FROM STREETS TO SUITES:
HOW THE ANTI-BIOTECH MOVEMENT AFFECTED GERMAN PHARMACEUTICAL FIRMS*

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ABSTRACT

How do social movements affect decisions within corporations, such as the commercialization of new technologies? We suggest that the effect of movement activism is conditioned by the internal polity and therefore varies across organizations. This article examines how the anti-genetic movement in Germany during the 1980s affected six domestic pharmaceutical firms' commercialization of biotechnology. We develop a process model of how movements penetrate the relatively closed polity of private organizations. External contestation weakened the position of internal champions of biotechnology, precipitated divisions among organizational elites, and undermined collective commitment to the technology. The movement also increased perceptions of investment uncertainty, but the consequences of this uncertainty depended on organizational logics of decision making. As a result, investments in some firms were tilted away from domestic biotechnology projects. The model also explains this variation in organization-level outcomes of movement contestation.

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In the 1970s, the German pharmaceutical industry was known as the pharmacy to the world, and its leading companies were among the first to explore commercial applications of genetic engineering in the 1970s and early 1980s. Both Social Democratic and Christian Democratic governments supported biotechnology by creating national research laboratories and subsidizing university research. Leading pharmaceutical companies, such as Hoechst and Boehringer Mannheim, began in-house research on commercial applications of biotechnology in the late 1970s and collaborated with advanced research centers in the United States, such as Massachusetts General Hospital. In the early 1980s, German firms and researchers applied for more biotechnology patents per capita than their U.S. counterparts.[1] Due to the absence of venture capital, no entrepreneurial biotechnology sector existed in Germany until the late 1990s, so existing pharmaceutical firms were critical for driving innovation.

By the early 1990s, however, this surge by pharmaceutical firms faltered.[2] While a few smaller firms had some success with commercializing biotechnology, some of the largest, profitable, and politically powerful corporations struggled. Production plants were sitting idle (e.g., Hoechst's $37 million facility in Frankfurt), delayed (e.g., Bayer's plant to make genetically engineered protein for hemophiliacs in Wuppertal), or shifted abroad (e.g., to Japan, the United States, and France in the case of Bayer and Hoechst). Worse, they largely failed to commercialize their knowledge in the form of biotechnology-based products. Why were these firms unable to produce and develop biotechnological products in Germany? How did powerful and resource-rich pharmaceutical firms with pioneering knowledge come to lag behind less distinguished domestic counterparts? Our study suggests that an intense, short-lived movement against genetic technology in Germany in the 1980s affected decision processes inside some companies and impeded their commercialization efforts.

The events during this period are not simply of idiosyncratic interest to those concerned with the fate of medical biotechnology in Germany. Rather, they shed light on a question central to social movement research and neoinstitutional theory: How does political activism in the streets affect decisions in corporate suites? Zald, Morrill, and Rao (2005) emphasize the connectedness of internal and external polities, but there is little empirical research elaborating the links between external and internal polities (Binder 2002: 13). One reason for this dearth of research is that, compared with states, corporations are in fact relatively closed polities that offer few routine channels through which movements can affect decisions. In democratic societies, movements targeting the state can draw on legitimate channels of influence, such as electoral politics, public media, and a logic of citizen rights. Corporations, by contrast, are constituted as private interests that restrict formal control and participation to owners, insiders, and the legislature. Movement activists are outsiders to the corporate polity and do not have access to formal control structures such as boards. How then do social movements affect decision processes inside private organizations that provide few formal channels of access for activists (Clemens and Minkoff 2004; Davis et al. 2005; King and Soule 2007)?

While research on social movements has identified some of the more obvious paths to influence over corporations, these mechanisms are insufficient for understanding the impact of the anti-genetics movement on German pharmaceutical firms. One stream of research concentrates on indirect movement influence via laws and regulations issued by the state (van Dyke, Soule, and Taylor 2004); but our case examines movement impact prior to regulatory action. And when legislation was finally passed in 1990 many activists felt that the movement had failed to achieve its legislative goals.[3]

Another approach focuses on the mobilization of existing corporate stakeholders, for example, through consumer boycotts and shareholder action (Davis and Thompson 1994; King and

Soule 2007). Disruptions of operations or threats to profits due to stakeholder mobilization may prompt corporations to comply (Luders 2006). Activists' protests, however, did not disrupt routine operations and the main shareholders of the companies in our sample repelled attempts by activists to draw attention through shareholder resolutions.[4] Most pharmaceutical products are distributed through medical professionals, so consumer sentiment plays a lesser role. In fact, at the same time that the movement contested genetic engineering in Germany, biotechnology products produced abroad were already on the domestic market and received little attention.

Yet another possibility is that dedicated boundary spanning units, such as affirmation action officers, amplify threats and induce compliance (Sutton and Dobbin 1996). We find no evidence that legal and public relations departments increased compliance. If anything, public relations (PR) departments were the main organizers of the corporate counter-offensive. Finally, employees who share personal identities with movement participants can act as internal advocates (Briscoe and Safford in press; Raeburn 2004). Neither corporate leaders nor scientists, however, identified with activists in the anti-biotechnology movement and took up their cause. Instead, pharmaceutical companies' organizational elites were influenced by the movement even as they sought to discredit and counter-attack activists.

In this article, we develop a process framework to understand how external contestation works itself through firms' internal decision processes. We analyze corporations as heterogeneous polities that are connected to the external political economy through a set of linking mechanisms (Benson 1975; Zald 1970; Zald et al. 2005). This perspective is in contrast to approaches that view organizations as unitary actors that respond to outside pressures based on their defined interests. We find that some firms were more affected than others, and that different internal structures, routines, and decision logics led to divergent responses to the anti-biotechnology movement. Even though the movement failed in terms of legislative accomplishment and persuasion of insiders, it still

succeeded at least partially in impeding corporate actions.

SOCIAL MOVEMENTS AND CORPORATE POLITIES IN TECHNOLOGY COMMERCIALIZATION

Variance in corporations' technology commercialization is often attributed to technological competition among firms. One prominent explanation is that corporations' success may depend on their timing of entry—early movers have an advantage due to intellectual property protection and dominant technological designs (Suarez and Lanzolla 2007; Tushman and Rosenkopf 1992). Others suggest that pioneers bear the cost of the general ferment associated with early technologies, so their success rate is lower (Min, Kalwani, and Robinson 2006). One such "market externality" could be attention from activists. If either perspective could fully explain the fate of German pharmaceutical firms, we would expect a clear difference in outcomes between early and late entrants into biotechnology. Figure 1 shows the timing of companies' entry into biotechnology and their exposure to the anti-genetics movement in Germany. The figure shows that Hoechst, Bayer, Boehringer Mannheim (BM), and Boehringer Ingelheim (BI) were the early movers. Of these firms, BM and BI were successful; Hoechst and Bayer were not. As we will show, the latter two were especially targeted by the movement. Of the later entrants, Schering was successful, but BASF and Merck were not. Timing of entry alone cannot, therefore, explain commercialization success.

Figure 1 about here

Instead, our study suggests that the movement affected this variance in technology commercialization. Our point of departure to understand how movement activism percolates into organizational decision processes is Zald and colleagues' (2005) political economy model of organizations. The model is premised on the sociopolitical and economic dimensions of corporations being intrinsically intertwined. An organization's internal polity is characterized by the distribution of power, especially the unity or disunity of organizational elites, the extent of subunit

autonomy, and the rules and procedures for resource allocation and conflict resolution. These organization-level structures, rules, and practices are often connected to societal institutional logics and conceptions of control (Fligstein 1990; Friedland and Alford 1991; Thornton and Ocasio 1999). The external polity of business organizations consists of agents for the social control of corporate conduct. It includes not only stakeholders with immediate resource dependencies, such as specific investors, customers, and regulators, but also indirect parties, such as political groups, mass media, social movement activists and organizations, and the local community. Organization-level outcomes, such as the commercialization of technologies, hinge on the ability to forge effective internal coalitions and are shaped by the broader logics that guide decision processes.

RESEARCH DESIGN, METHOD, AND DATA

The polity model leads us to focus on two types of analyses. First, it prompts a focus on processual aspects of movements and organizations (McAdam, Tarrow, and Tilly 2001; Schussman and Soule 2005; Soule and King 2006), tracing external contestation through the internal political process of corporate decision making. For this, we obtained detailed qualitative data on framings, coalitions, and participants' subjective understandings. The polity framework also allows for a comparative analysis of internal and external political conditions and their consequences for the political process (Zald 1970). For example, internal polities vary along the unity of elites (e.g., scientists and executives), the allocation of authority to subunits (e.g., whether business units or corporate management make decisions about technology investments), and cultural logics for evaluating investment opportunities (e.g., whether technology investments are seen from a business portfolio perspective or as central to a company's core identity and expertise). To exploit this comparative dimension, we analyzed several companies instead of a single case.

Our research question is to understand how external contestation manifests itself in the

internal polity of organizations. Unpacking internal processes—central tendencies and generic mechanisms—therefore constitutes our primary analysis. We also verify that the model is consistent with variations that can be expected from the interaction of these general processes with specific parameters of the organizations' polities.

During the focal observation period for our study, 1980 to 1990, the pharmaceutical firms we examine were the key agents for commercializing biotechnology in Germany. Commercial biotechnology start-up companies, who could alternatively lead innovation, did not exist in Germany at the time. They began to develop only after 1995, when the government and a growing venture capital sector began to provide stimuli for entrepreneurship through the Bio-Regio initiative (Casper 1999). We end our window of observation in 1990 because a federal law regulating biotechnological facilities came into effect in 1991. This window of observation allows us to study the direct impact of the movement on corporations net of the indirect path through state regulation. In fact, the anti-genetic movement was, to some extent, a legislative failure, as the legislation regulated, but ultimately permitted, many of the genetic engineering practices that activists fundamentally opposed. By the early 1990s, anti-genetics activists shifted their attention away from medical applications to genetically modified food.

We collected detailed data on the movement and on six leading domestic pharmaceutical firms: Bayer, BASF/Knoll, Boehringer-Mannheim (BM), Boehringer-Ingelheim (BI), Hoechst, and Schering AG. These companies account for about 80 percent of the research-intensive segment of the industry and were consensually identified by industry insiders as the central corporate players in biotechnology. We also obtained more selective information on other companies, such as Grünenthal, Rentschler, Merck KG, and Altana, to verify patterns and working hypotheses. Our data include archival, interview, and secondary sources. We collected 295 articles in national and regional newspapers that comment on biotechnology or describe controversies, nine hours of

original TV footage of debates and documentaries, all public company reports, and several internal company documents related to biotechnology decisions. We obtained activist groups' newsletters published by *Fra-GEN* and *GEN-Ethischer Informationsdienst,* as well as monthly issues of the pharmaceutical industry association publication *PharmInd.* We also surveyed documents filed by political parties and government experts in the context of a parliamentary commission on "*Chancen and Risken der Gentechnik,*" and we drew on secondary sources relaying ethnographic and first-hand documentary data about key events and settings (Barth 1989; Elkins 1991; Robins 2002). In addition, we interviewed 18 executives, scientists, movement activists, and industry lobbyists who directly participated in key events and decisions at the time. Interviews lasted between one and four hours, with most exceeding two hours. We use these interviews to add detail to and validate the events and dynamics suggested by archival sources, and to understand the subjective experiences and framings of key decision makers within firms and movement groups.

EXTERNAL POLITY: ACTIVISTS, MEDIA, LEGISLATURE, AND LOCAL COMMUNITIES

In the early 1980s, German pharmaceutical firms at the forefront of recombinant genetic technologies faced opposition fuelled by the environmentalist movement and championed by the Green Party. The Green Party itself emerged from a set of loose local election coalitions among leftist and environmental groups in the late 1970s and gained representation in the national parliament in 1983. The Green movement picked up the genetics issue as early as 1982 to 1983, when activists like Erika Hickel, an MP for the Green Party from 1983 to 1985, organized the first conferences and debates. These events provided early forums for activists to develop frames of biotechnology as dangerous and to mobilize support from church and feminist groups. This initial mobilization paved the way for carrying the movement's ideas into the media, legislature, judiciary, and local communities by the second half of the 1980s.

Framing by Activists.

Movement activists described biotechnology as a threat not only to the environment but to the moral good of pure untouched nature, and they tapped into a deep-seated suspicion of eugenics in postwar Germany (see, e.g., Tolmein 1990; Weingart, Kroll, and Bayertz 1988). With the help of these framings, corporate actions could be "de-coded" not only cognitively, but also morally and emotionally (Benford and Snow 2000; Goodwin, Jasper, and Polletta 2001; Johnston and Noakes 2005). Activists seized on the vocabulary of the environmental debate about nuclear power (see, e.g., Elkins 1991; Kollek 1988), an analogy even more potent in the wake of the disaster at the nuclear reactor in Chernobyl in 1986. Specifically, activists borrowed the idea of "emission control" (*Freisetzung*) and argued that until the dangers of gene transfer across species were known, biotechnology was as unsafe as nuclear power because the consequences of accidents would be irreversible and just as dangerous as nuclear contamination. For example, activists described e-coli bacteria that were manipulated to produce insulin as posing incalculable risks should they ever escape into the natural environment. This line of argument turned the environmental issue of safety into a fundamental moral one around the notion of "respect for life" (*Respect vor Leben*): humans should not interfere with complex interactive life systems. As early as 1984 to 1985, a parliamentary *Enquete Komission* (a multiparty ad hoc commission constituted on key societal issues) was entrusted with writing a report on biotechnology. The commission was called *"Chancen and Risiken der Gentechnik"* (opportunities and risks of genetic technology) and as one of our informants, a university scientist, noted,

> *"The name was pushed by environmentalist left, the Green Party got into federal parliament for the first time in 1983, it needed issues to push besides nuclear energy and anti-missiles. With this title, the debates in that commission became very controversial and ambivalent about the entire project – they <u>had</u> to look at risks and strike a balance, and this controversy was taken out of this commission and shaped the character and content of the public debate at least until 1992."*

While environmental activists focused on the emission of transgenic organisms into an

unspoiled nature, religious conservatives and the women's movement framed the technology as a danger to values of universal human dignity. For instance, several authors pointed out that some genetic researchers had studied under scholars who supported eugenics programs during the Nazi regime (see, e.g., Sierck and Radtke 1989). When the Christian Democrat-led German government endorsed the European Human Genome project in 1988, a "predictive medicine" program on prenatal genetic screening became a lightning rod issue. The program was cast as proof of the dubious worldviews of proponents of genetic engineering, and women's groups attacked genetic counseling as "continuations of Nazi eugenics"[1].

Such culturally resonant frames helped overcome activists' lack of direct access to organizational decision channels by mobilizing a wide range of allies and sympathizers. One example is the *Ökoinstitut,* an independent, environmentally-oriented think tank and supplier of expert reports that was founded in 1977 by respected scientists opposed to nuclear energy. The view of nature evoked by opponents of biotechnology resonated with biologists affiliated with the institute, and courts and politicians frequently asked them to supply expert opinions. Their reports lent scientific credibility to arguments against biotechnology.

The Mass Media.

Anti-biotechnology activism was also helped by print and television journalists who, since the 1970s, had increasingly come to see their professional role as one of exposing powerful actors and reporting critical challenger positions in controversies. Indeed, some reporters enjoyed personal ties with activists and shared the movement's master frames due to shared experiences in leftist student groups (Kepplinger 1994; Kepplinger, Ehmig, and Ahlheim 1991). Activists, in turn, maximized media exposure. They targeted protests at large physical structures, such as corporate fermentation plants, and used the work of the parliamentary commission to exploit norms of

[1] "Embryonenschutz und Reschtsrisko Schwangerschaft". GENethischer Informationsdienst, Vol. 32, May 1988.

balanced reporting. They participated in numerous TV debates and employed emotional protest formats, for example, having disabled protestors hold signs against reproductive genetic screening. As a result, the mass media paid significant attention to conflicts around genetic technology.[6] In addition, Kepplinger and Ehmig (1995) found that most general articles about biotechnology were located in the political rather than the science sections, and articles in the political sections were more critical of biotechnology than were articles in the science section. They also found a dramatic negative turn in journalists' evaluation of genetic technology during the time of movement activism in the mid to late 1980s. A parallel study on news coverage of medical biotechnology found a shift after 1980, from an emphasis on benefits to one on risks (Gutteling et al. 2002).

The Legislature.

The Green Party, a key ally of the anti-biotechnology movement, gained rapid representation in local, state, and federal parliaments from 1980 onward. Members of the party could garner attention by calling hearings on the topic and writing minority dissents to government reports. In Hesse in 1985, when the Green Party joined a coalition government for the first time, their leader, Joschka Fischer, became the Minister of Environment. His ministry revoked and blocked Hoechst's applications for permits to build biotechnology facilities, although the permits were later reauthorized by a new government.

Some movement groups used provisions in existing building and environmental regulations to demand public hearings about planned biotechnology facilities. They also filed formal objections that needed to be addressed by the permit applicant before approval could be granted. In several cases, for example at Hoechst, Grünenthal, and Behringwerke, activists distributed ready-made forms that local residents could sign and file. Others sued companies for violating procedural provisions of emission legislation, thereby delaying projects (Elkins 1991). Some members of the judiciary accepted the activists' risk and anti-corporate framing. Several lower courts concluded that

in the absence of regulation similar to that for nuclear technology, risky biotechnological facilities could not be approved because they operated in a legal vacuum (Barth 1989; Robins 2002).

Local Communities.

Movement activists also used local channels to carry their opposition into the personal and professional space of employees, scientists, and executives of targeted companies. For example, critical scientists associated with the *Ökoinstitut* organized conferences giving credence and immediacy to claims that might otherwise have been dismissed by corporate researchers as fears of uninformed laypeople (Maurer 1986). Most importantly, however, movement groups also targeted the local communities close to pharmaceutical companies. They distributed leaflets, called town hall meetings, and sympathetic teachers preached the evils of biotechnology in school (see Elkins [1991] for a detailed documentation of community-based tactics surrounding Hoechst's plan to build a plant for recombinant erythropoietin in Marburg).

Corporations as Movement Targets.

Corporations became a primary target for activists contesting biotechnology. This was not simply because large pharmaceutical firms played a central role in the German innovation system. Powerful, established firms constituted particularly salient enemies against whom activists could construct an oppositional and insurgent identity (Bernstein 2003). To critics of the industrial system and its environmental impact, powerful private interests were suspect a priori (Douglas and Wildavsky 1982; Schudson 1989). Several earlier scandals in the industry had already undermined pharmaceutical companies' moral standing. For example, Thalidomide, a drug made by midsized German manufacturer Grünenthal, had been prescribed to treat morning sickness during pregnancy but was found to cause birth defects. Grünenthal's refusal to take the drug off the market until forced by the health authorities permanently undermined public belief in the morality of the industry. Corporate facilities also provided tangible physical structures and public venues where

protests could be staged effectively. For example, activists repeatedly gained access to shareholders' annual meetings by purchasing a few shares. They then delivered public challenges to managers that were reported in the media. As one anti-biotechnology activist we interviewed said,

> *"It is hard to get people to do something about invisible microbes in garden soil or unspectacular university labs, where do you go to protest? This is not like nuclear power plants where you have a locale. So initially we had to turn to commercial companies because they were more concrete targets… so the protests were about insulin fermentation and the first field experiments with recombinant petunias… both more technical issues, less about some of the real ethical questions that we were concerned about, and not that well supported by scientific arguments either. Companies for that reason probably sometimes got a harsher treatment than they deserved, but in the larger scheme of things that was necessary to push the issue."*

Within our sample, large, diversified, publicly-traded firms were particularly likely to be targets for movement activists. Not only did public firms serve as visible targets with protest forums such as shareholder meetings, but diversified firms (e.g., BASF, Bayer, and Hoechst) also operated large chemical units. In the early 1980s, the chemical industry was a prime target of environmental protests around the issues of water and air pollution. During this period, dioxin, a poisonous waste product of chemical processing, leaked into several densely populated areas in Europe and caused public outrage. Boehringer Mannheim, by contrast, is a privately-owned, low profile pharmaceutical specialist that had not been central to earlier campaigns and scandals. Hence, biotechnology in Germany became selectively associated with corporations that represented big business interests of dubious moral standing.

Targeted companies tried to fend off legitimacy threats to biotechnology. They counterframed genetic engineering as the march of progress and as creating jobs and argued that the use of biotechnology is better decided by scientific experts rather than through a disorderly political process involving many ill-informed and radical constituents (see, e.g., Catenhusen and Neumeister 1987; Elkins 1991). Scientists employed by the pharmaceutical companies were often chosen to debate biotechnology opponents in public forums. Their scientific framings, however, failed to

match the resonance created by activists' more emotional frames, and their corporate affiliation undermined their credibility. As one scientist and PR manager of a pharmaceutical company confessed,

> *"I went to a panel at the nearest high school with a Green member of the state parliament. There were 500 people in attendance and it was packed. I was winning the argument, and suddenly [his opponent] started to scream and cry. So I said to her, "don't you think we should stop being so emotional and be more objective/factual about this?" At that point a 50 year old lady in the audience stood up and said, "Mr. [name], are you only a brain or do you actually have a heart in this issue, too?" That's when it became very clear to me that…the problem for the big corporations is that they are already anonymous and faceless, perfect target for activists, you can't win with the rational stuff, you have to show a genuine human face."*

MOVEMENT EFFECTS ON CORPORATIONS: THE ROLE OF INTERNAL POLITY

Is the anti-biotechnology movement a story of a social movement gaining significant coercive power and compelling firms to abandon biotechnology? We find that this is not the case. The anti-biotech movement did not gain access to direct structures of corporate control, such as boards. It did not succeed in triggering consumer boycotts or getting legislation passed until 1990. And when legislation was passed, it generally permitted genetic technology and fell short of key movement objectives. It is thus oversimplistic to assume that powerful companies like Bayer, Hoechst, and BASF simply succumbed to the coercive pressure of activists and public sentiment and decided to reduce their biotechnology activities. As one interviewee, a senior executive for a pharmaceutical company, put it,

> *"We operate in a regulated industry. We are used to politics and being attacked all the time, you only have to think about animal testing, drug prices and so on. We are normally not affected in our decisions by public sentiments and demands."*

Corporate elites did not accept the movement's frames and goals, either. Rather, pharmaceutical companies' organizational elites strongly rejected and fought the movement's claims in public and in private. We find no evidence of established stakeholders, such as shareholders

(Davis and Thompson 1994; King and Soule 2007), employees (Raeburn 2004; Scully and Segal 2002), or customers (Friedman 1999) simply "internalizing" the movement via personal identities defined by the movement. Workers and labor leaders with access to influence through works councils saw anti-biotechnology activists as a threat to employment. Also, at the same time that public opinion was against the creation of biotechnology facilities in Germany, consumers showed no negative reaction to several recombinant products that were sold in the country.

The target companies' polities remained relatively closed to direct coercive and normative influence. Instead, external contestation translated into technology choices in more intricate ways, mediated by the targeted organizations' existing internal political systems. This process can best be understood when organizations are treated not as unitary actors, but as coalitions among internal elites, with only partially aligned identities and interests that follow culturally defined logics of decision making to resolve conflict (March 1962; March and Simon 1958; Zald 1970). Organizational action regarding a novel technology that is externally contested and uncertain in its immediate commercial promise requires some members of the elite to champion the technology over alternative agendas. It also requires effective coalitions with other organizational elite actors and compliance with decision rules legitimated by logics of corporate control (Fligstein 1990).

Executive managers and R&D scientists were the two elite groups most centrally involved in the evaluation and development of biotechnology. Executives controlled financial resources and had jurisdictional authority over broader organizational strategies, while R&D scientists had knowledge-based authority and enjoyed a high informal status in research-intensive pharmaceutical firms. The two elite groups overlapped to a large extent: of the 81 executives who sat on the six companies' management boards between 1982 and 1989, 55 had doctorates in the sciences or in medicine (the remainder had backgrounds in business or law).

Status Threats to Technology Champions.

The anti-biotechnology movement undermined strong organizational commitments to biotechnology by threatening the public image and internal status of those who championed and supported biotechnology—namely executive managers and scientists. This heightened existing divisions within these elites along professional and divisional lines. As a result, the unity needed in the face of external opposition became more difficult to achieve.

Executive champions with strong commitments to biotechnology played a large role in German firms' early forays into the technology. For example, Boehringer Mannheim's longtime CEO and family owner, Curt Engelhorn, studied pharmacology in the United States and made early investments based on his belief in the inevitability of a biotechnological revolution in the industry. Hoechst's pharmaceutical business unit manager, Hans-Georg Gareis, was also instrumental in pushing early forays into the technology. By contrast, in the absence of a strong believer in medical biotechnology, most members of BASF's executive team did not see a need for major investments in the early 1980s.

Public hostility to biotechnology, however, reduced the status, influence, and, at times, confidence of potential and actual technology champions in executive teams. Members of executive teams pursue agendas with multiple issues, and they are concerned about their overall status and the standing of their business areas. Identification with a particular cause, such as biotechnology, can help or hinder their ability to realize other goals and coalitions. Pharmaceutical executives who promoted biotechnology risked being seen as under siege by the stiff societal opposition and distracted from larger business objectives, which weakened their willingness to push the issue among their peers. They were concerned not only about a positive image outside the organization, but also about their status as an effective member within the executive group. As one executive put it,

> *"[My company] had enough on its plate financially and trouble from environmentalists [about chemicals], and didn't want to get even more tainted with opposition to genetics…In Germany, the initial opposition to recombinant technology delayed the launch of [company's product] by several years – lost us*

a lot of money on a high volume product… that didn't exactly help the pharma unit look any better compared to [other business units]."

Anti-genetics sentiment had a similarly damaging impact on another group who would seem natural promoters of the technology within firms: research and development (R&D) scientists. The negative portrayal of biotechnology as rife with incalculable risks threatened the professional identities of medical scientists and made them ambivalent about their work. While they were very interested in the scientific and career prospects associated with genetic engineering, they were also exposed to questions and moral issues reported in the media, raised by the *Ökoinstitut*'s scientific reports, and posed by friends and family. As a manager of a biotechnology production facility explained,

"There was at a very early stage indeed some debate and uncertainty among our scientists about the potential dangers of recombinant cell cultures. It's an issue because you deal essentially with viral material, known to be hard to contain. It was novel stuff. [At our facility], we took this very seriously."

Other scientists did believe that biotechnology was unambiguously safe, but they were concerned about their image, especially because the medical aspect of their work was traditionally highly valued. They experienced a sense of insecurity that had more to do with not wanting to be seen as engaging in immoral research than with accepting activists' claims. Another interviewee, the former head of R&D at a pharmaceutical company, explained,

"We built a laboratory in [the U.S.A.], and sent people from Germany, but they would come back and not want to work on biotechnology in Germany. The movement was such that some of our scientists did not tell their kids what they worked on because their teachers would criticize them."

As a result of these status threats, some natural internal champions lacked the determination to act as forceful promoters for biotechnology and to obtain the strong organization-wide commitments that were required in the face of external opposition. It did not seem worth the cost to push this issue, especially when other alternatives, such as conventional pharmacological research and less contested investment causes, were available

Variation in Threat. The strength of these forces on executives and scientists depended on how extensively their company was targeted by activists and how successful the movement was in mobilizing local constituencies. The mobilizing ability of anti-genetics activists varied geographically. Large cities and university towns could draw on environmental, leftist, and feminist networks developed in the '60s and '70s. Frankfurt, Cologne, and Berlin, in particular, had large, well-connected communities centered on left-leaning universities and union organizers that had played a key role in the student protests of the 1960s and in the emergence of the Green Party. The Frankfurt area, for example, had seen some of the earliest and most confrontational environmentalist protests in the late 1970s around nearby nuclear power plants and an airport extension. Scientists and managers at Bayer, Schering, Hoechst, and Grünenthal therefore experienced the threats created by the movement more immediately. By contrast, in rural areas and conservative cities such as Munich, opponents of biotechnology lacked critical mass and protest experience. The movement was a weaker force where activist networks were sparse and pro-business parties were dominant. BI and BM fall into this category, with BASF being an in-between case.

Unity of Organizational Elites.

A united commitment of organizational elites to biotechnology was even more important in companies facing external resistance. To start with, the risk of image contamination made it difficult for technology champions to persuade members of the organizational elite who did not have immediate knowledge or interest in the technology to commit themselves. In addition, the external threats to the legitimacy of biotechnology became a discursive resource in broader struggles for power within the elite.

Major decisions about biotechnology engagements, such as building new facilities, forming alliances, and making acquisitions, were generally made by corporate executive councils rather than business unit managers. Champions of biotechnology projects could promote some exploratory

research at their own discretion, but they needed more extensive coalitions for larger-scale commercial applications. Executives who identified with their business units, such as chemicals or consumer health products, lacked an immediate stake in the technology and their projects and interests competed with biotechnology for resources. Others took a more neutral view and compared biotechnology investments to allocating resources to alternative business areas.

Some executives were concerned that aggressively pursuing domestic biotechnology projects might open the door to greater scrutiny and public intrusions in other domains in the future. It was difficult to unite executives who identified with non-pharmaceutical business units or a corporate perspective behind major investments in biotechnology because, unlike pharmaceutical executives, they had the option of easily disassociating themselves from a technology with doubtful legitimacy. For example, several of our interviewees reported difficulty in getting members of the executive team to agree on acquiring U.S. biotechnology companies to accelerate the commercialization of biotech drugs. These executives preferred a wait-and-see approach.

The public discourse of biotechnology as dangerous and morally suspect also gave ammunition to executives and scientists who sought to defend or extend their power within the organizational elite. For example, while traditional pharmaceutical knowledge was based on organic chemistry, the new biotechnological techniques favored expertise in molecular biology and genetics. Biotechnology is a "competence-destroying" technology that alters the skills and knowledge at the core of an organization's operation, and it is associated with major changes in the distribution of power within firms (Henderson, Orsenigo, and Pisano 1999; Tushman and Rosenkopf 1992). Some R&D scientists with a traditional pharmacological background in organic chemistry saw biotechnology as a threat to their expertise, status, and career prospects. The moral and ethical objections voiced in the public provided a cultural resource for doubting the technology. Similarly, executives of chemical business units who sought to curtail the power of pharmaceutical units in

struggles over resources and promotion opportunities could not only invoke business grounds for their opposition, but they could also cite the general opposition and ethical and safety concerns voiced in the public sphere as potential risks of biotechnology investments.

Variation in Elite Unity. More diversified firms had more diverse elites, who proved more difficult to unite behind domestic biotech investments. As biotechnology was most relevant to pharmaceuticals, the relevant dimension of diversification is beyond pharmaceuticals. Bayer, Hoechst, BASF, and Merck KG were diversified into chemicals and consumer products and hence had many executives and scientists without a natural stake in medical biotechnology; BI and BM were more singularly focused on pharmaceuticals. Schering AG started out as in-between but divested its non-pharmaceutical businesses around 1990 to become more specialized. The composition of these firms' executive boards reflects this pattern, as shown in Table 1.

Table 1 about here

Table 1 categorizes members of the companies' executive boards according to their backgrounds. The data refer to the most critical years, 1985 to 1989, but the pattern presented in the table is very stable over time. All firms had at least one executive with a medical, pharmacological, or biochemical background, but BASF's board was dominated by chemists and Bayer, Hoechst, and Merck had many chemists and non-scientists with business and legal degrees. By contrast, executives with medical, pharmacological, or biochemical backgrounds had a strong position in the specialist firms of BI and BM, and to some extent Schering AG, which made coalition formation for biotechnology easier within these firms. One interviewee, an executive with a diversified firm, explained,

> *"We were a chemical company; grew out of dyes. Later, after much discussing we defined ourselves as a chemical pharma company. But the CEOs were chemists or came from the commercial side. Out of the [number of] people on the management committee, perhaps one person was from pharma and one from R&D. When I joined the board, there was no pharma predecessor for me."*

In summary, the movement's goals seeped into organizations' internal polity partly by affecting the status and political interests of different elite groups. Image and status threats reduced the political will and coalition-building ability of groups identifying strongly with the technology, raised the hurdle for persuading uncommitted players concerned about contaminating their own domain's legitimacy, and strengthened the position of those opposed for other reasons to the promoters of biotechnology. These challenges were more pronounced in diversified firms whose executives and scientists had more diverse backgrounds and interests.

Creation of Perceived Uncertainty.

Corporate executives analyzed commercial-scale biotechnology projects as investment decisions, that is, as the commitment of financial and human resources to specific projects with the expectation that future returns would exceed expenditures. This logic is a core dimension of the internal polity, guiding how conflict between competing projects and internal constituents is resolved (Zald 1970). Within this decision calculus, the anti-biotechnology movement's mobilization of public sentiment and obstacles made biotechnology investments more uncertain, riskier, and hence less attractive. Company executives did not consciously bow to pressure, but they were affected by the movement simply because they followed standard decision-making procedures.

Perceived uncertainty increased in regulative and political terms. Movement activists created regulative uncertainty as they successfully contested the domain jurisdiction of corporations over the technology. The extent and nature of any future public control was uncertain, however, until the passage of the federal *Gentechnikgesetz* in 1990. Until then, the application and interpretation of regulative procedures was unreliable. Various levels of local, regional, and national authorities had a say in the approval of facilities, and the interpretation of existing emission laws and administrative procedures often depended on the individuals involved. Operating permits could potentially be revoked, and the requirements for future procedures remained unknown, as evidenced by the Green

Party's intervention in the approval process for Hoechst's insulin facility in Hesse (Barth 1989). Court challenges by activists also created uncertainty about the speed with which companies could bring biotechnology products to market and their returns on investment (Elkins 1991; Robins 2002). Approval of biotechnology facilities could take a few months (e.g., Boehringer Mannheim's expansion of its facility in Penzberg, Bavaria), a year or two (e.g., BASF's and Grünenthal's efforts in Ludwigshafen and Cologne), or four or more years (e.g., Hoechst in Frankfurt).

The speed of approval affected the expected returns on pharmaceutical companies' investments,. For many of the drugs in question (e.g., EPO, recombinant insulin, Factor VIII, and betaseron) several companies competed to bring them to market first and delays also shortened the period of patent protection during which new drugs recoup most of their development costs. One interviewee, a pharmaceutical executive, explained:

> *"It's a very simple calculation. Take the total return on any pharmaceutical product over the life cycle. As a general rule, if you go 50% over budget in development costs, the total return drops 10%; if you go 50% over budget in production costs, the total return drops 15%; if you delay the launch by 1 year, the total return drops 30%. Speed is key in the market we're in… Speed is very critical in biotechnology, because the knowledge turns over so quickly and because patents can very quickly lock you out of a lucrative area."*

The Green Party's electoral success and the negative public sentiment toward biotechnology also created political uncertainties. The R&D cycle of a biotechnology product is at least 10 to 20 years, much longer than the electoral cycle of parliaments. To the extent that frequent changes in parliamentary majorities could be expected, uncertainty about the future viability and protection of initial investments arose.

Variation in uncertainty. Aside from potential federal regulation, state and local political conditions also increased or decreased companies' uncertainty. Uncertainty was greater in "swing states," such as Hesse (Hoechst and Merck) and Berlin (Schering), and lower in states with stable, conservative pro-business majorities, such as Bavaria and Baden Württemberg (BM and BI). For example, in 1995, when Schering wanted to start production of betaseron, the company did not try

to create a facility for in-house production in Berlin, partly because majorities in the Berlin state government frequently alternated between SPD-Green and CDU-FDP coalitions. Instead, Schering outsourced production to Boehringer Ingelheim's existing plant in stable Baden Württemberg.

Institutional Logics and Investment Decisions.

Groups championing, disinterested, or opposed to biotechnology had to justify biotechnology commitments in investment terms in all the companies we studied. Investment calculus is not void of politics, however, and the specific framings applied to these decisions were influenced by broader institutional logics and conceptions of control (Fligstein 1990; Thornton and Ocasio 1999). Logics describe broad understandings of what corporations are (Fligstein 1990); they structure cognition, guide decision making, and lead to logic-consistent decisions that reinforce extant organizational identities and strategies (Friedland and Alford 1991). In the German pharmaceutical industry, organizational elites alternatively employed a "diversified portfolio" and a "pharmaceutical core identity" logic, with one or the other being more dominant at the corporate level. The "pharmaceutical core identity" logic sees the firm as a commercial medical research enterprise. Within this logic, biotechnology is seen as an inevitable trend in their industry and biotechnology capabilities as critical to a firm's future viability. Importantly, the reference group of alternative investments against which returns on domestic biotechnology investments are compared is limited here to other biotechnology projects.

Other people in the industry understood their companies more as a portfolio of businesses that corporate executives manage for financial returns. Biotechnology was therefore one of several business-unit level opportunities and did not require an a priori commitment for the overall company's viability. Returns on domestic biotechnology investments were not only compared with alternatives within the pharmaceutical domain but also with alternatives in other lines of business,

such as chemicals or consumer healthcare. The perception of increased investment risk created by the contestation of biotechnology was therefore more consequential within the frame of a "diversified portfolio" logic because decision makers considered additional alternatives with more certain returns, for example in chemical businesses. Similarly, the challenge of coalition formation was greater within this logic than within a pharmaceutical core identity logic. Promoters of biotechnology could make more optimistic assumptions about their projects than could other executives, but, as the head of pharmaceutical R&D at a diversified company noted, even this tactic was limited:

> *"The only way to justify the [biotechnology] investment at home [in Germany] was to fudge the calculations and paint a more rosy picture – this worked sometimes but it also costs credibility if it repeatedly doesn't pan out."*

Variation in dominant logics. Specialized pharmaceutical firms usually acted on a dominant logic of "pharmaceutical core identity" because their executives often had medical or pharmaceutical backgrounds. In companies that diversified beyond pharmaceuticals, fewer members of the executive teams had a pharmaceutical background; more often they came from financial or chemical backgrounds, so the dominant logic was a "diversified portfolio." The executive team composition shown in Table 1 gives an approximate impression of these differences. Firms such as Bayer, Hoechst, and BASF were more likely to consider the opportunity cost of biotechnology investments against alternatives in other business divisions that often promised more certain returns. Focused companies with a pharmaceutical core identity logic, whose executives saw biotechnology investments as inevitable (e.g., BM and BI), considered a narrower range of investment alternatives within biotechnology with similarly uncertain returns.

Firms' Resulting Technology Choices.

Companies exposed to greater investment uncertainty, with weakened technology champions, non-united elites, and diversified portfolio logics did not completely refrain from

biotechnology investments. In fact, some of them, especially Bayer and Hoechst, made significant commitments to biotechnology prior to the domestic opposition in the late 1980s. When the movement's activities penetrated internal polity processes, however, they triggered organizational search processes for alternatives (Cyert and March 1963; March and Levitt 1988). This was mostly a *local search* in the sense of Cyert and March (1963:170), meaning that responses were sought (1) close to the problem and (2) close to alternatives historically used to address similar problems. What counts as "local" depends on a company's scope and history. For example, investing in chemicals is a "local" alternative for companies diversified into chemicals but a "distant" alternative for pharmaceutical specialists. Three local responses can be attributed to the movement's opposition entering organizational processes and structures: allocating investments to alternative businesses, shifting biotechnology investments to different regional subsidiaries facing lower activism, and reducing or isolating initial commitments to biotechnology.

Hoechst's experience with its domestic insulin and EPO production illustrates several of these responses by a diversified company that had been an early mover in biotechnology, with a heterogeneous elite and a diversified portfolio logic. When Hoechst CEO Hilger took the helm in 1985, one of his first actions as CEO was a very large acquisition in ceramics, a local solution for a company with a large chemicals unit. Hoechst's executive board then decided in 1988 that future investments involving biotechnology would be made outside Germany to avoid the risk of costly approval delays and negative press. They made initial investments in France and in Belgium at Hoechst's existing Roussel-Uclaf subsidiary, a local solution for this company. Until at least the mid-1990s, the German insulin and EPO plants received no significant expansion investments and remained in limited use as "demonstration facilities." In response to the fierce opposition around Frankfurt, Hoechst concentrated its biotechnological R&D activities in its Behringwerke subsidiary in Germany and its U.S. subsidiary, rather than its central pharmaceutical research organization.

Hilger's successor, Dormann, broke up the company, and in 1997 he merged the pharmaceutical portion with Rhone-Poulenc to create Aventis, headquartered in Strasbourg, France. Hoechst's main domestic biotechnology unit, Behringwerke, was divested in the process. As one former Hoechst executive noted,

> *"the question often was, Why spend money on this biotech thing, where we may make some money in 10 years or not, when we could spend it on a chemical product or a product line extension where we can make money within two or three years?"*

Other companies targeted by the anti-biotechnology movement decided to locate their biotechnology operations abroad and thus seemingly evaded the opposition in Germany. For example, in 1988, Bayer set up production operations in Berkeley and BASF/Knoll located its main future biotechnology research center in the Greater Boston area.

Companies that were less exposed to immediate movement activism and had more united elites and a pharmaceutical core identity responded differently. Companies located far from movement hotspots, such as BI and BM, engaged in less of a search for alternatives to their existing domestic biotechnology operations. Schering AG is a pivotal case illustrating the role of dominant logics and elite unity on search processes in the face of movement opposition. The company, a late entrant, was initially diversified into chemicals and had no significant foreign subsidiaries. It was also located in Berlin, a center of anti-genetic activism. Its biotechnology engagement therefore lacked both the urgency associated with a pharmaceutical core identity and the local alternatives to domestic investments. Schering's response in the late 1980s was largely to refrain from commercial biotechnology investments. With a change in management in 1989, however, Schering adopted a pharmaceutical core identity logic and began to divest several chemical businesses. It also engaged in distant (rather than local) search in response to continuing local opposition and made two major acquisitions of U.S.-based biotechnology companies in 1990. While movement contestation triggered search processes for alternatives in all companies, a company's internal polity, in the form

of elite unity and dominant institutional logic, accounted for variation in the type of search (local versus distant) and the willingness to risk investing in a contested technology.

Amplification of Movement Impact Through Internal Polity Processes.

Initial decisions to evade movement opposition created problems that amplified the movement's immediate impact. Bayer's CEO Wenninger, for example, called expectations that his company would bring its biotechnology R&D back to Germany in the wake of the 1992 legislation "illusory."[7] Biotechnology involves a high degree of tacit knowledge and organizational routines and there is knowledge synergy between, for example, biotechnological fermentation in production and research and development activities. For example, when BI restructured in the early 1990s, it decided to concentrate pharmaceutical research and development in Ingelheim. Biotechnological research and development was exempt from this decision, however, and remained in Vienna and Biberach, the two existing locations of biotech production and R&D facilities.

Conversely, foreign subsidiaries that were chosen for biotechnology activities due to domestic opposition were often not configured to perform the full range of drug development and commercialization. They were also treated as autonomous profit centers within the structure of the polity. Biotechnological knowledge thus became disconnected from other tacit knowledge and routines of commercialization and became more distant from power elites and resources at headquarters. At Bayer, for example, different aspects of biotechnological research, development, production, and marketing were distributed across several business units in the United States. Each unit was an independent profit center, had little experience working with others on development projects, and often had incomplete capabilities to commercialize products. With this fragmented political structure, the need for coalition formation and coordination increased at the same time that experience with these processes was lacking. Table A1 in the Appendix shows a set of negative binomial analyses of patent citations between units, which corroborates the compartmentalization of

knowledge in German multiunit corporations. Initial decisions led to problems of internal coordination and a lack of synergy that aggravated the impact of domestic anti-biotechnology contestation.

Variation in Commercialization Success. To verify the pattern described above, we examined a tangible measure of a firm's biotechnology abilities—whether it introduced biotechnology products.[8] Figure 2 shows that Schering AG, BI, and BM, the smaller and nondiversified firms, were successful in launching new products during the 1990s. By contrast, the larger and diversified firms—Bayer, Hoechst, Merck KG, and BASF—were less successful. The temporal pattern of product launches is particularly informative. Hoechst and Bayer, who were early movers with recombinant insulin in 1982, did not sustain this early advantage with a stream of subsequent products in the 1990s.

Figure 2 about here

We emphasize that this variation in commercialization success cannot be explained simply by differences in organizations' access to knowledge. Table A2 in the Appendix shows a set of supplementary statistical analyses demonstrating that owning biotechnology patents and access to external knowledge in the form of alliances and patent citations do not explain the pattern of success.

A PROCESS MODEL OF HOW MOVEMENTS PENETRATE ORGANIZATIONS

Figure 3 summarizes the proceeding sections in a simplified process framework. It highlights that technology decisions within organizations result from internal political processes in which organizational elites engage in framing and coalition building.

Figure 3 about here

Variance in process and outcomes is introduced by different internal power structures that arise from elites' interests and decision logics. Interests and logics derive from professional and organizational identities; in the present case, educational background and the diversification of business units. Movements can enter the relatively closed internal polity of private corporations via two mechanisms: threats to the image and status of members of organizational elites, which affect how these members construct their internal interests and commitments, as well as how easy it is for them to build broader coalitions; and through the creation of investment uncertainty, which affects how technology investments are evaluated within organizational decision logics. Perceived status threats and investment uncertainty transpose external contestation onto existing structures and processes of the internal polity. Changes in these processes may then amplify the movement's impact beyond isolated decisions.

CONCLUSION

Much of the impact of movements on social change comes via their impact on *organizational* policy and practice. To date, researchers have often focused on how movements affect organizations via the enactment of laws. But what happens when movements do not achieve desired legislation? In such cases, how can movements get inside organizations when activists lack access to formal channels such as boards of directors, proxy contests, shareholder resolutions, or designated boundary spanning units? Our study shows that the internal polity of organizations underlies variations in their responses to social movements. In the case of the anti-biotechnology movement in Germany, external contestation threatened the status of biotechnology proponents, undermined elite unity, and increased the perceived uncertainty of investments. In turn, the standard decision calculus used by firms rendered domestic biotechnology unattractive, especially for firms driven by a

portfolio logic. Even when firms relocated their biotechnology operations overseas to insulate them from activist pressure, they suffered from ensuing coordination and synergy issues.

Our study shows how social movements may affect new technologies by influencing private organizations' decisions prior to legislative action by the state. It also moves beyond influence through formal channels (e.g., boards of directors, proxy votes, or union agreements) and by existing stakeholders (e.g., shareholders, employees, or customers). It is precisely the lack of such conventional access channels that forms a distinctive challenge for many movements that seek to affect decisions within corporations (King and Soule 2007).

Our analysis thus sheds light on a larger question in institutional theory—when and how organizations respond to institutional environments. Neo-institutional research often uses the imagery of "force" and "pressure" to describe institutional influences and conceptualizes responses as ranging from passive conformity to outright defiance and manipulation (Oliver 1991). The underlying premise is that organizations are unitary actors with defined interests, and their response to institutional pressure hinges on the extent to which the environment has power over them (for a parallel approach in social movement research, see Luders 2006). We extend this research by identifying indirect mechanisms best described as induction or transposition (Scott 1991). These mechanisms hinge on an understanding of organizations as polities of coalitions with emergent interests, rather than as unitary actors with clear positions. While external pressures trigger search processes for responses, the type of solutions found and the extensiveness of the response vary according to dimensions of a company's internal polity.

Another implication of our study is that social movements can be a powerful source of imprinting. Stinchcombe (1965) argued that the social technologies available at the time of founding permeate organizations, and researchers have demonstrated how founders and social structures are sources of imprinting (Lounsbury and Ventresca 2002). Our study suggests movement activism as

another source of imprinting. Imprinting works not only by organizational members importing "social technology available at the time" to run organizations, but it also includes responses to social contestation. Organizations seeking to enter biotechnology at the peak of the movement's presence in Germany (such as Hoechst and Bayer) had to react to contestation and thus located operations away from their natural base. This decentralization in turn increased coordination costs, hampered commercialization, and left an imprint not by internalizing movement ideas but by impeding the development of new technology. By contrast, the movement's imprint was weak for entrants who out-waited the peak of the movement, such as Schering, or who were not strongly targeted, such as BM. To expand on these imprinting ideas, future research should examine the role of temporal variations in movements' power to affect corporations, in addition to the spatial variance we emphasize.

Finally, our study adds to a growing literature on technology development that integrates social dynamics into our understanding of the evolution of science and technology (Callon, Law, and Rip 1986; Latour 1988). Our study shows that cultural and political contestation play an important role in the period when new technologies move from basic research toward applied research. While we focus on a movement that was clearly opposed to a technology that corporations promoted, the sides can be reversed, with social activists promoting technologies, such as sustainable energy or recycling, and organizations wedded to the status quo (Hess 2007). Similarly, while our study looks at a movement in one industry (pharmaceuticals), it may be interesting to examine how movements expand their scope (e.g., from pharmaceuticals to agricultural products). These processes may in part depend on the opportunities afforded by different industry systems (see, e.g., Schurman 2004). Research into such issues is needed to enhance our understanding of how and when movements affect firms' technological scope.

REFERENCES

Barth, Norbert. 1989. "Der Fall Hoechst." Pp. 245–59 in *Gentechnik: Wer kontrolliert die Industrie?,* edited by M. Thurau. Frankfurt am Main, Germany: Suhrkamp.

Benford, Robert D and David A Snow. 2000. "Framing Processes and Social Movements: An Overview and Assessment." *Annual Review of Sociology* 26:611–39.

Benson, J. Kenneth. 1975. "The Interorganizational Network as a Political Economy." *Administrative Science Quarterly* 20:229–49.

Bernstein, Mary. 2003. "Nothing Ventured Nothing Gained? Conceptualizing Movement 'Success' in the Lesbian and Gay Movement." *Sociological Perspectives* 46:353–79.

Binder, Amy J. 2002. *Contentious Curricula: Afrocentrism and Creationism in American Public Schools.* Princeton, NJ: Princeton University Press.

Briscoe, Forrest and Sean Safford. in press. "The Nixon-in-China Effect: Activism, Imitation and the Institutionalization of Contentious Practices." *Administrative Science Quarterly* forthcoming.

Callon, Michel, John Law, and Arie Rip. 1986. *Mapping the Dynamics of Science and Technology.* London, UK: Macmillan.

Casper, Steven. 1999. "National Institutional Frameworks and High Technology Innovation in Germany: The Case Of Biotechnology." *WZB Discussion Paper* FS I 99–306.

Catenhusen, Wolf-Michael and Hanna Neumeister. 1987. *Chancen und Risiken der Gentechnologie: Dokumentation des Berichts an den Deutschen Bundestag.* München, Germany: Schweitzer.

Clemens, Elizabeth S. and Debra C. Minkoff. 2004. "Beyond the Iron Law: Rethinking the Place of Organizations in Social Movement Research." Pp. 155–70 in *The Blackwell Companion to Social Movements,* edited by D. A. Snow, S. A. Soule, and H. Kriesi. Malden, MA: Blackwell.

Cyert, Richard M. and James G. March. 1963. *A Behavioral Theory of the Firm.* Englewood Cliffs, NJ: Prentice-Hall.

Davis, Gerald F., Doug McAdam, W. Richard Scott, and Mayer N. Zald. 2005. "Social Movements and Organization Theory." New York: Cambridge University Press.

Davis, Gerald F. and Tracey A. Thompson. 1994. "A Social Movement Perspective on Corporate Control." *Administrative Science Quarterly* 39:141–73.

Douglas, Mary and Aaron Wildavsky. 1982. *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers.* Berkeley, CA: University of California Press.

Elkins, Stephan. 1991. "Gentechnologie im Konflikt: Eine diskursanalytische Betrachtung der Auseinandersetzung um die gentechnische Produktion von Erythropoietin bei den Marburger Behringwerken." Fachbereich Gesellschaftswissenschaften und Philosophie, Philipps-Universität Marburg, Marburg, Germany.

Fligstein, Neil J. 1990. *The Transformation of Corporate Control.* Cambridge, MA: Harvard University Press.

Friedland, Roger and Robert R. Alford. 1991. "Bringing Society Back In: Symbols, Practices, and Institutional Contradictions." Pp. 232–63 in *The New Institutionalism in Organizational Analysis,* edited by P. J. DiMaggio and W. W. Powell. Chicago, IL: University of Chicago Press.

Friedman, Monroe. 1999. *Consumer Boycotts: Effecting Change through the Marketplace and the Media.* New York: Routledge.

Goodwin, Jeff, James M. Jasper, and Francesca Polletta. 2001. "Passionate Politics: Emotions and Social Movements." Chicago, IL: University of Chicago Press.

Gutteling, Jan M., Anna Olofson, Bjorn Fjastad, Matthias Kohring, Alexander Goerke, Martin W. Bauer, and Timo Rusanen. 2002. "Media coverage 1973–1996: Trends and Dynamics." Pp. 95–128 in *Biotechnology: The Making of a Global Controversy,* edited by M. W. Bauer and G. Gaskell. New York: Cambridge University Press.

Henderson, Rebecca M., Luigi Orsenigo, and Gary P. Pisano. 1999. "The Pharmaceutical Industry and the Revolution in Molecular Biology: Interactions among Scientific, Institutional, and Organizational Change." Pp. 267–311 in *Sources of Industrial Leadership: Studies of Seven Countries,* edited by D. A. Mowery and R. R. Nelson. New York: Cambridge University Press.

Hess, David. 2007. *Alternative Pathways in Science and Industry.* Cambridge, MA: MIT Press.

Johnston, Hank and John A. Noakes. 2005. *Frames of Protest: Social Movements and the Framing Perspective.* New York: Rowman & Littlefield.

Kepplinger, Hans Matthias. 1994. "Historical Notes on German Press Coverage of Technology." *Risk: Health, Safety & Environment* 5:213–20.

Kepplinger, Hans Matthias and Simone Christine Ehmig. 1995. "Press Coverage of Genetic Engineering in Germany: Facts, Faults and Causes." Pp. 495–505 in *Biotechnology: Legal, Economic and Ethical Dimensions,* Vol. 12, edited by D. Brauer. New York: VCH.

Kepplinger, Hans Matthias, Simone Christine Ehmig, and Christine Ahlheim. 1991. *Gentechnik im Widerstreit: Zum Verhältnis von Wissenschaft und Journalismus.* Frankfurt, Germany: Campus Verlag.

King, Brayden G. and Sarah A. Soule. 2007. "Social Movements as Extra-Institutional Entrepreneurs: The Effect of Protest on Stock Price Returns." *Administrative Science Quarterly* 52:413–42.

Kollek, Regine. 1988. "'Verrückte' Gene: Die inhärenten Risiken der Gentechnologie und die Defizite der Risikodebatte" *Ästhetik und Kommunikation* 69:29-38.

Latour, Bruno. 1988. *The Pasteurization of France.* Cambridge, MA: Harvard University Press.

Lounsbury, Michael and Marc J. Ventresca. 2002. "Social Structure and Organizations Revisited." *Research in the Sociology of Organizations* 19:3–36.

Luders, Joseph. 2006. "The Economics of Movement Success: Business Responses to Civil Rights Mobilization." *American Journal of Sociology* 111:963–98.

March, James G. 1962. "The Business Firm as a Political Coalition." *Journal of Politics* 24:662–78.

March, James G. and Barbara Levitt. 1988. "Organizational Learning." *Annual Review of Sociology* 14:319–38.

March, James G. and Herbert A. Simon. 1958. *Organizations.* New York: Wiley.

Maurer, Margarete. 1986. "Machbarkeit und Verantwortung: Gentechnologie in der Kritik." *AUF: Eine Frauenzeitschrift* 51:7–14.

McAdam, Doug, Sidney Tarrow, and Charles Tilly. 2001. *Dynamics of Contention.* Cambridge, UK: Cambridge University Press.

Min, Sungwook, Manohar U. Kalwani, and William T. Robinson. 2006. "Market Pioneer and Early Follower Survival Risks: A Contingency Analysis of Really New Versus Incrementally New Product-Markets." *Journal of Marketing* 70:15–33.

Oliver, Christine. 1991. "Strategic Responses to Institutional Processes." *Academy of Management Review* 16:145–79.

Raeburn, Nicole C. 2004. *Changing Corporate America from Inside Out: Lesbian and Gay Workplace Rights.* Minneapolis, MN: University of Minnesota Press.

Robins, Rosemary. 2002. "The Realness of Risk: Gene Technology in Germany." *Social Studies of Science* 32:7–35.

Schudson, Michael. 1989. "How Culture Works: Perspectives from Media Studies on the Efficacy of Symbols." *Theory and Society* 18:153–80.

Schurman, Rachel. 2004. "Fighting 'Frankenfoods': Industry Opportunity Structures and the Efficacy of the Anti-biotech Movement in Western Europe." *Social Problems* 51:243–68.

Schussman, Alan and Sarah A. Soule. 2005. "Process and Protest: Accounting for Individual Protest Participation." *Social Forces* 84:1083–1108.

Scott, W. Richard. 1991. "Unpacking Institutional Arguments." Pp. 164–82 in *The New Institutionalism in Organizational Analysis,* edited by W. W. Powell and P. J. DiMaggio. Chicago, IL: University of Chicago Press.

Scully, Maureen A. and Amy Segal. 2002. "Passion with an Umbrella: Grassroots Activists in the Workplace." *Research in the Sociology of Organizations* 19:125–68.

Sierck, Udo and Nati Radtke. 1989. *Die Wohltäter-Mafia: Vom Erbgesundheitsgericht zur humangenetischen Beratung.* Hamburg, Germany: Mabuse-Verlag.

Soule, Sarah A. and Brayden G. King. 2006. "The Stages of the Policy Process and the Equal Rights Amendment, 1972–1982." *American Journal of Sociology* 111:1871–1909.

Stinchcombe, Arthur L. 1965. "Social Structure and Organizations." Pp. 142–93 in *Handbook of Organizations,* edited by J. G. March. Chicago, IL: Rand McNally.

Suarez, Fernando F. and Gianvito Lanzolla. 2007. "The Role of Environmental Dynamics in Building a First Mover Advantage Theory." *Academy of Management Review* 32:377–92.

Sutton, Robert I. and Frank Dobbin. 1996. "The Two Faces of Governance: Responses to Legal Uncertainty in U.S. firms, 1995–1985." *American Sociological Review* 61:794–811.

Thornton, Patricia H. and William Ocasio. 1999. "Institutional Logics and the Historical Contingency of Power in Organizations: Executive Succession in the Higher Education Publishing Industry, 1958–1990." *American Journal of Sociology* 105:801–43.

Tolmein, Oliver. 1990. *Geschätztes Leben: Die neue "Euthanasie"-Debatte.* Hamburg, Germany: Konkret Literatur.

Tushman, Michael L. and Lori Rosenkopf. 1992. "Organizational Determinants of Technological Change: Toward a Sociology of Technological Evolution." *Research in Organizational Behavior* 14:311–47.

van Dyke, Nella, Sarah A. Soule, and Verta A. Taylor. 2004. "The Targets of Social Movements: Beyond a Focus on the State." *Research in Social Movements, Conflict and Change* 25:27–52.

Weingart, Peter, Jürgen Kroll, and Kurt Bayertz. 1988. *Rasse, Blut und Gene: Geschichte der Eugenik und Rassenhygiene in Deutschland.* Frankfurt am Main, Germany: Suhrkamp.

Zald, Mayer N. 1970. "Political Economy: A Framework for Comparative Analysis." Pp. 221–61 in *Power in Organizations,* edited by M. N. Zald. Nashville, TN: Vanderbilt University Press.

Zald, Mayer N., Calvin Morrill, and Hayagreeva Rao. 2005. "The Impact of Social Movements on Organizations: Environment and Responses." Pp. 253–79 in *Social Movements and Organization Theory*, edited by G. F. Davis, D. McAdam, W. R. Scott, and M. N. Zald. New York: Cambridge University Press.

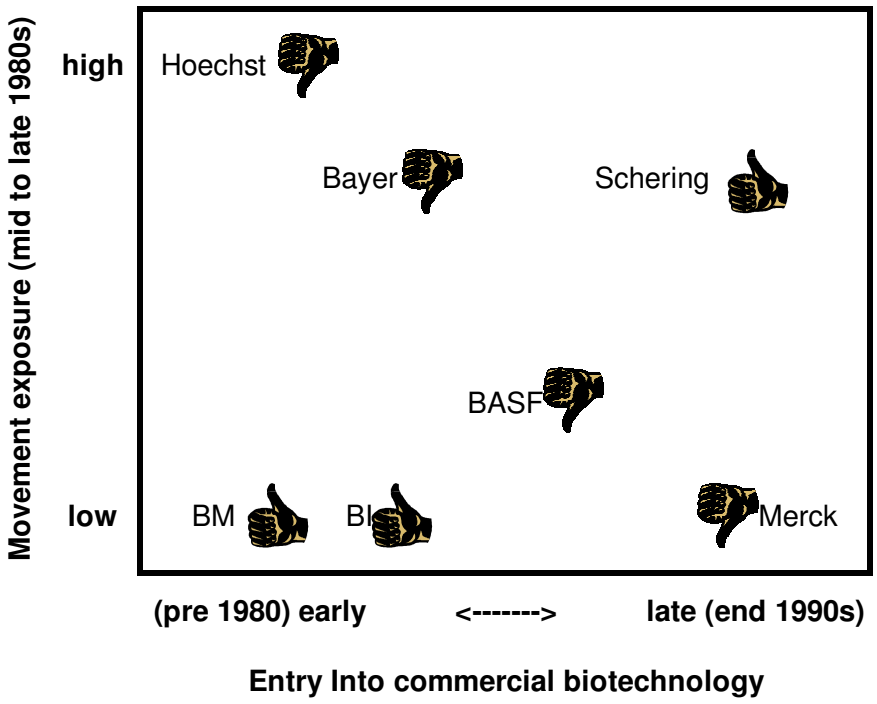
TABLE 1: COMPOSITION OF EXECUTIVE BOARDS, 1985-1989

Board Members by Background Category (%)				
	Chemical, Chemical Engineering	Medical, Pharma, Biochemical	Business, Law, Economics	Other, Unknown
BASF	0.62	0.08	0.23	0.08
Bayer	0.39	0.09	0.32	0.21
Hoechst	0.40	0.17	0.35	0.08
Merck KgAA	0.47	0.18	0.21	0.13
Schering AG	0.14	0.32	0.41	0.14
Boehringer Mannheim	0.00	0.49	0.49	0.02
Boehringer Ingelheim	0.00	0.65	0.35	0.00

* Background coded from highest degree (usually doctorate) and primary business unit experience where available

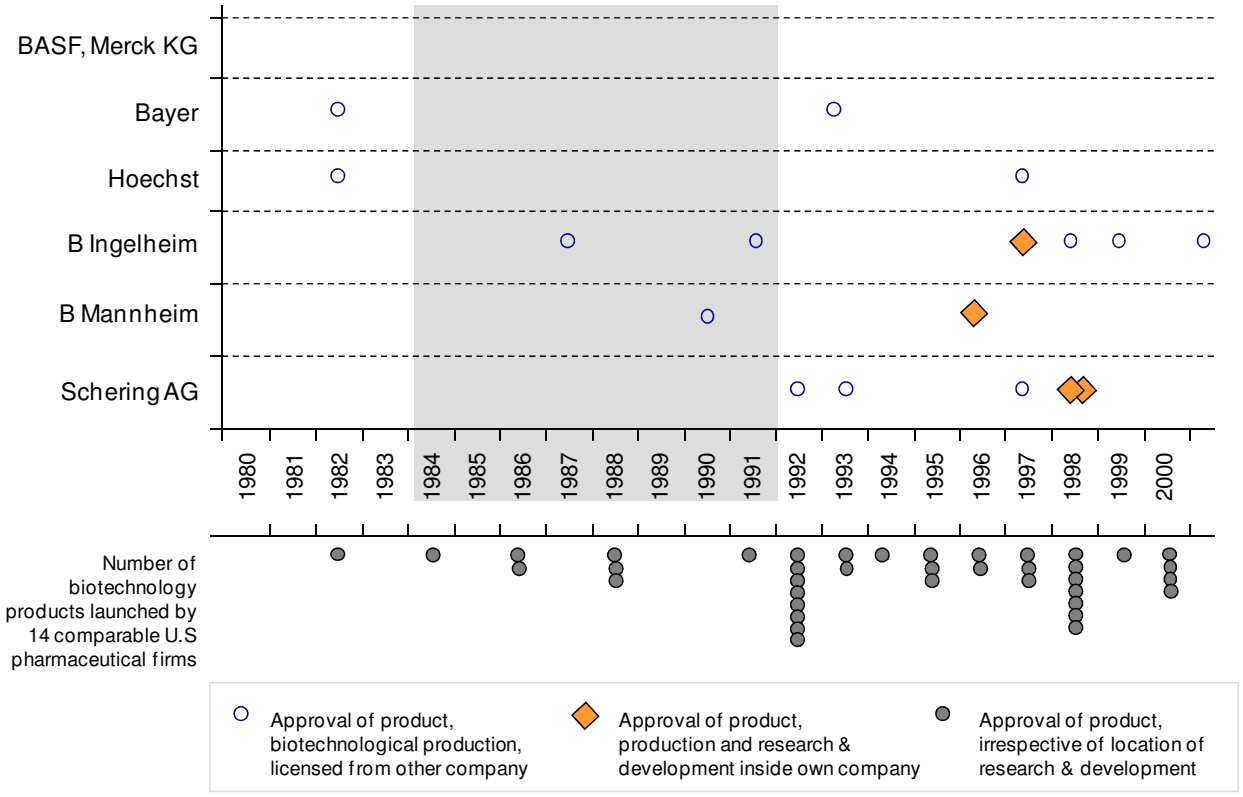
Sources: Annual Reports, web searches, *"Leitende Männer und Frauen der Wirtschaft"* (various years)

FIGURE 1: TIMING OF ENTRY, MOVEMENT EXPOSURE AND BIOTECHNOLOGY SUCCESS*



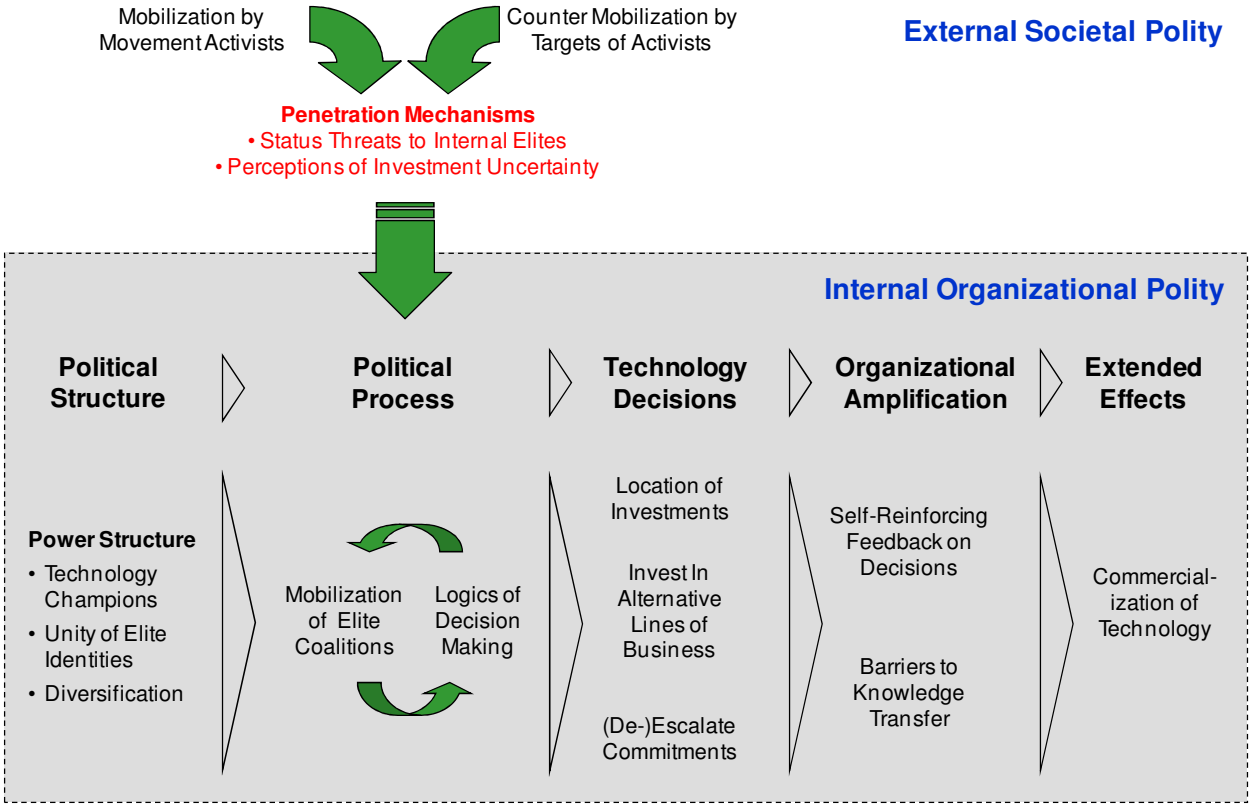
* = more successful in commercialization; = less successful in commercialization
Success classifications based on consensus ratings of industry experts and product launch data 1980-2000
Entry based on companies' own reporting of biotechnology investments (annual reports, press releases)
Movement exposure classified based on own research based on the data reported in this paper

FIGURE 2: BIOTECHNOLOGY PRODUCTS LAUNCHED BY LEADING GERMAN PHARMACEUTICAL COMPANIES, 1980-2000



** Shaded area marks years of main movement activity.*

FIGURE 3: PROCESS MODEL OF HOW MOVEMENTS PENETRATE ORGANIZATIONAL POLITIES



APPENDIX A: PATENT CITATION ANALYSIS OF INTER-UNIT KNOWLEDGE FLOWS

The more knowledge that flows from an autonomous business unit specialized in biotechnology to other pharmaceutical units, the more those pharmaceutical units should cite patents of the biotechnology unit. We gathered data on patent citations and conducted a statistical analysis of cross-unit patent citations on the three German firms with dedicated biotechnology business units. We included only multiunit firms and a reference group of the six most prominent U.S. pharmaceuticals organized with an equivalent multiunit structure. We first selected the 14 largest U.S. pharmaceutical companies and then eliminated those that do not file biotechnology patents at the business-unit level. The included companies are: Bristol-Myers-Squibb, Johnson & Johnson, Eli Lilly, Merck Co, Monsanto, and Wyeth/AHP. Table A1 shows a negative binomial analysis of cross unit patent citations with dummy variables for the three German companies (Bayer–Miles, Hoechst–Behring/MMD, Schering–Berlex) and for their core drug units.

Population Averaged Negative Binomial Regression Estimates	**(1)**	**(2)**	**(3)**
Independent Variables	Count of citations of other units' patents, Full panel	Count of citations of other units' patents, <1990	Count of citations of other units' patents, >=1990
Corporate drug sales, logged	0.16	0.736*	-0.24
	-(0.15)	-(0.32)	-(0.17)
Corporate drug patents, logged	0.60	0.39	0.44
	-(0.36)	-(0.67)	-(0.31)
Coporate diversification (1 - proportion of pharmaceutical sales)	-0.60	-1.439**	-0.86
	-(0.57)	-(0.53)	-(0.46)
Business unit patent citations, logged	0.710***	0.41	0.759***
	-(0.20)	-(0.33)	-(0.09)
Peripheral unit	-0.95	-1.16	-1.009***
	-(0.72)	-(0.81)	-(0.24)
Bayer corporation (Bayer, GER + Miles, USA)	1.816**	2.213***	2.005***
	-(0.60)	-(0.65)	-(0.46)
Bayer core drug unit (Bayer, GER)	-3.781***	-3.956***	-3.697***
	-(0.72)	-(0.90)	-(0.58)
Hoechst corporation (Hoechst + Behring, GER + MMD, USA)	1.284*	2.372***	1.116**
	-(0.60)	-(0.35)	-(0.39)
Hoechst core drug unit (Hoechst, GER)	-2.211**	-2.518***	-2.081***
	-(0.70)	-(0.76)	-(0.46)
Schering corporation (Schering, GER + Berlex, US)	-0.46	1.407*	-1.69
	-(0.27)	-(0.73)	-(1.31)
Schering core drug unit (Schering, GER)	-2.820***	-14.563***	-2.04
	-(0.67)	-(1.02)	-(1.56)
Wald Chi Square	1290.87***	2757.82***	168.36***
N	458	216	242

Panel data, 1980-2000.
Observations are business unit years, of largest 6 US and 3 German multi-unit pharmaceutical companies
Robust standard errors in parentheses
* significant at 5%, ** significant at 1%, *** significant at 0.1%

Model 1 shows that Bayer's, Hoechst's, and Schering's German units cited patents developed in other parts of their firms at significantly lower rates than the comparison group. Models 2 and 3 separate the effects for 1980 to 1990 and 1991 to 2000 and show that Bayer and Hoechst had lower cross-unit patent citation rates in both decades. By contrast, as expected, Schering only had the issue in the first decade when its internal polity was more diversified. The coefficient for the general measure of corporate diversification suggests that this pattern is specific to the three German firms in this sample, most likely because they had to locate biotechnology research in units that were less naturally suited for integration than did their U.S. counterparts. This tentative statistical analysis thus largely confirms the qualitative analysis reported in the article.

APPENDIX B: STATISTICAL ANALYSIS OF PRODUCT INTRODUCTIONS

Could the observed variation in product launches alternatively be explained simply through differences in organizations' access to knowledge and their skill in utilizing it? One might suspect, for example, that Schering, BI, and BM did better simply because they had knowledge in the form of patents. Table A2 shows a set of tentative statistical analyses that address this alternative explanation. We tested alternative predictors for whether companies launched new biotechnology products, their knowledge creation (biotechnology patents filed), and their ability to access external knowledge (via alliances and patent citations).

	(1)	(2)	(3)	(4)
	Bio Products	# Bio Patents	# Bio Alliances	% External Patent Citations
	Random Effect Logit	Negative Binomial	Zero-inflated (year) Negative Binomial	Quasi ML
Log of Drug Sales	2.19***	0.30***	0.66***	0.06
	(0.73)	-(0.07)	(0.05)	-(0.07)
Drug Sales Squared	-0.65**			
	(0.31)			
Log of Drug Patents in prior 3 years	0.1	0.36***		-0.28**
	(0.28)	(0.06)		-(0.09)
Log of Biotech Patents in prior 3 years	0.1			
	(0.33)			
Log of biotech Alliances in prior 3 years	-0.16			
	(0.30)			
Bayer	-0.29	0.50***	0.02	0.08
	(1.01)	(0.12)	(0.18)	-(0.08)
BASF	-17.7	-0.38	0.47**	0.37**
	(2241.5)	(0.22)	(0.23)	-(0.12)
Hoechst	0.34	0.40**	-0.17	0.33**
	(1.03)	(0.20)	-(0.18)	-(0.08)
Boehringer Ingelheim	3.12***	-0.46	0.16	-0.27***
	(1.09)	(0.27)	(0.21)	-(0.07)
Boehringer Mannheim	3.37**	1.91***	0.46**	0.02
	(1.56)	(0.14)	(0.23)	-(0.11)
Schering AG	2.37**	-0.62***	0.13	0.42***
	(1.05)	(0.15)	(0.20)	-(0.08)
Merck KGaA	-18.67	-0.43**	-0.16	-0.06
	(2070.7)	(0.18)	(0.23)	-(0.11)
Rho statistic	0.11			
	(0.10)			
Wald Chi Square	25.52**	563.64***	249.97***	
Pearson				103.54
N	392	432	429	432

Panel data, 1980-2000.
Observations are company years, of 14 US and 7 German leading pharmaceutical companies
Robust standard errors in parentheses. * significant at 5%, ** significant at 1%, *** significant at 0.1%

Model 2 shows that of the firms that were less successful at commercializing biotechnology, two firms, Bayer and Hoechst, held more patents than others, while Merck held fewer patents. Of the more successful firms, only BM had more patents, while BI and Schering did not differ. The

argument that those who commercialized biotechnology simply had better internal knowledge cannot be sustained. Alternatively, perhaps firms with a stronger biotechnology commercialization record were simply less insular and drew more effectively on external knowledge from other firms. To address this explanation, we analyzed whether a given firm entered alliances or cited the biotechnology patents of others in the industry in their own patents. Models 3 and 4 suggest that both BASF and BM entered more biotech alliances, but BASF was unsuccessful while BM was successful in commercialization. Of the less successful companies, BASF and Hoechst cited more patents belonging to others, while Bayer and Merck did not differ significantly from the others. Of the firms that did commercialize biotechnology, Schering cited more patents of other firms, but BI cited less, and BM did not differ significantly from the mean. Success thus cannot be attributed to firms better utilizing outside knowledge.