartial arbiters on issues of biotechnology were ruined. Faculty in CNR, and particularly within ESPM, most often expressed this view.

For those who were already critical of UCB, the agreement with Novartis largely confirmed their doubts as to the kind of research promoted at Berkeley. For others, UCB-N is either viewed positively or, at worst, as a short-term smear on UCB's reputation, one that the university will quickly erase. However, it is perhaps beside the point whether UCB-N did or did not impact the ability of some faculty in CNR to undertake objective research or participate in policymaking as independent experts. If people perceive UCB-N has having such effects, then they are real and have potentially important consequences. Clearly, the administration and faculty at Berkeley have to be more attentive to the effects that relations with industry might have on the university's reputation when considering future agreements.

Public Mission

The rise of universities was part and parcel of the rise of the nation-state and modern society, embracing a mission to distill research and teach national culture and natural science to the evolving citizenries of the nineteenth and twentieth century. David Harvey (1998, 199) puts it this way:

In Europe it helped to solidify national cultures, gave "reason to the common life of a people," and fused "past tradition and future ambition into a unified field of culture." The university embodied an ideal. In the United States the mission was parallel. But here it was to deliver on a promise – to create tradition, found mythologies, and form a "republican" subject who could combine rationality and sentiment and exercise judgment within a system of consensual democratic governance. The university was where elite citizens went to be socialized and educated.

Within this context, LGUs popularized this practice, their original mission, "as set forth in the first Morrill Act, [being] to teach agriculture, military tactics, and the mechanic arts as well as classical studies so that members of the working classes could obtain a liberal, practical education" (NASULGC 1995). In part as a result of the intensification of rural-to-urban and international migration, combined with the rising complexity of national divisions of labor, race and class structures, the democratization of education itself increased – often in line with the model developed by California Progressives that included three tiers of higher education.

Following World War II, in the context of Cold War liberalism, civil rights struggles, environmentalism and new modes of multicultural appreciation, the clarity and

singularity of the idea of one universal science and one singular national culture increasingly came into question and the manifold constituencies served by the university came to engender what Kerr (1963) deemed the multiversity, an institution with multiple – and at times contradictory – missions. More recently, the struggle for cultural inclusiveness and the diversity of science has come to the fore in the context of the Culture Wars and the Science Wars that arose coincident with the end of the Cold War, and the rise of the information and risk society (Beck 1992; Castells, 1991, 1996). Delanty (2001a, 158) optimistically addresses the uncertainty over the mission of contemporary public universities, given decreases in public funds and increases in academic entrepreneurialism and corporate grantsmanship, as follows:

The implication of this for the university is that it will have to look beyond the nation for its cultural mission. Neither the capitalist-driven market nor postdisciplinary managerialism will provide the solution on the other side to the challenges that technology poses. The solution resides in linking the challenge of technology with cultural discourses. Universities are among the few locations in society where these discourses intersect. As sites of social interconnectivity, they can contribute to the making of cosmopolitan forms of citizenship.

Like much of the debate regarding UCB-N, the impacts, if any, that the agreement has had on Berkeley's public mission vary significantly according to whom you ask. On the one hand, proponents of the agreement, primarily PMB faculty and administrative officials at UCB, view close links with industry as largely compatible with the public mission. On the other hand, for those who are critical of the agreement, including faculty and graduate students doing work on social and environmental sustainability, and representatives of populist agricultural and environmental advocacy organizations, doing research that is of direct benefit to private firms is antithetical to the public mission. For them, the public and private spheres are distinct, and research that benefits private firms is not necessarily of benefit to the public. It also needs to be noted that a number of participants from both sides asked whether UCB was still a public university or whether it had become a "publicly assisted" university. Proponents of UCB-N tended to have little problem with this transformation, while opponents of the agreement tended to see it as highly distressing. These positions regarding the public mission of UCB are outlined below.

For faculty in PMB who signed the agreement, there is little conflict between industry relations and the public mission of UCB. Industry research, it was argued, serves the public in that it contributes to the knowledge base of society and furthers technological development. In fact, some faculty in PMB argued that collaboration with industry actually enabled them to better fulfill the public mission. First, it provided essential funding, given reductions in the state budget for education. The funding from Novartis allowed research to continue or even expand, which, it was claimed, meant greater benefits for the people of California. Second, collaboration with Novartis was viewed as

making the transfer of research into the public domain more efficient through increased patenting and licensing opportunities.

The administration at Berkeley also sees little conflict between industry relations and the public mission of UCB. For some in the administration, industry groups are understood as part of the public. Thus, they are entitled to the same benefits as other constituents of the university. Like many faculty in PMB, administrators see collaboration with industry as offering an additional avenue through which to move research into the public domain.

The public mission tended to be interpreted differently among faculty who were critical of the agreement. Generally, they had a more populist vision of the public mission. For example, a number of such faculty claimed that they were the “the people’s researchers” and the “people’s scientists.” Critics of the agreement also tended to believe that a distinction between the public and private spheres was a central component of modern society. For such faculty, the public mission of Berkeley was viewed as doing work that would benefit the public sphere and not necessarily the private sphere. In other words, the public mission mandates doing work that is in the public interest, which is not done by other groups. As one faculty member commented, “We’re a public university and we have responsibilities to pay attention to people who can’t pay for our attention.” Thus, for many faculty who opposed the agreement, doing research for the benefit of private firms was antithetical to the public mission.

Another concern that some critics of the agreement had was that the university was being sold off for virtually nothing. This was a concern that a number of populist agricultural and environmental organizations also expressed. A number of faculty commented that the \$25 million that Novartis was giving PMB was a great bargain for the company and a loss to UCB. For these faculty, UCB-N was viewed as giving Novartis the right to over 135 years of public investment that the people of California had made in UCB.

Similar to faculty who were critical of the agreement, populist agricultural and environmental advocacy organizations also held a populist vision of the public mission. For example, in speaking of California’s public universities, one member of an advocacy organization remarked that “we own them, and they are not to be sold.” Such populist agricultural and environmental organizations argue that all research produced in public institutions, like Berkeley, should be public (i.e., freely available outside the market). Thus, for them, university-industry relations go against the public mission of Berkeley, because they privatize research that rightfully belongs to the public.

Such organizations also saw university-industry relations as potentially undermining the ability of universities to partake in research that is in the public interest, but is not necessarily of interest to private firms. Criticizing not only UCB-N, but also the management of the UC system, Peter Rosset, co-director of Food First remarked that UCB-N “demonstrates that there is no democratic mechanism between the taxpayers who are paying for a school of natural resources and the decisions that are made within that school of natural resources as to the ... emphases, or focus to take in the research activities.” For such populist agricultural and environmental organizations, the

privatization of UCB was of high importance, because they worried that, if public universities were privatized, then no institution would exist to do research on behalf of the public interest. As one representative of a populist agricultural/environmental organization put it, the public ownership of UCB was “absolutely critical to the survival of independent research and an effective educational system.”

The above evidence indicates that the definition of the public mission is highly contested. In part, the above groups of actors differ on the answer to the following questions: Who are the public? What is the relation between the public and private spheres? All the groups claimed that the research done at UCB should at least partially serve the public interest. However, the groups differed on who counted as “the public.” For administrators, private for-profit firms were clearly part of the public, whereas for populist agricultural and environmental organizations they were not. Many critics of the agreement had a more defined, and narrower view, of who were the public. For them, the public was farmers, workers and ordinary people, not corporations or other large institutions. In contrast, for faculty in PMB and administrators, doing research for Novartis served the public interest, because Novartis would then turn around and translate that research into useful products that benefited the public. However, for faculty critical of the agreement and populist agricultural and environmental organizations, doing research for Novartis benefited Novartis, but there was no guarantee that it would benefit the public.

The implication is that how one views the public and the relationship between the public and private sphere affects how one sees the public mission. The structure and goals of the university change as who the public is and how it is best served changes. Those concerned about UCB-N are little different from others across the nation. The debate reflects a point raised by Slaughter and Rhoades (quoted in Becher and Trowler 2001, 9) who note that: “Politics and statutes moved from an ideology that defined the public interest as best served by shielding public entities from involvement in the market, to one that saw the public interest as best served by public organizations’ involvement in commercial activities.” This shift by definition made market exchange the central distribution principle of university research, diminishing research based on need or desert.

Land Grant Mission

The Morrill Act of 1862 established the LGUs. The specifics of the Morrill Act provided for “at least one college” and “a minimum of forty acres of land” set aside by each state. The mission of establishing such universities was to combine the applied arts and sciences with public service to and teaching for the citizens of each state. LGUs would disseminate knowledge to the laboring classes, and the knowledge produced there would be verified by public disclosure so as to ensure its universal availability and validity. The public service component of the Land Grant mission was further reinforced with the passage of the Hatch Act in 1887. With the Act’s establishment of SAES, scientists at LGUs were encouraged to support agricultural development, expansion and

intensification through applied, empirical research as well as through teaching. All results of such research were to be made known to all who were interested in it through bulletins, circulars, speaking engagements, and classroom education.

The impetus for the establishment the Land Grant system came from two, often conflicting, segments of society. On the one hand, the Land Grant system was a reaction to pressures to extend higher education to broad segments of the U.S. population (National Research Council 1996). Thus, LGUs would provide “useful and relevant scientific education” for the agricultural and artisanal classes (Sanders 1999). On the other hand, the establishment of the LGUs was a response to demands by bankers, wealthy farmers and editors of many of the agricultural journals for a more productive form of agriculture. Citing the findings of Liebig’s research into soil nutrients in Germany, pro-science farmers and journalists, argued that a greater productivity in agriculture was achievable through the application of science (Busch and Lacy 1983). To fully realize the potential of agriculture, organized research and government funding were considered necessary. Thus, since their inception, LGUs have had to negotiate between a populist and a progressive mission. These debates continue today, and are somewhat evident in the different understandings that persons both within and outside of the university have of UCB’s Land Grant mission.

As we describe in the following paragraphs, the divide between different members of the university and constituent groups regarding the Land Grant mission is similar to the discordant perspectives regarding the public mission. PMB faculty and the administration largely viewed industrial relations as fully congruent with the Land Grant mission. Faculty who were critical of the agreement were mixed on whether or not industry relations fit with the Land Grant mission. This is somewhat different than with the public mission, where nearly all of such faculty view industrial relations as incongruent with UCB’s public mandate. Populist agricultural and environmental advocacy organizations argued most vehemently that industry relations went against the Land Grant mission. For them, biotechnology is large-scale agriculture, and serving the interests of big agriculture does not fit the Land Grant idea.

Our findings indicate that most faculty do not think about the Land Grant mission in conducting their research or fulfilling their teaching responsibilities. For example, one faculty member in PMB remarked, “around the department most faculty would have a hard time explaining what the experiment station is.” However, when asked, faculty in PMB generally see collaborations with industry as fulfilling the Land Grant mission. It was argued that collaborations with industry gave university researchers an additional path through which to transfer their research into the public domain. Relations with industry were also viewed as a mechanism for turning basic research into useful applications. In these ways, faculty in PMB argue that the agreement with Novartis enabled them to fulfill the Land Grant mission. However, although faculty in PMB see their work as congruent with the Land Grant mission, they would be doing the same work regardless of whether the Land Grant mission existed and was emphasized. Thus, when one looks at the matter empirically, it is clear that the Land Grant mission has had little influence on most faculty in PMB.

When asked about the Land Grant mission and the appropriateness of industry relations, the administration at Berkeley tended to also view relations with industry as consonant with the Land Grant mission. From the perspective of the administration, university-industry relations fulfill the Land Grant mission of UCB by promoting practical work connected with ‘real world’ needs. W.R. Gomes, Vice President of DANR, commented, “the partnership of public and private can, in its best form, be an ideal way of making sure that important, current issues are addressed, and we are a mission-oriented division.” Similarly, Paul Gray, the EVCP of Berkeley, remarked, “The industry connection and the funding of work here has a pronounced effect on making the work more relevant and less disconnected from real world applications.” For administrators, doing research that is ‘applied’ fulfills the Land Grant mission. Industry support is viewed as a highly efficient way to turn university research into ‘useful’ products that will benefit the public.

A more mixed vision of the relation between university-industry relations and the Land Grant mission emerges from faculty who are critical of the agreement. Some faculty viewed collaborative arrangements with industry as violating the Land Grant mission. For most of these faculty industry control is not new, as it was argued that California agriculture has been run by ‘big agriculture’ for decades and that the Land Grant mission was taken over by rich farmers long ago. This is a point that a number of faculty who were not critical of UCB-N also made. Commonly citing the “tomato harvester incident” (Friedland and Barton 1975), they argued that Land Grant funding, such as SAES funds, is also not necessarily independent of industry influence.

Some of the faculty who were critical of UCB-N did not believe that industry relations were necessarily in conflict with the Land Grant mission. They believed that it was one way to fulfill UCB’s service obligation. However, careful governance was viewed as necessary to ensure that relations with industry were conducted in an appropriate fashion. By “careful” it was meant that relations with industry were governed in a transparent manner and were subject to some form of oversight. Such careful governance was seen by many as lacking in the case of UCB-N.

However, it needs to be reiterated that the Land Grant mission is of little importance to most faculty and administrators at UCB. With the exception of a portion of faculty in ESPM, the Land Grant mission has little effect on the current faculty’s research. In part, this is because UCD and UCR have been allocated applied and commodity group-focused Land Grant activities and UCB has embraced basic research in agricultural economics, plant and microbial biology, nutrition, and the environmental sciences, management and policy. In fact, it was clear that many faculty in CNR had little knowledge of what the Land Grant mission is. Even many faculty who thought the Land Grant mission was important said that they did not tend to think about the Land Grant mission in their daily work. Rather, they believed that since they were doing work that they perceived to be in the public interest, they were fulfilling UCB’s Land Grant mandate. Thus, as the above findings indicate, for both administrators and faculty the Land Grant mission is not of

much relevance. In general, it was only as a result of our probing that concerns about the Land Grant mission were raised.

The degree to which a discussion and possible re-working of the Land Grant mission is necessary is further supported by the position of populist agricultural and environmental organizations that argue that the Land Grant mission is long dead at UCB. When the Land Grant mission was raised, populist agriculture and environmental advocacy organizations pointed to what they saw as a long history of UCB violating the Land Grant mission. Echoing longstanding populist critiques of the Land Grant system (e.g., Hightower 1973), they argued that the people of California had lost UCB to agribusiness a long time ago. For them, UCB-N is a continuation of this history. UCB-N was viewed as benefiting big agriculture, largely at the expense of small farmers and alternative agriculture. This went against the Land Grant mission, which they saw as embodying populist ideas, such as serving small farmers and the people of California. Dave Henson, the director of the Occidental Arts and Ecology Center, commented, “the Land Grant was such a great idea, but it’s only serving capital; it’s not serving ecological health, which is one and the same as human health, and one and the same as sustainable economy.” Concerns that LGUs are increasingly controlled by private firms are not limited to agricultural and environmental activists. Such concerns are also widespread in the farm community (Patricio 2001).

While some populist agriculture and environmental advocacy organizations agreed that industry ties provided UCB with much needed infusions of money, there was general agreement that increasingly close relations with corporate agricultural industries violate the idea of the Land Grant mission. Peter Rosset perhaps best sums up the position of these advocacy organizations:

One direction is that the university ally [itself] with the private sector and get on the bandwagon of the trend of genetically modified crops and further industrialization of agriculture and appropriation of farming for private profit; the other direction was the university would ally itself with the community surrounding it and lend its research and education support for alternative food systems and people farming at a smaller scale and in a non-industrial way but playing an important role in community food security in the Bay Area.

Conclusion

Many of the issues that are at the center of the UCB-N and the ensuing controversies are not new to Berkeley or to higher education. All the issues discussed in this section – the academic freedom and diversity, collegiality, the reputation of UCB and its faculty, and the public and Land Grant missions – return to the central principles of the university: creativity, autonomy, and diversity. Our findings indicate that for some, namely faculty in PMB, UCB-N promoted and ensured each of these three principles. For others, namely those faculty engaged in research on alternative agriculture, they perceive UCB-N as constraining their ability to conduct the kinds of research they see as important and

valuable. For them, this limits the creativity and diversity of research at UCB. The outcome is homogenization. Homogenization impairs not only the ability for CNR to be a college known for doing cutting edge research, but also the ability of CNR to serve its many constituents, as certain kinds of research and forms of extension disappear.

UCB-N has raised a number of issues that reflect specific internal matters at UCB, and in the UC system generally. However, many of these issues are best seen as examples of a set of larger questions relating to the future of public universities and higher education. We now turn to these questions.

VIII. Conclusions and Recommendations

Rethinking the Role of Public and Land Grant Universities in the 21st Century

Despite a fairly bumpy ride through the 20th century – encompassing two world wars, a global depression, a number of recessions, and the cold war – the structures of public higher education remained largely in a Progressive vein before starting to gradually implode during the late 1960s. Starting with the emergence of the New Left, connected to and following from the Civil Rights Movement, the academy served as a hotbed for every sort of liberal reform and radical program. At the same time, though less visibly, universities remained intimately engaged with conservative intellectual and Cold War economic and military institutions.⁴⁹ In this context, stagflation in the 1970s, the recessions in the 1980s, and fiscal restructuring in the 1990s has generated changes in public funding of the academy which is as much about a cultural reaction to political correctness, identity politics and “left elitism” as anything else. Neoliberal economic and fiscal restructuring combined with neoconservative political and cultural reform has thus contributed to a widely perceived crisis in the mission, purpose and programs of public universities. This crisis is evidenced in controversies such as UCB-N, and is inextricable from intellectual debates such as the Culture Wars and Science Wars (See, e.g., Gross and Levitt (1998), Latour (2002).

Delanty (2001a, 4-5) writes of four major changes associated with this crisis. First, the dominance by the state of knowledge production begins to be balanced by new private and public-private research programs. Though the state remains the primary financier of technoscientific development, changes in patent law, information technologies, and global trade in commodities and cultural practices expands the arenas of knowledge production and application. Second, economic profitability, political influence, and everyday activities are more and more dependent on technoscientific, political economic and cultural knowledge. As such, the role of the university has had to shift as education – often of very particular, as opposed to liberal and generalist – kinds of knowledge become of greater importance to wider classes of people in global society.

⁴⁹ As is common knowledge, from the Free Speech movement to the nuclear weapons work at Lawrence Livermore Laboratories, UC Berkeley has long been situated at the intersection of these diverse trends in intellectual and public life.

Third, mass education and mass movements have succeeded in altering the terrain and scope of university enrollments as lay and professional knowledge increasingly converge. Fourth, and finally, the democratization of knowledge has informed and resonated with the condition Beck (1992) first called *Risk Society*, and later *Reflexive Modernization* (Beck, Giddens, and Lash 1994). Here, the combined growth in public understanding of science and increasing numbers of science-based social, public health and environmental crises has led to rising contestation by a range of social movements of knowledge and the primacy of expert-driven technoscience. This has contributed to the partial delegitimation of traditional images of ivory tower academics and more frequent calls for academic, technological and scientific accountability.

It is in this setting that Delanty addresses what others have deemed the entrepreneurial science, “academic capitalism” in the context of the “new managerialism” (Clarke and Newman 1997; Etzkowitz 2003; Etzkowitz and Leydesdorff 1998; Slaughter and Leslie 1997) In this same context Derek Bok has talked of the commercialization of higher education (Bok, 2003). What this means is that, on the one hand there have been a series of state-level fiscal shocks to public universities and, on the other hand, there has been a society-wide restructuring of the public’s relation to knowledge, science and education. On another axis, while state-level support for general educational funding (teaching) has fallen, federal support for big science has increased. Importantly, however, Delanty suggests that the present debate over the status of the university in an era of neoliberal fiscal constraints and economic and cultural globalization is far wider than that of academic capitalism and managerialism.

From the perspective of Bill Readings (1996), the 20th century university struggled to hold together Kantian commitments to pure science and Humboldtian commitments to public citizenship. During the Cold War, due to widely shared economic commitments to technical and military efficiency, alongside social commitments to liberal civic reform, the tension between these tendencies declined. However, in the context of the serial rise of the New Left and New Right, these tensions have re-appeared. From the perspective of the mid-1990s, six broad claims appeared to have been made within the public discourse over academic restructuring. Here, advocates variously suggest that the university needs to return or develop a new orientation to:

- a. the inculcation of traditional liberal values (e.g., Bennett 1992; Bloom 1987);
- b. critically evaluating contemporary social and cultural problems (e.g., Fuller 2000; Krinsky 2003);
- c. the pursuit of (basic scientific and cultural) knowledge for knowledge’s sake (e.g., Committee to Review Swedish Research Policy 1998);
- d. training students for the (now global) job market (e.g., Thurow 1999);
- e. providing innovative technology for industry (e.g., Clark 1998; Etzkowitz and Leydesdorff 1997); and

- f. serving as an engines of regional and state economic growth (e.g., Nelson 1993; Varga 1998).

These six kinds of claims fit the Kantian-Humboldtian divide as the first three focus on the reproduction of scientific culture, and the second triplet focuses on socio-economic development issues. What is clear, however, is that holding on to the idea of a singular, universal mission for higher education has become quite difficult.

In an article, “The University in the Knowledge Society,” Delanty (2001b) reframes Readings’ perspectives into four broad approaches to thinking about the university’s role in contemporary society. These are: 1) *the neoliberal critique* of the decline of the Western canon; 2) *the postmodern thesis* that the end of the university coincides with the end of the viability of a singular, universal culture; 3) *the reflexivity thesis* that suggests the disciplinary basis of the university is in crisis as new relations between the university, the economy and the public arise in the context of global post-Fordism; and 4) *the globalization thesis* that argues that the university needs to be (or has already been) remade in the face of its new, instrumental associations with global capitalism and commodifiable information technologies.

Whereas Readings (1996) saw *The University in Ruins*, Delanty argues more coherently that the university needs to re-vision its role in the knowledge society. Much like Derek Bok (2003), Delanty sees universities moving down all of these paths largely by a process of uncoordinated crisis management. The uncertainty of the combination of the Culture Wars, the Science Wars, and fiscal crisis management leads Delanty, Bok and others to find the *lack* of a formal, public discussion as to the nature and future of the university to be generating extraordinary unintended consequences. What we have found is that the controversy around UCB-N has been approached by people speaking, acting and writing based on the different kinds of assumptions reviewed above. Whether focused on the cultural, rational, political, scientific and economic grounds upon which the university – and the historical agricultural college within it – is believed to properly stand, participants in the controversy have been presented with no opportunity for real dialogue.

The major advantage of analyses such as those of Readings and Delanty is that they see universities as necessarily tension-filled places: The diversity of roles and purposes universities serve, and the myriad foundations necessary for their proper execution, verge on the incommensurable. For them, Kerr’s multiversity is contradictory and multifunctional, but this is not necessarily a bad thing. Contemporary society manifests the same condition. What this suggests is that universities, in order to remain socially and scientifically viable, must accept that they are the locale wherein these incommensurabilities meet, and where debate must be fostered rather than foreclosed. Here, the democratization of the institution is fundamentally necessary for its future stability and effective survival. Yet, present trends appear to be towards fiscal, research and teaching efficiency at the cost of democratization. In our interviews, one of the most common criticisms of the agreement was the ways that the *process* of its negotiation –

and subsequent exchanges between administrators and faculty – was illustrative of a decline in the efficacy of faculty participation in the shared governance of the University. Existing structures of democratic governance need to be revitalized such that a regular, institutionalized discussion of the missions, responsibilities and directions of the university are (once again) made central to an ongoing debate. The alternative is further bureaucratization, accompanied by greater managerial control, and eventual decline into mediocrity.

Future of the Land Grant Mission at the University of California, Berkeley

The place and role of agricultural and natural resource research at UCB is in need of re-examination. Changes in political-economic and cultural conditions generally as well as particular developments at UCB and within the UC system raise questions pertaining to the role and appropriateness of the Land Grant mission at UCB.

We see several options regarding the future of the Land Grant mission at UCB. The first option is to completely remove all Land Grant funding and responsibilities from UCB. This would entail shifting all Land Grant research and extension activities to UCD and UCR. This is the option that the administrations of UC and UCB have tended to favor when budget crises and other concerns have forced discussions on restructuring and/or downsizing in the past. However, every time relocating faculty to UCD and UCR has been proposed, it has been met with strong opposition from UCB faculty.⁵⁰ The other option is to recraft the Land Grant mission at UCB in such a way that is congruent with the mission of UCB, makes sense in the Bay Area, and complements the research done at UCD and UCR. Many faculty in CNR and agricultural and environmental organizations might in fact welcome this option, as there is much unhappiness among some factions in the agricultural and environmental communities with the way that the Land Grant mission has historically been implemented by UC.

It is beyond the capacity of this report to offer a specific recommendation regarding the future of the Land Grant mission at UCB. Rather, we outline a number of issues and concerns that need to be addressed in evaluating the future of the Land Grant mission at UCB. First, is our finding that the Land Grant mission is of little or no importance to most faculty and administrators at UCB. Of the faculty in CNR that we interviewed, the overwhelming majority said that the Land Grant mission was not something they considered in their research. Even more troublesome was that many faculty in CNR had little knowledge of what the Land Grant mission is. Furthermore, those faculty who do claim to construct their research around the Land Grant mission, also tend to be the same faculty who feel increasingly marginalized by the administrations of CNR and UCB.

⁵⁰ While the opposition may or may not have anything to do with Land Grant mission at UCB, it does indicate that proposals to move faculty are often met with significant resistance by those faculty who are to be moved. This may limit the feasibility of completely moving those research and extension activities that have been traditionally associated with the Land Grant mission.

Second, the degree to which departments are engaged in research that fits the Land Grant mandate is quite uneven. On the one hand, ESPM and the ARE are the two departments that fit most closely with the Land Grant mission. However, one of those departments, ESPM, continues to be a forced amalgamation of faculty from previously distinct disciplines who have little in common. On the other hand, PMB is the department that least fits with the Land Grant mission because of its orientation towards basic research and its self-described disconnect from food, agriculture, and natural resource concerns. NST is somewhere between these poles.

Third, the relations among different departments in their current forms are problematic. Significant tensions exist within CNR between faculty engaged in “conventional” and “alternative” research, which continues to go largely unaddressed. These differences will need to be addressed as both groups have very different visions of what constitutes “good” agriculture and how best to achieve it.

Fourth, “traditional” kinds of Land Grant research have become largely irrelevant at UCB because of its urban setting. Therefore, a discussion of the ways the Land Grant mission is applicable in an urban area is needed. Fifth, continued state fiscal crises need to be taken into account. In the State of California, reductions in the state budget for both higher education and the Agricultural Experiment Station in the early to mid 1990s and again more recently have exerted considerable pressure on both the DANR and CNR to restructure and downsize.

The above issues and concerns lead us to recommend that UCB and UC undertake a review of the Land Grant mission and CNR. The purpose of such a review is to determine whether, and, if so, how the Land Grant mission might be made more meaningful in the context of UCB.

Conflicts of Interest and Conflicts of Mission

A worrisome consequence of the agreement was a perceived conflict of interest (COI) widely reported in the popular and scientific press. In a flurry of media attention, UCB, and LGUs more generally, were accused of selling their integrity. Press reports illuminated the tension between a public university’s industry ties and its broader responsibilities to the public. UC’s written guidelines advise that in “pursuing relationships with industry, the University must keep the public trust and maintain institutional independence and integrity to permit faculty and students to pursue learning and research freely” (University of California Office of the President 1989, 1). As the above discussion on academic freedom and diversity indicates, it is open to debate whether the University fulfilled this obligation.

In fact, UC administrators acknowledged that controls on research integrity deserved a second look. For example, the President of UC pointed out that agreements with industry “contain complex IP matters and may involve conflict-of-interest issues that do not typically arise in government-sponsored contracts and grants.” The University’s goals

are “not simply to generate royalty revenue and stimulate economic growth but to create relationships with industry that will help faculty in pursuing their own research and in training graduate students” (Atkinson 1999, 47). Individual conflicts of interests are “not easy issues to resolve,” and “ensuring the integrity of university research” calls for “open discussion within the academic community” (Atkinson 1999, 47).

The idea that objectivity may be compromised by self-interest is well known. It is typically addressed through attention to professional ethics (or codes of conduct) and COI policies. The public and well-tempered policies of the UC provide a useful illustration for research universities in general. Individual conduct is spelled out in considerable detail in UC’s Code of Conduct. The University’s COI policies conform to state law aimed at protecting the public interest. They define a conflict of interest as “a situation in which an employee has the opportunity to influence a University decision that could lead to financial or other personal advantage, or that involves other conflicting official obligations” (University of California Office of the President 1989). While the COI policy formation in the 1980s and 1990s focused on entrepreneurial faculty and their external financial interests, the UCB-N agreement raised issues of a different sort. In this case, it is the *institution’s* potential for COI relative to funds it receives that is at issue.

Existing COI policy and procedures of UC concentrate on the financial implications of licensing agreements and the governance of on-campus research. Yet the financial return from agricultural biotechnology is not determined solely by the terms of IPR agreements. The financial interests of individual researchers, academic units, UCB, and UC as a whole are also linked to governmental regulatory decisions, the documented results of field trials, findings on environmental consequences, findings on alternative approaches to agriculture, findings regarding agricultural economics, and the state of the public dialogue on biotechnology. The degree to which individuals affiliated with UC inform and/or influence any of these activities either directly or through other organizations could constitute a potential conflict of interest. For example, a faculty member who uses his or her influence to help persuade the Environmental Protection Agency that a new plant variety will have no harmful effect on the environment could yield financial benefit at public expense under current IPR agreements. In the same fashion, if the institution reduces its support of environmental research, while holding a financial stake in the success of agricultural biotechnology, the same adverse trade-off could occur. These scenarios illustrate conflict deriving from a duality of purpose or a conflict of mission. Perceived COI endangers the credibility of fair and transparent agricultural, regulatory, and environmental research.

Standard attention to conflicts of interest and codes of conduct may well fall into what Power (1997, 123) refers to as “shallow rituals of verification.” In effect these procedures do not begin to fit the depth and breadth of the issues at hand. The debates that have occurred regarding UCB-N suggest that the boundaries of current university COI policy are unrealistically narrow in several respects. Ideally, research related to the possible consequences (including risk assessment and regulatory science) of agricultural biotechnology should be secure and independent from both individual and institutional conflicts of interest. This is no simple task. Scientists may influence the regulatory

regime through multiple channels, including: 1) engaging in scientific dialogue (e.g., scientific conferences); 2) contributing to the scientific literature through submissions or through the peer review or editorial process; 3) managing and assessing IP; 4) engaging in public communications including interactions with the media; 5) participating in boundary work and supporting boundary organizations; 6) conducting or choosing not to conduct research specifically for regulatory purposes; 7) serving directly on scientific advisory panels or in similar roles; and 8) consulting with industry on related matters.⁵¹

Controversy over the UCB-N agreement highlights a growing uncertainty between individual and institutional responsibilities. The landscape surrounding the agreement suggests that public institutions need to cast a broader net in order to capture the full range of COI issues. Even with growing attention to institutional conflicts of interest, the agreement brings existing COI policies into question for at least four reasons. Current procedures generally 1) do not capture the range of actor influence in highly regulated markets; 2) poorly integrate potential financial and non-financial conflicts; and 3) fail to acknowledge the potential detrimental influence of institutional self-preservation; and 4) do not capture the influence of an extensive web of boundary organizations. Moreover, the University's own accountability appears to lag behind its growing role in managing industry relationships and IPR. For example, UC guidelines assert:

It has long been recognized that the only truly effective safeguard against conflicts of interest situations is the integrity of the faculty and staff. A codification of the complex ethical questions involved, even if possible, would be unduly restrictive. At the same time, even the most alert and conscientious person may at times be in doubt concerning the propriety of certain actions or relationships. Whenever such doubt arises, the University expects the individual involved to consult with the Office of the Chancellor, or the Chancellor's designated representative, before making a decision (University of California Office of the President 1989).

In this passage, UC policy refers to the "integrity of the faculty and staff," yet mandatory assignment of inventions matched with the terms of the UCB-N agreement could circumvent the faculty's control of IP of their own creation. Faculty members have an obligation to disclose patentable inventions, and the University has a contractual obligation to report these to an industrial sponsor.⁵² Faculty members have an obligation to disclose patentable inventions, and the University has a contractual obligation to report these to an industrial sponsor. Under UC's patent policy (effective October 1, 1997), the President is responsible for managing "IPR for the public benefit" in consultation with

⁵¹ In a brief analysis of the Novartis agreement, Krinsky (2003) likens the problems it poses to the oil leak in 1969. At that time, the California attorney general was unable to find petroleum engineers at UCB or UC Santa Barbara willing to testify for fear of losing industry grants and consulting contracts.

⁵² Under UC's patents policy (effective October 1, 1997), the President is responsible for managing "intellectual property rights for the public benefit" in consultation with the Technology Transfer Advisory Committee chaired by the Senior Vice President for Business and Finance. The Senior Vice President for Business and Finance is responsible for implementation of this policy and may grant exemptions from the policy. However, his or her charge under the policy is limited by "overriding obligations to other parties."

the Technology Transfer Advisory Committee chaired by the Senior Vice President for Business and Finance. The Senior Vice President for Business and Finance is responsible for implementation of this policy and may grant exemptions from the policy. However, his or her charge under the policy is limited by “overriding obligations to other parties.”

The question of control was also raised in a laboratory study at the University of Wisconsin. Kleinman (2003) provides a detailed case study (conducted in 1995) of a laboratory led by Jo Handelsman in the Department of Plant Pathology, University of Wisconsin, Madison. Within this environment, he noted that for Handelsman “the reality of running a university biology lab does not allow... the luxury of separating ‘the science’ from matters of patenting, funding, and administration that play important parts in her professional life.” (Kleinman 2003, 158). While still optimistic that such externalities can be isolated from “the science,” Kleinman concludes with a continuing concern for university research as an engine of growth and doubts whether the pursuit of IPR actually enhances a scientist’s control over the fruits of their research.

Universities also hold a financial interest in growing research dollars for respectability or self-preservation. With this in mind, a *lack of commitment* to biotechnology, relative to other approaches with potential advantages to agriculture and the environment, may also generate a perceived conflict of interest. Even though the management of *non de minimis* ownership by faculty is well advanced, institutional COI remains a largely open topic. However, institutions generally ask individuals to completely disclose any *non de minimis* financial interests.⁵³ Institutional conflicts of interest related to biotechnology attracted more attention after the agreement due in part to a 1999 death at the University of Pennsylvania (Barnes and Florencio 2002). Attempts to engineer viruses for medical uses (coined “virotherapy”) include injection of genetically engineered viruses. This experimental technique was apparently responsible for a death during clinical trials (Nettelbeck and Curiel 2003). In this case it was found that researchers and the institution had equity interests in the company (Genovo) that would have profited from the experimental gene therapy. Since the incident, the Association of American

⁵³ Conflict of interest is typically an issue of concern where certain funds go above a trivial amount or a *non de minimis* level to use a common legal term. A *de minimis* calculation may be made in the case of the UCB-N agreement. The popular media rarely places university revenues from IPR into context relative to the huge scale of university finances. The impression left is that a return of millions of dollars is sure to endanger the research agenda or creditability of the institution. This is generally not the case. The Association of American Universities (AAU) estimated that in 2000 colleges and universities in the United States conducted \$30 billion in research and development. The sum equals 11 percent of the nation’s total of \$265 billion. Academic institutions accounted for 42 percent of basic research, 13 percent of applied, and less than one percent of development. These institutions self-financed \$6 billion of academic R&D. In 1999, UCB received \$432 million in grants and contracts (NASULGC 2001, p. 25). Therefore, the \$3.2 million received in royalties and fees (with a net income of \$831,000) and the \$5 million per year received from research from the Novartis (Syngenta) agreement amounted to 0.7 percent and 1.2 percent of the total respectively. These figures appear to be *de minimis* at the campus level for the agreement and for all technology transfer activities. The same may not be true for faculty members who could see royalty payments that are several times larger than their annual salaries. Finally, figures at the department level are reported to be between 30 and 40 percent, which is arguably *non de minimis*, causing UCB to take special precautions.

Universities (2001) and the General Accounting Office (2001) have expanded the COI discussion to include institutional finances.

In addition, reference to the University in this context is somewhat misleading. A wide variety of boundary organizations have emerged to mediate between public and private institutions. For example, to prepare a report for policymakers on genetically modified organisms, the General Accounting Office worked with the National Academy of Science's National Research Council and received advice from a long list of boundary organizations, including the Association for Analytical Communities International (formerly the Association of Official Analytical Chemists), American Oil Chemists' Society, American Association of Cereal Chemists, Center for Science in the Public Interest, the Union of Concerned Scientists, the Biotechnology Center of the University of Illinois, the Health Sciences Center of Tulane University, Consumer Federation of America, Union of Concerned Scientists, the Council for Agricultural Science and Technology, the Pew Initiative of Biotechnology, the Biotechnology Industry Organization, Institute of Food Technologists, and the United Nations' Food and Agriculture Organization (U.S. General Accounting Office 2002). A California review of the same question produced by the California Council on Science and Technology (itself a boundary organization) included input from: the California Institute of Food and Agricultural Research; the Competitive Enterprise Institute; Greenpeace; the Grocery Manufacturers of America; the Hoover Institute, National Food Processors Association, the Organic Consumers Association, and the Union of Concerned Scientists (California Council on Science and Technology 2002).

A university's sphere of influence includes many of these entities each of which can influence activities in the private sector. Therefore, institutional COI policy is inappropriately limited if it does not look beyond the University to incorporate language addressing relations with boundary organizations. Individual participation in these organizations would be considered as Category II and Category III activities under UC's policy on Conflict of Commitment and Outside Activities for Faculty Members, yet COI issues are not covered.

Recent attention to the financial holdings of researchers also overshadows other motivations for scientific misconduct. Other interests among researchers include the personal satisfaction of solving one of nature's tightly held riddles, a drive for professional positions, recognition, and/or public notoriety. Financial conflicts are not needed for questionable behavior on the part of researchers or university leadership. While most policies address financial incentives derived from individual and institutional commercial interests, non-financial conflicts may have the same if not greater detrimental influence.⁵⁴ Individuals, especially in highly specialized fields, and institutions with

⁵⁴ Non-financial conflicts of interest include career advancement, publications, and fame (Cicero 2003). According to the AAU, misconduct in science relates to the inappropriate behavior in "proposing, carrying out, or reporting results" but not including "honest differences in interpretations or judgments of data." The AAU defined the falsification of data to include both outright fabrication and "deceptively selective reporting."

customized assets may have a sufficient potential for loss from outside commercial ties without financial COI. Numerous governmental, legal, and regulatory decisions can precede the investment of significant private capital. At this early stage when the agenda is still fluid, academic scientists inform the process through many distinct avenues. Early on few researchers if any would have financial ties to industry relative to a scientific innovation. Therefore, financial disclosures in the critical pre-lock-in period would likely provide little insight on potential COI.

The management of conflicts of interests must address both real and perceived conflicts. Even if biotechnology opponents are proven misguided alarmists at a future date, it does not alter the fact that the perception of a conflict exists and should be managed forthrightly. In this light, individual and institutional decisions within a broader scope could be brought under COI review. It is also routine to acknowledge that the establishment of new controls does not, in and of itself, imply any past wrongdoing.

Visions of the University

The various documents and interviews we conducted indicate profound disagreement about the role of the university. While others might put it in somewhat different terms, we see three somewhat overlapping yet distinct models of the university implicit in both documents and interviews. We have called the three models (1) the Engine of Growth, (2) Societal Betterment, and (3) Knowledge models. Probably only a handful of persons fully subscribe to any of the implicit models described here. They are best seen as Weberian (1947) ideal types rather than as descriptions of coherent views of well-defined groups of people. Yet, they do serve to put the matter in clear relief. Let us sketch out each of them below.

University as an Engine of Growth

Historically, growth was not problematized in the behavioral and economic sciences; in general, growth was viewed either as natural (e.g., Malthus) or serendipitous (Schumpeter). With the elaboration of the modernization project in the second half of the 20th century, attention was directed toward the factors that fostered economic growth. In general, four types of factors were identified – culture, human capital, social organization, and technology. Cultural themes of individualism, inquiry, and innovation were seen as supporting economic growth. Enhancements in human capital, both in general education and in specific occupational skills, contributed to the expansion of the economy. Particular forms of social and economic organization – democracy, free markets, trade, urbanization, the LGU – were viewed as fostering economic growth. And new forms of technology – energy, chemistry, information, biology – gave rise to new goods and services in an expanded economy. The role of the university in the growth process derives from its relationship to each of these four types of factors.

The concept of “engine of growth” or “growth machine” was one of the outcomes of the study of growth just described. Initially, it was an answer to an empirical question: How have the Four Tigers and the Newly Industrialized Countries been able to do what they

have done? But then the concept became an effort to identify the policy levers which could be manipulated to produce economic growth in a state, region or country. Once those levers were identified, the concept became contested terrain, where different social actors competed for social resources on the basis of claims about which factors produced the greatest economic growth. Four groups of claimants were particularly prominent in this contestation. A group of economists (e.g., Roemer 1970) emphasized the developmental impacts of trade and export-led development. Educators and labor economists (e.g., Romer 1989) emphasized the growth that followed from upgrading human capital. Sociologists and urbanists (e.g., Molotch 1976) wrote extensively about the city as a growth machine. And finally, advocates of different technologies (plastics, telecommunications) claimed that resources invested in their particular industries would produce the greatest return in economic growth.

During the 1980's and 1990's, biotechnology and information technology were viewed as the growth engines of the coming decades. Chemical companies (the growth industry of the late 19th century) built and bought significant biotechnological capabilities. Universities established biotechnology research parks where professors could undertake and direct work on for-profit ventures (Buttel 1986; Isserman 2000). Large clusters of biotechnological R&D were created in the metropolitan areas of Boston, St. Louis, and San Francisco. Between 1980 and 2000, hundreds of biotechnology venture capital firms started up; although many paid good salaries and wages, few made profits or paid a return on investment.

Especially as public financial support has decreased, universities have competed more openly for the "engine of growth" banner. Richard Levin (2001), the President of Yale University, has perhaps articulated this view in the greatest detail: at least in the U.S., universities are the principal source of new scientific discovery and thus of technological advance and economic innovation, and universities foster critical inquiry and creative leadership for industry and commerce. In an attempt to bolster its standing with the state legislature, in 2002 the University of Wisconsin at Madison commissioned a study of the impact of the university on the state's economy (Northstar Economics 2002); the chancellor of the university used the results of the study to argue against a reduction in funding that would hamper the university's ability to create high-paying jobs through the establishment of research parks. In 2003 the eight research universities in the Boston area compiled a report on the economic impact of the universities on the region (Appleseed, Inc. 2003).

UCB also employed the tactic used by the University of Wisconsin and the Boston area universities, and commissioned a study of the growth impacts of the university on the regional economy. *California's Future: It Starts Here* is an independent report on the breadth and depth of the university's contribution to California's economic growth, health, and community resources. Among its findings are that UC's impact on the state economy exceeded \$14 billion last year" (ICF Consulting 2003). The results supported the views that had been expressed over the years by many administrators.

In 2000, Trudis Heinecke, the director of physical planning for the university, pointed to “the expectation of research universities, that they will become an economic engine.” Geoffrey Owen (2003), the Dean of Biological Sciences, put it most straightforwardly: “the state’s education system has been the engine of economic growth in this state for decades.” The importance of biotechnology specifically had some political resonance; shortly before he was recalled, Governor Davis suggested:

A large part of California’s future is going to be in the rapidly growing life science industry, which is not only an engine for economic growth, but holds the key to alleviating vast suffering and improving the health and well-being of literally every person in the world. This is why life sciences is going to be a key focus of our overall economic growth strategy (quoted in Sacramento Business Journal 2003).

It was noted above that an economic frame was present in the early newspaper coverage of the controversy, and that economic aspects were the third most common theme in the journalistic coverage. Most of the times the economic theme was used, it was in relationship either to the economic needs of the university or to the economic benefits which the corporation would gain from the agreement. Very rarely did the argument that the agreement would be the driver of an engine of growth for the region or the state appear.

Although the news coverage did not emphasize the possibility of biotechnology being an engine of growth for the Bay Area, several of the university administrators and faculty did articulate that view. “More than ever, the university is seen as an agent of economic development, and there’s no place where that’s truer than in the Bay Area”; that person went on to note that 30 percent of the world’s biotechnology firms are in California and 30 percent of those were started by UC faculty. One administrator suggested that upper administration was emphasizing the view that the agreement made it possible for faculty to make the kinds of discoveries that have commercial value, which in turn promotes economic growth. Another administrator argued that “It could also be a benefit to the California economy. Even though most of the PMB faculty weren’t doing applied research, the faculty were aware that there could be economic benefits from their work.”

One faculty member acknowledged the “engine of growth” spin that the administration was putting on the agreement, but argued that it was premised on the assumption that an “industry-driven trickle down approach” will result in economic development. Another faculty member suggested that the university as an engine of growth was a model other countries desired. “[T]hey all look at it as, as this is the source of economic development. All the new companies are being started up and all the industry, in the biotech industry, in the computer industry, all start at the university.”

One public official involved in the controversy felt that the Price and Goldman (2002) study accepted uncritically the assumptions of the “engine of growth” model. The official felt that the model should be turned the other way around, to make “sure that the private sector is accountable to the public.”

The University as a Source of Societal Betterment

Those who adhere to the notion that the university is a source of societal betterment take a different approach – one which is fundamentally transformative. They see the university not as a means to grow in a predetermined direction, but as a means for remaking society based on shared, though reformable, ideals. Proponents of this model have a more or less well-defined program for the refashioning of society.

First, they argue that research should generate knowledge which is a public good. Given the agrarian origins of the nation, it should be no surprise that at LGUs, farmers were the initial beneficiaries of such public goods. Colleges of Agriculture poured forth a wide range of farm innovations, mainly of a biological sort, with the express purpose of helping farmers to raise their incomes and levels of living. Of particular note is that the bulk of these innovations were in the form of improved seeds or cultural practices. Until recently, neither were subject to IP laws. Moreover, the Cooperative Extension Service, an institutional innovation to which federal, state, and local governments contribute, was established to further the rapid spread of technical change. Programs in Home Economics and 4-H (for youth) ensured that farm women and children were also recipients of the benefits of public research.

Second, and following from the first point, proponents of the Societal Betterment model argue that knowledge should flow freely both within the university as well as to various more or less well defined clientele groups of the university. If knowledge is power, then it should be available to everyone, irrespective of their wealth or income.

Finally, proponents of this model see education as preparation for citizenship in a democratic society. Indeed, the Morrill Act of 1862 establishing the LGUs spoke clearly of promoting “the liberal and practical education of the industrial classes.” Higher education in a democratic society is not to be reserved for the rich; it is to be made available to everyone, whatever their class position. Better educated citizens, it is claimed, participate more, making better decisions not only about their home and work, but about the forms of government they want. They also further the American ideal of equal opportunity.

The University as a Generator of New Knowledge

Others interviewed adhered more closely to the final model we discuss here, that of the university as a Generator of New Knowledge. Proponents of this model note its several distinguishing features:

First, knowledge is desirable for its own sake. The university is seen as a great Cathedral of Knowledge in which faculty are the masons and stonecutters. Proponents of this model argue that the immediate usefulness or utility of knowledge is of little importance. What counts is that it is known. The pursuit of truth unhampered by the cares of the

workaday world is central to this view.

It follows from this model that education is a matter of learning the facts about the world. Educators' jobs consist in transferring the received wisdom of previous generations to the new one. Students are to take classes in order to learn the facts, to participate in canned laboratory experiments to demonstrate truths revealed by previous generations of researchers.

For proponents of this model, too, free circulation of knowledge is essential. But the aim of that free circulation is quite different than it is for proponents of the Societal Betterment model. Instead, it is argued that knowledge must circulate freely so as to support the goals of the academy itself in its eternal quest for truth.

Conclusion

The reader will have little difficulty recognizing strong elements of utilitarianism, pragmatism, and positivism, respectively, in the above scenarios. Indeed, this is not entirely accidental. Initially, we had considered describing them in precisely those terms. However, on further reflection it became clear that the three models were not entirely congruent with the three schools of philosophy. One important reason for the distinction is that the three models were formed in the rough and tumble world of practice, rather than in the scholarly debate among philosophers. They make few claims about the nature of the world, and only a few more about the nature of knowledge. Or, to put the matter differently, the practice of philosophy is quite different from that of those who create, modify, and transform universities. Most philosophers worry little about budgets, funding, licensing, building construction, police and fire protection, legislative mandates, or public demands in developing philosophical positions. They *do* worry about logical consistency, convincing others, and producing an adequate set of claims.

In contrast, those who run universities – and especially large research universities – are faced with an endless set of emergencies, crises, reorganizations, and the task of running what are and must be political institutions. They have little time, perhaps too little, to reflect on the consistencies or lack thereof in their views and actions. Theirs is reconstructed logic, rather than logic in use (Kaplan 1964). Nevertheless, a clear pattern emerges: the vision of the university as an engine of growth is now the dominant view. Lamentably, this has occurred with little or no real debate among faculty, students, or external constituencies.

We would do well to remember both parts of Eisenhower's warning quoted in the epigraph to this volume: He warned us about the need to avoid both the domination of university faculty by money and the capture of public policy by a scientific-technological elite. We now face the possibility of a scientific elite dominated by money and in charge of public policy. That does not bode well for the critical inquiry necessary to sustain democracy.

Recommendations

The MSU assignment included suggestions on guidelines for university-industry agreements. Given the experience of the UCB-N agreement, how should universities handle future industrial relationships? Since the agreement explicitly included UC policy, review should extend from the specific language in the agreement to UC policy and practices. Recommendations for consideration by the Berkeley community are as follows. UCB should:

- 1. Avoid industry agreements that involve complete academic units or large groups of researchers.**

The UCB-N agreement's coverage by one firm of numerous faculty members in one department was outside the mainstream for research contracts with industry. While an intriguing experiment, there appears little rationale for repeating the approach. Standard agreements or templates can serve to streamline negotiations with industry without the complexity of unit-wide decision making. With general terms agreed upon, individual research projects may be defined around specific researchers and the specific scope, scale, duration, and matching funds involved.

- 2. Reassess in a comprehensive fashion the implications of non-financial and institutional conflicts of interest.**

This case study suggests that the boundaries of current COI policy and codes of conduct are unrealistically narrow in several respects. Additional consideration is needed of non-financial COI stemming from allegiance to a specific discipline or research agenda. Given the growing role of the institution in the management of IPR and economic development, institutional COI policies (or conflicts of mission) need heightened scrutiny. An assessment should review the full extent by which UC actors, including administrators, may influence commercial and governmental affairs as employees, consultants, and vocationally.

- 3. Encourage broad debate early in the process of developing new research agendas.**

The overall policy agenda for biotechnology took shape between the late 1970s and early 1990s. By the late 1990s, related commercial activity with its university and governmental components had gathered considerable momentum. The UCB-N debate came too late for some participants to exercise meaningful degrees of freedom. Events that tower in importance over the UCB-Novartis agreement include the Asilomar Meeting on Recombinant DNA (1975), the *Diamond v. Chakrabarty* Supreme Court decision (1980), the release of the U.S. government report on a *Coordinated Framework for Regulation of Biotechnology* (Office of Science and Technology Policy 1986), the release of U.S. government report *Policy on Foods Derived from New Plant Varieties* (Department of Health and Human Services 1992), and the recommendations of the

National Science and Technology Council's Interagency Working Group on Plant Genomes (1998). While the outcomes of the UCB-N agreement do not appear pivotal relative to research agendas, earlier occasions that were pivotal included input from UC scientists and administrators. Therefore, UC faculty and administrators may wish to engage in timely reviews of institutional commitments to possible alternatives to the dominant paths of scientific research in their formative years, especially when faced with public controversy.

4. Be attentive to the formulation of new goals when motivated by a disruption of patronage or by self-interest.

Financial uncertainty is a breeding ground for both creativity and the exploration of new goals for research. UC's experimental approach to industry-sponsored research in the late 1990s was born of financial woes. Disruptions of patronage or self-interest on campus should not distort the public interest or dilute public participation in goal formation. Future forums along the lines of the President's Retreat should include an emphasis on the University's ability and discretion to balance the interests of financial patrons with the articulated interests of other stakeholders.

5. Make organizations associated with UC or supported by institutional resources transparent to the public.

Various non-government organizations operate within the sphere of influence of major universities. Trade, professional, economic development, and special interest organizations are often important conduits of scientific findings under public, regulatory and legal review. Many of these entities can and do have an impact on the private sector above and beyond direct university-industry relationships. UC employees may provide influential assistance to these organizations and/or government agencies (e.g., testimony, scientific panels, and committees). Therefore, future policy review should look more broadly at institutional and individual codes of conduct that address relations with organizations linked to UC or to UC faculty and staff. Individual participation in these organizations are considered under UC's policy on *Conflict of Commitment and Outside Activities for Faculty Members* without discussion of potential conflicts of interest and codes of conduct. This omission should be examined in the public interest.

6. Assess institutional obligations and commitments to reliable production and communication of regulatory science.

While government regulators are the final protection against unexpected consequences of new technology, these actors frequently rely on the expert opinion of university researchers. Any perceived conflict of interest on campus can undermine confidence in the regulatory system key to emerging science and technology. The danger to the public is that university-industry bonds could dilute the implementation of desirable regulations considered inconsistent with private-sector interests. For example, scientific interpretations on the existence of allergens or carcinogens should be independent from any financial interests from the sale of products undergoing such testing. Scientists may

influence the regulatory regime through multiple channels, including: 1) engaging in scientific dialogue (e.g., scientific conferences); 2) contributing to the scientific literature through submissions or through the peer-review or editorial process; 3) managing and assessing IP; 4) engaging in public communications including interactions with the media; 5) participating in boundary work and supporting boundary organizations; 6) conducting or choosing not to conduct research specifically for regulatory purposes; 7) serving directly on scientific advisory panels or in similar roles; and 8) consulting with industry on related matters. UCB should review its own financial support of regulatory science and how the University encourages an environment for honest brokers of information and analysis. Additional attention to the health of regulatory science could be both a public service and a check against perceived conflicts of interest and institutional duplicity.

7. Strive to educate the public on the specific nature of intellectual property, technology transfer, and the nature of institutional accountability.

Much has been made of the public's general lack of scientific knowledge. It is also true that there is considerable misunderstanding regarding the patenting system and university licensing. The latter lack of understanding may lead to the belief that patented technology developed at and licensed by the UC carries a *de facto* endorsement by the University. The absence of institutional liabilities should be more actively communicated. On campus, faculty, students, and administrators should have a better grounding in the specifics of IP management and policy.

8. Work to identify and prevent the masking of intended applications of knowledge or potential negative consequences of commercialization with the privileges implied by academic freedom.

One feature apparent in the UCB-N experiment is the continuation of a long-term pattern whereby certain participants successfully circumvent public and scientific concerns surrounding a specific research agenda. There are indications that the overstatement of academic freedom mixed with interests in commercialization is simultaneously eroding the public trust in science and the genuine merits of scholarly autonomy. University scientists and administrators have found occasion to use the ideals of academic freedom to create distance from accountability relative to any ethical, moral, or economic issues pertinent to their research agendas. Academic freedom should encourage the expression of alternative views rather than shelter conduct from scrutiny. The privileges of academic freedom do carry the responsibility of professional ethics and candor. In this context, UCB faculty and administrators should confront the rhetorical construction of pure science distinct from externalities. Is it truly meaningful to assert that resource allocations or tenure decisions are made solely on the merits of science? Or does this ideal now serve as the central pillar in a dysfunctional debate? The UCB community could explore a working ideal for scientific research that is better grounded in the reality of applications and patrons. A revised approach could include administrative procedures and mechanisms of the Academic Senate for faculty and staff seeking assistance with

professional tensions and/or multidisciplinary disputes. Thoughtful assistance would acknowledge the complexity of outside influences rather than assuming that these influences may be eliminated with heightened vigilance in the name of academic freedom or pure science.

9. Begin the difficult task of determining the role a public Land Grant University should play in the twenty-first century by re-examining core commitments.

The UCB-N agreement acted as lightning rod for numerous inarticulate concerns about the role and purpose of the university. Both supporters and detractors claimed to take the high road with respect to what we argue are the three core principles of the university. In some sense all are right. But what has been obscured by the day-to-day business of the university – the teaching, research, and service obligations of faculty, the myriad requirements of managing a large and dynamic institution, the financial exigencies – is attention to the broader goals and objectives of the university. These issues have received scant attention as ad hoc, short-term decision making has intruded on faculty and administrators alike. This is true at UCB, but it is also true at nearly every public research university in the United States.

First, there is widespread agreement on the need for faculty autonomy at the university, but the various (usually implied) definitions of autonomy are vague and perhaps antithetical. Of what shall autonomy consist? What do we mean by academic freedom? How ought we to try to reconcile the disparate goals of diverse fields of endeavor? Is academic freedom merely the freedom of individual researchers to pursue their interests, or must we begin to consider the concept as it applies to departments and centers as well?

Second, there is also widespread agreement on the need to support and even bolster creativity among the faculty. But here, too, the definitions are vague. Can UCB do this in a manner that does not reward some by penalizing others? Can it develop mechanisms for enhancing creativity that are inclusive rather than exclusive? Can it better define what kinds of grants and contracts best serve to enhance the creativity of some faculty without limiting the creativity of others?

Third, there is widespread support for diversity. But diversity means different things to different people. Here, too, universities face what appear to be tradeoffs between enhanced intellectual diversity within a given field of endeavor versus enhanced intellectual diversity across fields of endeavor? Is there really a tradeoff? If so, how might UCB ensure that it is equitable? If not, how does UCB determine whether to pursue greater depth in a given field of scholarship *v.* supporting multiple fields of scholarship?

Fourth, the UCB community must ask whether the three core principles of autonomy, creativity, and diversity are in fact still at the core of higher education. Do they need to be modified? Replaced? Reordered?

Finally, UCB must ask again how it shall distribute goods in order to achieve its goals. What mix of markets, need, and dessert is appropriate for teaching, research, and service in the new century? How can the University reconcile these disparate approaches to the distribution of goods in a way that achieves the common good?

These are difficult questions without simple answers. But failing to address the questions is likely to be far more damaging to the future of research universities than continuing to ignore them and proceeding virtually blindly into the future. Clearly the future will not be a mere repetition of the past. But it will be molded, perhaps not just as some would like it, by decisions made today not only on university campuses, but by state and national legislative bodies and even the courts. UCB, and similar institutions, need to examine those policies and procedures and see whether they fit together in ways that are meaningful and serve the common good.

UCB is particularly well situated to begin this kind of national dialogue. Although both the greatest hopes of its supporters and the greatest fears of its detractors have not come to pass, the agreement with Novartis has served as an icon for the divergent views of the university. As a recognized national leader in higher education, with a strong and vibrant tradition of faculty governance, UCB is perhaps best situated as a place to begin such a serious debate. And, as a leader, perhaps it has an obligation to do so as well.

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Methods Appendices

Interview Methods

The analysis contained within this report is based on a variety of information sources including press releases, newspaper articles, committee minutes, policy reports, internal studies, and legislative hearings. Semi-structured interviews were also conducted with a wide range of people to provide a broad perspective on the strategic alliance between UC Berkeley and Novartis. As such, no attempt was made to ensure a 'random sample' of interview participants, although we did try to interview all of the PMB faculty members. The selection of interview participants occurred with the aim of maximizing the diversity of standpoints, although a truncated snow-ball sample approach was also employed.

Eighty-four people were interviewed including (1) PMB faculty; (2) PMB post doctoral researchers; (3) PMB graduate students; (4) ESPM faculty; (5) ESPM graduate students; (6) UCB faculty outside of CNR; (7) Academic Senate Committee members; (8) UCB administration; (9) UC central administration; (10) agricultural commodity groups; (11) alternative agricultural and environmental organizations off-campus; (12) USDA Plant Gene Expression Center employees; and (13) TMRI/Syngenta employees. Most of the interviews occurred face-to-face during three periods of time: (1) January 2002; (2) August 2002; and (3) from September 2002 to October 2003. During the latter period, telephone interviews were also conducted.

The interviews progressed in the same manner regardless of the physical setting of the interview. First, the participants were made aware of the voluntary character of the interview and were asked to sign either a confidential or public letter of consent (see latter in this section for examples of these letters). The interview was conducted as a semi-structured conversation where there were pre-identified topics of conversation but they were not asked in a particular format. Also, as new topics came up in the course of discussion, these were followed as and when they appeared relevant to the broader question of the implications and consequences of increasing involvement of public universities with private industries. An example of the interview schedule can be found later in this section, although clearly not every question was relevant to, or asked of, every participant. The interviews were tape-recorded with the participant's knowledge and consent in order to ensure any verbatim quotations were reproduced correctly. The tapes were not formally transcribed, nor will any voice record be maintained after the conclusion of this study. All of the interviews lasted between thirty minutes and two hours.

The notes taken during the interview were written up, with the aid of the tape recordings, in an electronic format soon after the interview. Using *QSR NVivo*, a qualitative data analysis program, each interview was coded three times in an effort to ensure reliability for subsequent analysis. The analysis of these interviews and other documents are presented throughout this report in the appropriate sections.

Media Data and Methods

This section gives more detail to how the media section in this report was developed. We discuss both content and context of the data gathering for both the UCB materials and popular press.

UCB Press Releases and The Berkeleyan

When we began our systematic analysis of the reports which were sent to us by people at UCB, we treated them all as popular press articles until we realized that some of the documents were being written and published by UCB organizations. We decided to search the UCB public relations web site for other reports of the Agreement, and found that thirteen such documents did exist. We distinguished between UCB press releases and articles appearing in the campus newspaper – *The Berkeleyan* – as the former would be sent to outside sources, while the target for the latter would mainly be the faculty and staff on campus.

Given that we only had thirteen articles to analyze, we decided upon a qualitative approach to these documents (e.g., Altheide 1996; Nord 1989), focusing on the trajectory of the internal evaluation of the Agreement. We paid special attention to who was being quoted in the documents, how they talked about the Agreement, and how this changed, if at all, over time. As mentioned in the section on the public face of the Agreement, our analysis showed how Gordon Rausser was tied heavily to the Agreement in the beginning, and all internal discourse was positive. As the Agreement was ending, Rausser's name was not as prominent, and the UCB Public Information Office (PIO) was taking a more guarded, though still optimistic, stance on the issue.

The Popular Press

Our study of the popular press was expanded to a national search for stories on this Agreement. A *Lexis-Nexis* search was conducted for 1998 to 2002, revealing 15 articles using the search terms Berkeley and Novartis. In addition, we searched the newspaper archives for the *San Francisco Chronicle*, *San Francisco Examiner*, *San Francisco Guardian*, *San Jose Mercury News*, *Contra Costa Times*, and *Daily Californian*, the latter being the general campus newspaper. Finally, we received a packet of general news articles from an individual at UCB, some of which overlapped other searches. A total of 71 articles were found on the topic between October 1998 and June 2002.

The framework for analyzing these 71 articles was based on research focusing on news coverage of biotechnology by one of the co-investigators of the project (see Ten Eyck et al. 2001; Ten Eyck and Willment 2003), which in turn was based on the work of Gamson and Modigliani (1989). The codebook developed consisted of variables ranging from the name and type of author (journalist, editorial writer, etc.) to length of the article to demands being made and accounts given. A total of 30 variables could be coded,

including up to three themes, three actors (or sources), two demands, and two actors making demands. All articles were coded and entered into SPSS by two coders once intercoder reliability was reached (approximately five articles). All ambiguous or unclear articles were discussed between the two coders. We decided that only descriptive statistics would be given based on the small number of articles appearing on the topic.

Consent Letters

Public Record Letter

Dear Colleague,

In recent years, the relationship between universities, corporations and the government has been changing. New opportunities for collaboration between public and private institutions in the funding of research, the setting of research goals and the priorities of technological development have emerged. Additionally, recent legislation has introduced new intellectual property rights, allowing new forms of patents including the patenting of new forms of living organisms. The Academic Senate of the University of California, Berkeley, has engaged researchers at Michigan State University (MSU) to study the recent, agreement between Berkeley's Department of Plant and Microbial Biology and Novartis Corporation, now part of Syngenta Corporation. The objectives of our study are to examine the effects of the agreement on the University's inner workings, both administrative and academic, and its relationship with industry, government and the public.

We request that you allow us to ask you questions about your understanding of the agreement and its outcomes. Your permission to tape the interview is requested so that we may use the tape to aid in compiling detailed notes from the interview. We will not be engaging in a verbatim transcription of the interview and the tapes will be destroyed at the end of the study. No voice record will be maintained. The interview will take approximately one hour. Our concern is with the effects of the agreement on the University's internal workings and external relations. As such, we will not be asking any personal questions or requesting any private or sensitive information about your work. For this reason, and because we would like to report on the views and activities of a wide range of persons involved, we will consider your responses, unless you indicate otherwise, *for the public record*. They will therefore not be treated in a confidential manner.

Of course, your participation is entirely voluntary, and you may feel free to withdraw from the interview, to skip any items or request that the recorder be turned off any time during the interview. Your help and cooperation would be greatly appreciated. Should you have any questions about the interview, feel free to call the Director of this research, Dr. Lawrence Busch, at 517-XXX-XXXX. If you have questions about being a human subject of research please call Dr. Ashir Kumar at the MSU's human subjects office at 517-XXX-XXXX.

Sincerely,

Dawn Coppin, Ph.D.
Research Associate

Your signature and date below indicates that you have read the above letter and indicate your agreement to participate in this study.

Signature: _____

Full name: _____

Date: _____

Confidential Letter

Dear Colleague,

In recent years, the relationship between universities, corporations and the government has been changing. New opportunities for collaboration between public and private institutions in the funding of research, the setting of research goals and the priorities of technological development have emerged. Additionally, recent legislation has introduced new intellectual property rights, allowing new forms of patents including the patenting of new forms of living organisms. The Academic Senate of the University of California, Berkeley, has engaged researchers at Michigan State University (MSU) to study the recent, agreement between Berkeley's Department of Plant and Microbial Biology and Novartis Corporation, now part of Syngenta Corporation. The objectives of our study are to examine the effects of the agreement on the University's inner workings, both administrative and academic, and its relationship with industry, government and the public.

We request that you allow us to ask you questions about your understanding of the agreement and its outcomes. Your permission to tape the interview is requested so that we may use the tape to aid in compiling detailed notes from the interview. We will not be engaging in a verbatim transcription of the interview and the tapes will be destroyed at the end of the study. No voice record will be maintained. The interview will take approximately one hour. Our concern is with the effects of the agreement on the University's internal workings and external relations. As such, we will not be asking any personal questions or requesting any private or sensitive information about your work. We will consider your responses confidential to the extent that the law allows. They will not be reported individually, but only as aggregate trends.

Of course, your participation is entirely voluntary, and you may feel free to withdraw from the interview, to skip any items or request that the recorder be turned off any time during the interview. Your help and cooperation would be greatly appreciated. Should you have any questions about the interview, feel free to call the Director of this research, Dr. Lawrence Busch, at 517-XXX-XXXX. If you have questions about being a human subject of research please call Dr. Ashir Kumar at the MSU's human subjects office at 517-XXX-XXXX.

Sincerely,

Dawn Coppin, Ph.D.
Research Associate

Your signature and date below indicates that you have read the above letter and indicate your agreement to participate in this study.

Signature: _____

Full name: _____

Date: _____

Sample Interview Schedule

UC-Berkeley/Novartis (Syngenta) Study Tentative Questions for Faculty Interviews

Organization and Governance

1. In what ways, if at all, has the Novartis agreement and/or others like it affected organizational and governance processes, systems, or structures at UCB?
2. From your perspective, has the UCB-Novartis (Syngenta) agreement and/or other agreements like it changed the decision making processes of the university? If so, at what levels (department, college, university)? In what ways?
3. Have the relationships between your unit and other units changed as a response to changing relationships between the university and industry? If so, in what ways? (Funding, resources, salaries, etc.)
4. Are agreements like the UCB-Novartis (Syngenta) agreement producing closer ties between UCB and industry? Have new organizational and institutional arrangements come into being as a result of closer ties to industry? If so, what are these? How have they changed?
5. Has industry funding changed the way in which research is conducted in your department? In what ways has it helped? Hindered?
6. Universities are generally collegial places in which ideas are frequently exchanged among faculty. Has the collegiality and exchange of ideas among faculty at UCB changed in recent years? To what extent do you see those changes in collegiality/exchange as due to the changes in university-industry relationships (funding, agreements) you described above? What are some of the consequences of those changes in collegiality/exchange?

University Mission

7. In what ways, if at all, has the Novartis agreement and/or others like it affected the university at UCB?
8. Does the Land Grant mission of the University of California, Berkeley play a significant part in your work?
9. From your perspective, does Berkeley's Land Grant mission fit with the increase in corporate research funding over the last few decades?
10. Is the agreement with Novartis (Syngenta) meaningfully different than other corporate agreements in terms of its relationship to the University's Land Grant mission?
11. Do you find the agreement with Novartis (Syngenta) to fit within the context of the Land Grant mission of the University of California?
12. From where you sit, does the Land Grant mission of the university need to be updated, to catch up with the changing times and new relations between government, the academy, and industry?

University-Government Relations

13. In what ways, if at all, has the Novartis agreement and/or others like it affected university-government relations at UCB?

14. Does the UCB-Novartis (Syngenta) agreement and others like it indicate to you that the character of governmental oversight and regulation of universities has changed? If so, how? And, if not, where do you see the role of governmental or public oversight fitting in the arena of university-business relations?
15. Do you see agreements such as that between UCB and Novartis (Syngenta) as an indication of changing relations between governmental granting programs and research universities?
16. Do you see a change in government funding, or funding priorities, as a likely consequence of agreements such as that between UCB and Novartis (Syngenta)?
17. Do you see a changing role, or possibly conflicting roles, for scientists in public hearings, or in court, as a result of university-corporation agreements such as that between UCB and Novartis (Syngenta)?

University-Industry Relations

18. In what ways, if at all, has the Novartis agreement and/or others like it affected university-industry relations at UCB?
19. What sectors of the California economy will be significantly impacted by the UCB-Novartis (Syngenta) agreement?
20. In what ways will the UCB-Novartis (Syngenta) agreement affect the kinds of research projects that are conducted at UCB with respect to California economic interests?
21. What impacts will the UCB-Novartis (Syngenta) agreement have on the ability of California economic interests to influence research programs at UCB?
22. What impacts will the UCB-Novartis (Syngenta) agreement have on relationships between California's economic interests and UCB faculty?
23. What implications or likely impacts do you think that the UCB-Novartis (Syngenta) agreement will have for the food and agriculture sector of California? For different groups within that sector?
24. What implications or likely impacts do you think that the UCB-Novartis (Syngenta) agreement will have for the environmental management and natural resource management industries in California? For different groups within those industries?
25. Has the UCB-Novartis (Syngenta) agreement had any impacts on other campuses of the California system?
26. Does the UCB-Novartis (Syngenta) agreement make departments or faculty at UCB more or less attractive as partners for other biotechnology corporations or other corporations in general?

Intellectual Property Rights

27. In what ways, if at all, has the Novartis agreement and/or others like it affected handling of intellectual property rights at UCB?
28. Do you find that intellectual property restrictions (often included in confidential disclosure, material transfer, licensing, and research agreements) alter the nature or scope of your research? Have your collegial research relationships on- or off-campus been impacted?

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29. Do you find the intellectual property rights relative to the UCB-Novartis (Syngenta) agreement unique relative to other agreements with industry? If so, what has been the impact on your research?
 30. Do you find that the financial incentives related to licensed intellectual property motivate or influence the nature or scope of your research? Do you feel that these incentives alter the department and university decisions that impact your research? Would your answers be different regarding the specific case of the UCB-Novartis (Syngenta) Agreement?

Media

31. In what ways, if at all, has the Novartis agreement and/or others like it media relations at UCB?
32. Have you seen/heard/read much in the popular mass media concerning the University of California-Berkeley -- Novartis (Syngenta) agreement, and has there been any coverage of similar agreements? What about the academic press?
33. In general, how do UCB faculty relate to popular press reporters? How do they relate to scientific reporters?
34. Are there issues in which faculty members are either encouraged or discouraged from talking with reporters?
35. Would you need prior approval to discuss university work with a reporter?
36. Do you think the Internet is important on issues such as the UCB-Novartis (Syngenta) agreement? To what extent do faculty use the Internet for either research or disseminating ideas, and are there procedures to follow if the Internet is used?

Faculty Relations

37. In what ways, if at all, has the Novartis agreement and/or others like it affected faculty relations at UCB?
38. Overall, has the Novartis (Syngenta) agreement and/or others like it changed how you think about and do your work? If so, in what ways?
39. How has the association with Novartis (Syngenta) affected research funds available to your laboratory?
40. Has the Novartis (Syngenta) agreement and/or others like it influenced the direction of your research?
41. Since the initiation of the agreement, has there been a change in your involvement in graduate or undergraduate education?
42. Do you perceive a change in your relationship and collaborations with colleagues outside your Department and University?

Appendices

Appendix A: Project Title and Amount of UCB-N Funding by Faculty Member

Faculty	Project Title	Total Funding
Thomas Bruns	Population Structure and Autecology of <i>Tomentella sublilacina</i> and <i>Boletus edulis</i> , Two Key Ectomycorrhizal Species	\$500,000
Bob Buchanan	Understanding Thioredoxin-Linked Proteins	\$950,000
W. Zacheus Cande	Discovery and Characterization of Meiotic Genes of Maize	\$570,000
John Coates	Investigation of a Novel Activation Step in Anaerobic Benzene Degradation	\$100,000
Lewis Feldman	Environmental Sensing in Roots: The Role of Changes in pH	\$425,000
Michael Freeling	Valuable Alleles From Exotic Grasses	\$950,000
Louise Glass	Genetic and Molecular Dissection of the Process of Hyphal Anastomosis	\$550,000
Wilhelm Gruissem	Genetic and Molecular Dissection of Isoprenoid Synthesis in Plants	\$320,000
Antje Hofmeister	Mechanism of Signal Transduction for the Proteolytic Activation of a Developmental Transcription Factor	\$425,000
Jay Hollick	Epigenetic Mechanisms of Gene Control in <i>Zea mays</i>	\$410,000
Andrew Jackson	Strategies for Isolating Genes Affecting Host Susceptibility to Viruses	\$560,000
Russell Jones	Programmed Cell Death in Plants	\$500,000
Sydney Kustu	Whole Genome Studies Of Nitrogen-Regulated Transcription in Enteric Bacteria	\$810,000
Peggy Lemaux	Using Genomics Research Tools to Understand and Improve Cereals and their Transformation	\$700,000
Steven Lindow	Disruption of Microbial Extracellular Signalling Systems as a Novel Method of Plant Disease Control	\$575,000
Sheng Luan	Protein Phosphatases and Stress Signaling	\$575,000

Faculty	Project Title	Total Funding
Anastasios Melis	Genes for the Repair of the Photosynthetic Apparatus	\$370,000
Krishna Niyogi	Functional Genomics of <i>Chlamydomonas reinhardtii</i> : Responses to Oxidative Stress in Adverse Environments	\$650,000
Peter Quail	Signaling Intermediates in phyD and phyE Transduction Pathways	\$650,000
Brian Staskawicz	Development of Mutational and Functional Genomic Strategies to Elucidate Bacterial Disease Resistance Pathways in Solanaceous Plants	\$950,000
Z. Renee Sung	<i>EMF</i> , the Floral Repressor?	\$450,000
John Taylor	Inheritance and Molecular Population Genetics of Arbuscular Mycorrhizal Fungi	\$575,000
Norman Terry	Novel Biotechnological Approaches for the Improvement of Plants for Selenium Phytoremediation	\$370,000
Loy Volkman	Baculovirus Pathogenesis and Host Resistance Mechanisms	\$575,000
Patricia Zambryski	Analysis of the Transmembrane Transport Channel Utilized by <i>Agrobacterium Tumefaciens</i> during the Genetic Transformation of Plant Cells	\$730,000
Total		\$14,240,000

Appendix B Graduate Program Numbers

Table 9. Combined PMB Graduate Program

	Applications	Admissions	Matriculation	% Matriculation	Stipend \$
1995	58	10	9	90.00	14,803
1996	52	14	8	57.14	14,839
1997	57	14	9	64.29	15,300
1998	57	16	11	68.75	15,700
1999	94	23	11	47.83	17,200
2000	82	26	16	61.54	20,000
2001	109	29	16	55.17	21,500
2002	108	23	10	43.48	22,000
2003	138	22	11	50.00	22,000
2004	117	25	13	52.00	

Note: As of 05/27/04 the 2004 stipend amount is unavailable.

Table 10. Plant Biology Division Graduate Program

	Applications	Admissions	Matriculation	% Matriculation
2000	62	19	12	63.16
2001	63	16	8	50.00
2002	61	14	8	57.14
2003	78	13	6	46.15
2004	54	13	9	69.23

Note: Prior to 2000 there were numbers only for the entire department.

Table 11. Microbial Biology Graduate Program

	Applications	Admissions	Matriculation	% Matriculation
2000	20	7	4	57.14
2001	46	13	8	61.53
2002	47	9	2	22.22
2003	60	9	5	55.56
2004	63	12	4	33.33

Note: Prior to 2000 there were numbers only for the entire department.

Appendix C: Number of Undergraduate Majors in Comparable Departments to PMB

Table 12. Undergraduate Majors (Fall-Spring Average)

	MCB	ESPM	ARE	NST
1994-95	738.60	230.25	97.50	122.75
1995-96	769.02	218.75	86.00	129.50
1996-97	745.90	224.75	77.00	119.25
1997-98	740.30	231.25	79.25	109.75
1998-99	770.55	245.50	77.50	104.25
1999-00	831.33	292.25	96.00	101.00
2000-01	811.08	324.33	99.25	101.50
2001-02	778.17	280.42	93.25	100.75
2002-03	826.47	263.75	70.00	109.25

Source: Office of Planning and Analysis (2004)

Appendix D: Agreement provisions

The agreement between the Novartis Agricultural Discovery Institute, Inc. and the University of California, Berkeley was successfully completed on November 23, 1998. It noted that, “The ultimate goal of NADII is to achieve commercialization of products based upon technology developed under this agreement” (NADII and UC 1998, 1). At the same time, it was noted that the agreement would further the research and teaching goals of the university. Among the major provisions of the agreement were the following:

Funding

1. NADII was to provide \$25 million, 2/3 of which would go to PMB and 1/3 of which would be used to cover indirect costs.
2. NADII expected to receive a federal, state, and local tax credit for the research conducted at UCB.
3. No funds or research materials from other for-profit organizations were to be used under the agreement.

The Research Committee

1. A Research Committee was to be established with three members from PMB and two from NADII to review and approve research proposals from faculty on an annual basis.
2. The Research Committee was to base awards on the quality and intellectual merit of research, the potential advancement of discovery, and the productivity of the PI. Proposals were to be ranked in three categories: \$100,000-200,000/yr, \$50-100,000/yr, and \$0-50,000/yr.
3. “Research projects will be selected by PMBD faculty members in areas of their interests. The Research Committee will not make recommendations to PMBD faculty as to the scope and long-term goals of their proposed research projects” (NADII and UC 1998, 30).
4. Proposals were to consist of one page on objectives, 1/2 page on key results, one page on experimental outline, followed by citations and a curriculum vitae. Awards were to be made for three years subject to annual review.
5. Research Committee members were barred from taking part in discussions of their own proposals.
6. The Research Committee would encourage disclosure of inventions within the scope of agreement. NADII, in turn, would have the right to review and make suggestions on drafting of patents. Responsibility for filing would remain with the University, but NADII would pay for filing. If foreign patents were desired by NADII, it would both file and pay for those.

The Advisory Committee

1. An Advisory Committee was to be established with six members – the Vice Chancellor for Research, the Dean of CNR, and one UCB faculty member without ties to PMB or CNR, the President of NADII, and 2 Co-Presidents of NABRI – plus the Chair of PMB and the Chair of the Research Committee as non-voting members. The Advisory Committee was to be responsible for managing the relationship. It was to meet annually and would have no control over the selection of projects by the Research Committee.

Intellectual Property

1. The university was to own all research results but was not to publish, copyright, disclose, or disseminate any results that included NADII proprietary materials or information without consent of NADII.
2. All proposed publications were to be submitted to NADII 30 days prior to submission for publication to determine if they should be treated as a research invention.
3. If it was so designated, then it would be withheld from publication for 90 days or until a patent application is filed.
4. Inventions emerging from use of NADII's data were to be provided to NADII with an irrevocable, royalty free license.
5. NADII was to have the first right to negotiate a non-exclusive, royalty bearing license agreement. p17. NADII would be able to sublicense to its affiliates
6. NADII could terminate its licenses at its discretion
7. NADII could exercise its rights to an “allowed percentage” of all subject inventions. During the first three years, it was able to accumulate based on allowed percentages of the first three years.

Other Aspects of the Agreement:

1. NADII intended to establish a facility near the university that would provide workspace for PMB faculty.
2. Wilhelm Gruissem was initially to be the Principal Investigator. However, provision was made for his replacement by election of faculty in the event of his departure.
3. Supplies and equipment purchased became the property of the university.
4. Termination was permitted with one year's written notice.
5. Disputes were to be settled by arbitration through the American Arbitration Association.
6. NADII employees who received university appointments were to be subjected to university IPR policies. [None were so appointed.]
7. Faculty who had relations with the Novartis corporations were required to disclose any financial interest they may have had. If they did have a

- financial interest, then the Berkeley Conflict of Interest Oversight Committee was to review the case and advise the Vice Chancellor for Research.
8. UCB was to provide NADII with an annual research report 60 days after the end of each year. A meeting of all supported investigators was to follow soon after, at which research results were to be discussed. The cost of the meeting would be paid separately from the \$25 million grant, although travel expenses of grantees would be paid from grant funds.

The Agreement was amended three times. The first amendment reduced the funds slightly to permit transfer of funds to the nearby USDA Plant Gene Expression Center in Albany. A separate Cooperative Research and Development Agreement (CRADA) was signed with USDA. It also required NADII to inform the university within 30 days if a publication contained patentable subject matter. The university then had 15 days in which to supply NADII with information required for disclosure (NADII and UC 2000a).

The second amendment changed the rules governing the use of Affymetrix-Produced Expression Probe Arrays, a type of proprietary equipment in use in PMB labs for synthesizing organonucleotides. Prior to the signing of the agreement with Novartis, UCB had an agreement with Affymetrix. It was more favorable than a similar agreement between Affymetrix and Novartis. This amendment permitted PMB faculty to take advantage of the initial agreement with Affymetrix rather than being bound by the agreement between Affymetrix and Novartis. It also made minor modifications of the funding amounts (NADII and UC 2000b).

The third amendment changed the name of NADII to the Torrey Mesa Research Institute (TMRI) and clarified some technical points with respect to materials transfer (TMRI and UC 2002).