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Science and neoliberal globalization: a political sociological approach

Kelly Moore · Daniel Lee Kleinman · David Hess · Scott Frickel

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Abstract The political ideology of neoliberalism is widely recognized as having influenced the organization of national and global economies and public policies since the 1970s. In this article, we examine the relationship between the neoliberal variant of globalization and science. To do so, we develop a framework for sociology of science that emphasizes closer ties among political sociology, the sociology of social movements, and economic and organizational sociology and that draws attention to patterns of increasing and uneven industrial influence amid several countervailing processes. Specifically, we explore three fundamental changes since the 1970s: the advent of the knowledge economy and the increasing interchange between academic and industrial research and development signified by academic capitalism and asymmetric convergence; the increasing prominence of science-based regulation of technology in global trade liberalization, marked by the heightened role of international organizations and the convergence of scientism and neoliberalism; and the epistemic modernization of the relationship between scientists and publics, represented by the proliferation of new institutions of deliberation, participation, activism, enterprise, and social movement mobilization.

K. Moore (✉)
Department of Sociology, Loyola University-Chicago, 1032 W. Sheridan Rd., Chicago, IL 60660, USA
e-mail: kmoore11@luc.edu

D. L. Kleinman
Department of Community and Environmental Sociology, University of Wisconsin, Madison, WI, USA
e-mail: dlkleinman@wisc.edu

D. Hess
Department of Sociology, Vanderbilt University, Nashville, TN, USA
e-mail: david.j.hess@vanderbilt.edu

S. Frickel
Department of Sociology, Washington State University, Pullman, WA, USA
e-mail: frickel@wsu.edu

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Beginning in the 1980s, changes in government, industry, and the university have increasingly pressured academic and industrial scientists to align their research with the goals of national competitiveness, regional economic development, and marketplace opportunities. However, the changes have paradoxically opened new opportunities for scientists and citizens to develop science in the interest of the public and more specific constituencies. In this article, we argue that a new framework for the study of science is needed, one that seeks to provide a balanced understanding of both the new restrictions associated with the increasing influence of the private sector on the scientific field and the new forms of citizen participation and public-interest science that are emerging in response.

We develop a sociology of science that draws on concepts, tools, and approaches from political sociology, the sociology of social movements, and economic and organizational sociology (Frickel and Moore 2006). Our political sociology of science draws attention to the changing institutional and extra-institutional matrix of the scientific field. In doing so, we build on, but depart from, two traditions in the sociology of science: the institutional sociology of science, which focused on the internal mechanisms of the scientific field such as the reward system (e.g., Merton 1973), and the sociology of scientific knowledge, which drew attention to the microsociology of scientific networks and the social negotiations involved in the construction of knowledge claims (Knorr-Cetina and Mulkay 1983). In calling attention to the institutional and extra-institutional matrix of the scientific field, we also seek to avoid two theoretical pitfalls that have hampered previous attempts to improve understanding of the relationship between science and extra-scientific fields such as the economy. One problem emerges from the assumption that scientific change is an exogenous variable that leads to technological transformation and in turn influences the structure of the social order. Here, we end up with a reductive technological determinism (Stehr 2002), a view that can be found in some analyses of the "information society" (e.g., Castells 1996). A second, inverse problem begins with social structure as the exogenous variable. Here, analysts argue that long-term support by ruling elites for a system of knowledge production inevitably benefits those elites' class interests (e.g., Hessen 1971). An uncritical extension of this logic to the study of the current historical moment would likely lead to a reductive understanding of the relationship between globalization and science.

Our view springs from a third perspective, which assumes that science is a quasi-autonomous field of power that is subject to influence from other fields but also possesses a degree of self-governance (Fournier et al. 1975; Bourdieu 2001). The partial autonomy is due in part to the internal logic of the field that has been specified in both Mertonian and constructivist sociologies of science and in part to degrees of freedom that emerge from the countervailing powers exerted—often unevenly—by the economic, political, and civil society fields. This perspective enables us to develop an historical sociology of the contemporary changes in the scientific field that does not underplay the importance of structural change, including the increasing power of multinational corporations in global economics and politics,

and recognizes the role of scientists, political and industrial reformers, and the organized citizenry in charting alternative directions for the scientific field. We emphasize two central themes that can be observed across different institutional settings where science and neoliberal globalization meet: the existence of countervailing tendencies and the intertwining of scientific and political language in ways that asymmetrically stabilize and transform institutional relationships.

Background: globalization and neoliberalism

In defining the relation of science to neoliberal globalization as a central, new problem in the study of science, we need to specify what is meant by the central terms. We understand "globalization" as a descriptive characterization of an historical change in the scale of society. World systems theorists have documented the tendency for world systems to increase in scale and complexity over time (e.g., Chase-Dunn and Hall 1997), but the term "globalization" is used here to refer to general changes that have occurred since World War II. As Hirst and Thompson (1999) have argued, prior to World War I, the world was highly globalized on some measures, but the two world wars and high trade tariffs from the 1930s through 1950s reduced the level of economic globalization. However, after World War II, the world again became more globalized, and the changes can then be broken down by societal field. For example, in the political field the term refers to the increasing role of international governmental and nongovernmental organizations in organizing access to rights, identities, and material benefits; in the economic field to the increasing role of multinational corporations, and the interlocking of global financial institutions; and in the social field to changes in the volume and types of immigration and cultural flows.

As we use the term, "neoliberal globalization" is not a static or homogenous phenomenon. As a broad concept it can only be used effectively if it is understood as having undergone historical change and different levels of embeddedness across the world. In this context, Harvey (2005) emphasizes some of the differences in the institutionalization of neoliberalism around the world, and anthropologists such as Ong (2006) and Ferguson (2006) have explored differences in its forms and scope using ethnographic and other anthropological methods. Across these differences in analyses of neoliberal approaches to globalization, one common characteristic of neoliberalism at a global level is the new power of owners of large, multinational corporations that benefit from economic policies associated with innovation, trade liberalization, reduced government spending on entitlements and decreased state restrictions on labor, health, and environmental hazards of production (Campbell and Pederson 2001; Harvey 2005; Sklair 2001).

Just as there are various dimensions to globalization as an historical transformation, so there are various ideologies and practices that shape approaches to how it should or should not occur. From the 1930s to the 1960s, dominant ideologies included social liberalism (or social democracy) in the wealthy capitalist states, socialism in the communist countries and some of the developing countries, and developmentalism in other developing countries. Although highly diverse, the orientations had a family resemblance in that they emphasized a relatively

interventionist role of the state in the economy via public ownership, state planning, or strong regulation of exchange markets; protection of domestic markets via import substitution policies, industry subsidies, tariffs, and currency manipulation; and an approach to poverty and social safety nets as the responsibility of national governments through redistributive programs such as welfare, health insurance, and social security (McMichael 2000).

The term "neoliberalism" is used here to describe ideologies and practices that have also varied widely over time and across countries but have a family resemblance on three issues: a tendency to prefer markets over governments as instruments of policy (via privatization or, where regulatory policies are deemed necessary, via regulatory interventions that use marketplace mechanisms such as cap-and-trade systems); to favor trade liberalization over protectionism (with reductions in tariffs, subsidies, floating currencies, and regional and global trade agreements); and to approach poverty from the vantage point of self-responsibility, decentralized public-private partnerships, enterprise development, and other orientations to economic development expected to produce overall increases in the standard of living rather than redistributive change. As Foucault (2008) argued, neoliberalism emerged largely in response to the perceived totalitarian implications of state planning associated with fascism and communism; it was "neo" in the sense of encouraging a return to the state-economy relationship that had characterized some Western societies during the nineteenth century. The early German neoliberals ("ordoliberals") were not anti-state; rather, they argued that the intervention of the state in the economy was necessary to develop and protect markets. The American variant of neoliberalism placed a stronger emphasis on new market creation and entrepreneurialism, and it eschewed any contamination of homo economicus by concerns with poverty and social responsibility (Friedman 1970). As Harvey (2005) has argued, neoliberalism became politically influential as a response to the economic crises of the 1970s and 1980s, and the rapid spread of economic policies associated with neoliberalism can be explained by both their perceived effectiveness in solving economic crises and their benefits to the world's economic elites.

Categories such as "social liberalism" and "neoliberalism" are ideal types, and on many policy issues there are ongoing debates that show the continuing vitality of each as well as various mixes of the two. For example, a neoliberal approach to globalization (what we term here "neoliberal globalization") was tested in Chile during the 1970s, then introduced more broadly in the Reagan-Thatcher revolution of the 1980s and in the structural adjustment policies forced on developing countries as part of debt negotiation (Harvey 2005). After this "roll back" phase of neoliberalism, the policies were softened to some degree by the "third way" reforms exemplified by the Clinton administration and Blair government, each of which emphasized state intervention in the economy to encourage industrial innovation and competitiveness (Peck and Tickel 2002). Still, Clinton, Blair, and others tended to accept some of the fundamental tenets of neoliberal globalization, including trade liberalization and market-based solutions to policy problems.

Two factors are behind the differing forms and degrees of the influence of neoliberalism on public policies. First, neoliberalism is instituted in particular institutional, geographic, and cultural settings. As a result, it takes varied forms

because policies and ideas tend toward obduracy, not change. As we argue later, neoliberal ideas, such as limiting or expanding the "risks" associated with new technologies in the interests of promoting profit, are legally and culturally interpreted in extant policy domains and legal systems. Second, neoliberal public policies have been contested. Social movements, civil society organizations, socially responsible businesses, and some governments have articulated alternative visions of globalization, some of which call for a return to mid-twentieth century social liberalism and democratic socialism and point to the democracy deficit of global governance (Keck and Sikkink 1998; Della Porta and Tarrow 2005; Wood 2005; Routledge et al. 2006; Smith and Bandy 2005; Gautney et al. 2009). Alternative approaches to globalization can be found not only among grassroots anti-globalization movements but also among some of the prominent economists who were former insiders. For example, Stiglitz (2007) has argued in favor of a form of globalization that would retain trade liberalization but would work on the redistributive issues that have tended to be avoided under neoliberal policies that promise to solve poverty indirectly via economic expansion and increased productivity. Other social scientists have also questioned some of the assumptions behind descriptive characterizations of neoliberal globalization. For example, assumptions that place is no longer important in an era of globalization have been challenged by studies that show the reconstitution of place-based synergies leading to the creation of global cities (Sassen 2000), triple-helixes of government-industry-academic partnerships in regional development programs (Etzkowitz et al. 1998), and the renewed emphasis on localism (Hendrickson and Heffernan 2002; Winter 2003; DuPuis and Goodman 2005; Hess 2009a). Social scientists have also questioned the assumption that trade liberalization and deregulation produce an economic tide that lifts all boats; instead, new forms of inequality have been identified, such as growing inequality within nations, even as newly industrializing countries have become wealthier (Schmitt 2000). Assessments of the impact of structural adjustment policies in developing countries have also shown that their effects have often been deleterious for the poor (Davis 2006; Portes 1994; Portes and Roberts 2005) and to women (Duggan 2004; Lind 2010).

We extend the insight that the effects of neoliberal globalization have been both unevenly distributed and varied into the study of science, technology, and society. As we suggested earlier, under neoliberalism the economy is increasingly characterized as a free market that contains its own logics and rules, such that it operates outside of human direction. The naturalization of the market makes it analogous to older understandings of nature that characterized it as operating according to its own laws and rules that stood outside of human observation or intervention but that could be understood by experts. The new language of the economy-as-free-market black boxes the materiality, rules, and labor that are the foundation of economic life, subsuming them under an obfuscating numericism. Yet neoliberal policies and programs have never appeared in a standard fashion across the globe, because in practice "free markets" encounter cultures, histories, and geographies that make it difficult to implement, and give rise to resistances. As a result, scientized neoliberal globalization appears to operate according to natural law, but takes hold unevenly across the globe and in different institutional settings.

We argue that an understanding of the complex changes associated with neoliberal globalization and science requires attention to three related processes: the growth of the knowledge economy and new patterns of university-industry relations, new regimes of science-based technology regulation in a global economy, and the transformation of the relationship between science and social movements (or civil society more broadly). In describing these three phenomena, we both develop a new conceptual vocabulary for the study of science, and ground the concepts in a synthesis of empirical research conducted by each of us as well as by other sociologists and social scientists with similar interests.

Asymmetrical convergence in the new knowledge economy

As Noble (1977), Forman (1987), Kevles (1997), and other historians of science have demonstrated, there has been a longstanding relationship between the research needs of industry and the government and the general direction of research fields and research priorities. Thus, the argument that neoliberal globalization has led to an increasing impact of industry on scientific research needs to be inspected against the historical background of an ongoing relationship that was evident well before even the first articulations of neoliberalism. Our discussion in this section focuses on the United States, but other studies indicate that related changes have occurred elsewhere (e.g., Gibbons et al. 1994; Marginson and Considine 2000; Strathern 2000), and we hope that a comparative perspective will characterize future work in the political sociology of science.

With respect to the general argument that industry has had a growing influence on scientific research since 1980, one source of data is the pattern of changes in funding. Whereas from 1950 to 1980 the federal government was roughly equal to industry as a source of R&D expenditures, since 1980 government expenditures have been level while industry expenditures have doubled (Boroush 2008). Likewise, industry has also increased its share not only as a funding source, but as a performer of R&D, so that by 2007 industry performed 72% of R&D, in comparison with 11% for government R&D and 13% for universities and colleges (Boroush 2008). The changes in the extent of industry funding of scientific research, at least in the United States, provide a helpful picture of a background trend, but they do not in themselves constitute evidence for a relationship between neoliberal globalization and scientific research. One must ask instead what the changing relationship between industry and scientific research means and how scientific research has changed as a result.

A broad transformation in the role of the university in American society occurred as a result of increasing industrial and government concern with global competition, apprehension that predated trade liberalization but was heightened by its effects. After World War II, smokestack industry—firms responsible for the mass production of consumer durables—appeared as the "economic base" of the prosperity of the economies of the United States and other wealthy industrialized countries. As consumer goods production shifted increasingly to formerly agrarian societies with developing industrial economies, political and industrial leaders in high-income countries came to view science-intensive industries, such as information technology,

biotechnology, and nanotechnology, as necessary for maintaining economic leadership (Stehr 2002). Thus, in addition to shifts in funding that became weighted toward industry, there was also increased attention to the value of universities as sources of industrial innovation, often connected with regional industrial clusters (Croissant and Smith-Doerr 2007; Kleinman, 2003; Kleinman and Vallas 2001; Etzkowitz et al. 1998; Owen-Smith 2005; Slaughter and Rhoades 2004). Although concerns with the industrial competitiveness of the United States during the post-World War II period predated the emergence of neoliberal policies, those concerns were amplified by the growing pressure on American industries to innovate that emerged partly due to one central policy associated with neoliberalism: trade liberalization. As Fordist manufacturing in the industrial countries closed down, governments became preoccupied with rebuilding industry in sectors where there was a global advantage, specifically the knowledge economy.

New intellectual property regimes facilitated the repositioning of universities as engines of the new knowledge economy. In the United States, the passage of the Bayh-Dole Act of 1980 (which facilitated university ownership of intellectual property) and the Supreme Court decision of Diamond v. Chakrabarty (also in 1980, which enabled the patenting of life) correspond temporally with the Reagan revolution and the emergence of the roll-back phase of neoliberalism. However, as Berman (2008) has shown in an analysis of the factors behind the passage of the Bayh-Dole Act, federal officials were driven more by concerns with national competitiveness and the need for a new solution to the problem of technology transfer than they were by neoliberal ideology. Certainly, one could make similar arguments about the relatively unimportant role of neoliberal thought in the Chakrabarty decision. In other words, one needs to exercise caution in attempting to show the direct and explicit linkages between changes in the scientific field and neoliberal globalization. Following Bourdieu (2001, 2005), we approach the problem by looking for homologies or parallels in the transformation of the scientific and political fields and for causal links between actors and the structures of the fields in which they operate.

Although the two policy changes were not directly motivated by neoliberal ideology, they created political opportunities in the scientific field for the advancement of practices associated with neoliberalism. As the new intellectual property regimes were established, universities began to systematize relationships with industry via technology transfer offices. The emphasis on technology transfer and extramural funding had implications for the power relations among departments within universities. Not only were departments and schools with strong ties to the welfare state (such as criminology, welfare, public health, and some of the social sciences) eclipsed by departments and schools that were more closely aligned with industrial innovation, but departments that had built power bases on older types of industry linkages—such as chemistry and physics departments—were also challenged by emergent research fields such as information technology and biotechnology. Furthermore, because the effectiveness of technology transfer offices was uneven, the prestige relations among universities also shifted (Colyvas and Powell 2007, Owen-Smith 2005, Powell et al. 2007). For example, the Association for University Technology Managers (2000) surveyed 142 universities and found that 70 reported annual licensing income of less than one million dollars. Fewer than 15% of

the universities made over $10 million; in other words, many universities lost money on their investment. A wide swath of universities invested heavily in commercializing the research of their faculty, but the benefits have accrued mainly to the largest research universities. Universities that were able to establish research strengths in the new research fields were able to benefit from the new emphasis on technology transfer and industrial innovation.

Although the focus on technology transfer turned out not to be as broadly beneficial as first envisioned, it enabled a more general spread of the "culture of commerce" to academia. Here, one finds evidence of neoliberalism in the proliferation of industry-oriented language and practices in higher education. Again, one does not need to make the claim that individual administrators intentionally saw themselves as neoliberal ideologues. As new institutionalists have shown, practices often spread through changes in normative frameworks about how to handle routine and existing problems rather than through explicit rational calculation (DiMaggio and Powell 1983). In the new context of reduced government funding, enhanced concern with industrial competitiveness, and opportunities for revenue streams from technology transfer, administrators emphasized entrepreneurship and the spread of private-sector practices to university management. Slaughter and colleagues have explored the many related changes under the rubric of "academic capitalism" (Slaughter and Leslie 1997; Slaughter and Rhoades 2004). One of the primary features of academic capitalism is attention to the performance of academic units, often using numerical standards. Enabled by information technologies and external auditing agencies, university administrators could track with ease metrics such as faculty/student ratios, extramural funding, graduate students supported, publications generated, patents, and licenses. An "audit culture" (Strathern 2000) came to permeate the university, in which faculty became objects of managerial discipline and the financial autonomy of departments was undermined. Universities also moved away from cultivating administrative leadership within the academy itself and instead increasingly sought leaders with industrial or government management experience. In some institutions, undergraduate students were reframed as consumers, and faculty performance was measured within a frame of "customer satisfaction" (Kleinman 2010).

More generally, universities increasingly drew on "codes of commerce" originally developed in the corporate world. One of the most direct examples of the impact of such codes of commerce in connection with neoliberalism is the cultivation of entrepreneurialism, broadly construed, to encompass grantsmanship, program development, and technology transfer (Slaughter and Rhoades 2004; Donoghue 2008). With faculty, students, and even administrators understood as entrepreneurs, the reward systems changed fundamental attitudes toward risk-taking, program development, and research portfolio choices. On the one hand, scholarly and basic research into fundamental questions as well as teaching on such topics, a prerequisite of the autonomy of the scientific field via control over research and teaching agendas, was weakened. Unfunded research or poorly funded research, even if it generated significant prestige among other knowledge producers, was devalued. On the other hand, opportunities opened up for scientists to develop both new academic programs and new partnerships with industry that in turn could lead to a more diversified set of funding prospects and the potential for economic benefits via

licensing and start-up businesses. The changes produced tremendous pressures on young scientists as well as shifts in their evaluation of career opportunities. The scientist-entrepreneur may have emerged as an exemplar of the neoliberal academy, but not for all scientists in all fields. Rather, scientific fields tended to become structured by a tension between a producer pole that emphasized independence and traditional scholarship, and a practical pole that emphasized new collaborations and industrial applications. The dominant pole varied across disciplines (Albert 2003).

As some areas of university R&D become commercialized and subject to an entrepreneurial ethic, the codes and practices of academia were simultaneously finding their way into industry, especially in the high-tech sector. We term this double transformation *asymmetric convergence* (Kleinman and Vallas 2001; Vallas and Kleinman 2008; see also Owen-Smith 2005; Rabinow 1996). For example, some firms, generally in the high-technology sector, were situated on what they term "campuses." The benefits of an academic research environment went beyond recreational facilities, park-like settings, child care, libraries, and visiting lecturers; in some cases, industrial researchers had control over their on-campus hours and leeway in defining research programs, as long as they could be defended as potential new sources of revenue for the firm. In some ways, the new industrial R&D settings even offered advantages over university-based research. Whereas universities were often constrained by departmental structures, new industrial R&D settings promoted up-to-the-minute interdisciplinary research, cross-laboratory relationships, and multi-institutional collaboration, and they sought to promote open communication, especially within the firm. In this sense, the new structures of industrial R&D may have afforded greater autonomy for scientists, even though there were constraints on scientific communication outside the firm and on researchers' ability to pursue fundamental research problems that cannot be linked clearly to product innovation and new profits (Vallas and Kleinman 2008).

Thus, high-technology industry increasingly offered benefits once characteristic of university settings, even as universities became subject to the managerial practices associated with the corporate world. This convergence is asymmetrical because in many instances industry maintains an economic and (increasingly) cultural advantage. For example, in interviews, graduate students in the sciences have expressed disappointment upon discovering the high levels of entrepreneurialism required to keep a university laboratory afloat, and many have decided instead to pursue careers in high-technology industry, where ironically they believed they would have more autonomy and flexibility, experience less pressure than in academia, and be better able to serve the public good (Vallas and Kleinman 2008). Similarly, in an analysis of 2000 life scientists in the United States, Smith-Doerr (2004) found that female Ph.D.s in biotechnology firms were nearly eight times more likely to be in leadership positions than Ph.D.s in more hierarchical organizations, including universities. Consistent with the idea of asymmetrical convergence, where we see attributes widely thought to characterize academic life shaping high technology industry, Smith-Doerr contends that the networked character of high-tech firms promoted transparency and teamwork, which stresses collective over individualized rewards and benefits women scientists.

In summary, neoliberal globalization and the new knowledge economy intersect in two ways. First, neoliberal globalization is a background condition that facilitated

general economic changes that were already occurring as industrial production became more internationalized. The increase in global competition, which trade liberalization under neoliberalism facilitated, resulted in a shift of government and industrial research funding toward technological innovation, and new intellectual property regimes facilitated new relationships between universities and industry. Likewise industrial R&D spending shifted away from "blue sky" research toward potentially marketable technologies. Second, codes and practices associated with neoliberalism, especially the emphasis on entrepreneurialism, have come to permeate the research universities. In this context, industrial R&D centers, although more attuned to technology transfer issues than in the past, have adopted some of the practices associated with university-based research.

While the tendency is toward asymmetrical convergence between universities and industry with industrial models of work maintaining key economic and cultural advantages, countervailing patterns also emerge. The emphasis on entrepreneurialism and technology transfer has generated openings for research projects that are aligned with public interest concerns, such as environmental and health research, provided that this work also brings in extramural funding and prestige. The ethos of entrepreneurialism can be rechanneled in the form of social entrepreneurship, which diverts a portion of research portfolios toward pro-bono projects funded by governments, foundations, nonprofit organizations, and even, in some cases, corporate benefactors. Such social justice-oriented initiatives are also of special interest to universities, particularly those that are located in impoverished urban areas and in poorer countries, where the effects of deindustrialization and the dismantling of welfare-state protections may be visible in the deterioration of neighborhoods bordering campuses or in a society more broadly (Haufler 2006; Valdiya 2010). Moreover, many sites within the university—departments associated with public service roles rather than industrial innovation, faculty and governance structures, curricula and student programs that encourage voluntarism as a solution to collective problems, and connections with community development efforts and local political leaders—provide a countervailing force for the patterns of academic capitalism. We do not suggest a monolithic approach to understanding how global neoliberalism and the knowledge economy intersect–what we find, instead, is that the knowledge economy helps generate capital in university settings, and that knowledge-based firms have come to look more like universities.

The scientization of international regulation

Habermas (1970. p. 62) described the process of "scientization" in politics as involving an increasing orientation of state actors "to strictly scientific recommendations in the exercise of their public functions." Today, the intensification and expansion of scientization is broadly evident in the global knowledge economy, where firms and governments increasingly rely on science and technology to achieve, maintain, and strengthen their competitive positions. This has not gone unnoticed. As new materials and technologies are unleashed on markets, public concerns have mounted internationally with respect to the health, safety, environmental, and social implications of those products. As those

concerns become reorganized, public challenges that push against regulatory efforts to reduce state interference in international markets have become more frequent. Somewhat paradoxically, rather than curtailing contestations of neoliberal policies in international regulatory arenas, scientization seems to have focused and intensified those challenges.

Understanding why requires a conceptual framework that goes well beyond the concept of "deregulation." As the early German neoliberals argued, the role of the government is not to retreat from the economy completely but to make markets function efficiently (Foucault 2008). That goal may require some regulation not only to limit marketplace inefficiency, such as a tendency toward monopoly or inefficiencies in trading systems, but also to address public concerns that could otherwise lead to a collapse in confidence in markets. Thus, in the era of neoliberal globalization, the regulatory field becomes a complex arena in which battles take place less over "regulation versus deregulation" than over the types, degrees, and scope of regulation and its effects, particularly internationally.

This section identifies three intertwined changes that are occurring in the regulatory field and that directly implicate science. First, contrary to the argument that under neoliberal globalization voluntary industry self-regulation and deregulation by states have replaced state regulation, there is evidence that regulation is increasingly taking place in international governance bodies. Second, as international organizations have come to play an important role in the regulatory field, the influence of multinational corporations—and their backing by industrial science—has increased. Third, technology regulation is often framed, particularly at the international level, in a discourse of scientism that utilizes the authority of the scientific field but also depoliticizes the regulation of new technologies.

To map out these processes of change, we focus our attention in this section on food and agricultural biotechnology, partly because biotechnology is one of the central industries of the new knowledge economy and partly because biotechnology regulation is in some ways more developed than other emerging fields of technology regulation, such as nanotechnology. As a result, the study of biotechnology regulation can serve as a model for future research on technology regulation in the neoliberal era. We explore the problem comparatively and draw out key themes that frame our argument, including the existence of countervailing and contradictory forces and the multifaceted ways in which neoliberalism and science are understood and applied.

International governance

In the past, nation-states often created international organizations as means of coordinating relatively autonomous national policy efforts. International governance organizations have become even more important in coordinating international trade as economic systems have become more globalized. Thus, we find a paradoxical situation in which some aspects of neoliberal globalization have led to deregulation, such as the reduction of national trade barriers, while at the same time the increased internationalization of markets has created ongoing pressures for stronger international standards.

Under global neoliberalism, standards for the production, storage, and distribution of internationally traded goods are increasingly organized by international organizations that translate economic and social interests into scientific frameworks. Rather than synchronizing state-level regulation, some of the most prominent international trade and regulatory organizations have formulated entirely new standards, which rely heavily on scientific language and expert knowledge (Jasanoff 2004; Miller 2004; Kingsbury et al. 2005; Biermann 2002; Halfon 2010; Winickoff and Bushey 2010; Winickoff et al. 2005). We treat this process as as example of the general phenomenon of scientization noted above.

The Codex Alimentarius Commission provides an instructive example. The international organization was formed in 1962 by the Food and Agriculture Organization and the World Health Organization of the United Nations. Responding to global concerns about food additives, the Codex standardized the content of internationally traded foods and the processes by which foods were created and stored. Until 1994, the rules in the Codex were noncoercive; states could voluntarily use them and by doing so could engage more easily in international trade with participating partners. But in 1994, the World Trade Organization (WTO) built into its regulations incentives for participating nations to base their food regulations on those formulated in the Codex. While the use of Codex standards is still voluntary—participating nations can use the Codex standards or use a science-based risk assessment system—countries are advantaged in legal battles if they use the Codex standards (Post 2005). Since 1994, the number of countries that have joined the Codex Consortium has risen from 37 to nearly 200, and its rules cover the foods eaten by 97% of the world's population. This effectively makes the Codex the de facto basis for international food regulations (Post 2005; Winickoff and Bushey 2010; Lindne 2008). The very character of internationally traded food is based on its alignment with international scientific standards for moisture, purity, and other measures, not cultural meanings or national standards. Since the Codex governance system favors representatives from national governments—but particularly those that can afford to pay full-time members who can serve on highly influential subcommittees—it leaves food definitions in the hands of scientists and policy-makers. Yet it also offers opportunities for input from NGOs, citizens in participating countries, and scientists who can contribute independent reports, providing for at least some grassroots influence. Still, given that the WTO rules require decisions about the safety of food to be based on scientific and economic criteria, claimants using other forms of argument are at a disadvantage (Winickoff and Bushey 2010; Halfon 2010; Livermore 2006; Post 2005). More generally, given that nation states, not citizens or NGOs, are members of these kinds of regulatory organizations, even those that allow petitions by citizen groups are likely to be attentive to interests of nation-states, not external petitioners.

Countervailing effects of corporate influences

The second trend in the neoliberal regulatory field is countervailing. The increasing autonomy of the international regulatory organizations from the influence of individual nation states is counterbalanced by an increase in the types and volume of scientific input from industry into government regulations. Often these shifts in

input are supported by the neoliberal frame that values enhanced public-private partnerships. In the extreme case rulemaking by national governments and international organizations is replaced by standards set by international industrial consortium groups (Haufler 2001; Busch and Bain 2004; Vogel 2008). In some cases, industrial actors play a critical role in setting standards for trade, but there is less novelty in that practice—which has been taking place for centuries—than in the newest form of industrial self-regulation: the mitigation of the social and environmental effects of production and trade. Haufler (2001) points out that early industry self-regulation that developed in medieval Europe was organized around lowering transaction costs in production and has mainly continued to take that form until recently. Newer forms of international industry self-regulation, such as certification councils (e.g., the Forest Stewardship Council) are organized as a result of pressures from civil society and activist groups. Rather than submit to government regulation, producers and distributors set new scientific standards (sometimes with input from NGOs) to moderate unwanted or suspect social impacts (Haufler 2006).

Scientism as politics

Across these new forms of governance, there is evidence of the growth and uneven spread of "scientism" as a basis for regulatory policy (Kinchy et al. 2008; see also Winickoff and Bushey (2010) on "risk" as a specific type of scientism). By scientism we mean a discourse or framework for discussion that excludes consideration of distributional and other social impact criteria in the determination by a regulatory agency that a product is or is not suitable for markets. Scientism operates as an ideological frame that helps drive the broader process of scientization identified by Habermas. In its neoliberal form, scientism tends to restrict democratic participation and weaken the options for governments to regulate new technologies in ways that protect citizens rather than corporations. The influence of scientism in regulatory policy is uneven; that is, it varies considerably across different countries due partly to differences in political cultures (Jasanoff 2007). For example, although evidence of the influence of neoliberalism is pervasive in the European Union in comparison with the United States, the EU policymakers tend to be more tolerant of higher levels of government intervention in the economy—as revealed by the regulation of recombinant bovine growth hormone (rbGH), the first agricultural product of the biotechnology industry.

In the United States, neoliberal ideology was evident generally in agricultural policy during the 1980s, when changes in farm legislation required farmers to depend increasingly on market prices for their incomes. Such market-oriented policies were extended to agricultural biotechnology as well, where the government policy favored a hands-off approach to private-sector innovation. The multinational agrichemical company Monsanto first sought market approval for rbGH in the United States in 1986, a time of dairy surpluses and widespread fears of what the commercialization of the substance would do to the US dairy industry. In congressional hearings, social scientists pointed to studies that suggested that the commercialization of rbGH would lead to substantial consolidation of the industry, thereby hurting small producers and undermining the iconic family farm.

These prospects led to the mobilization of grassroots opposition to the substance. Many opponents of rbGH promoted a moratorium on commercialization of the drug on the basis of the likely adverse socioeconomic impacts it would have, and despite a broader political environment that favored deregulation, the arguments had some short-term impact, leading to a temporary federal moratorium and two state moratoria. Nevertheless, the US Food and Drug Administration ultimately rejected the arguments raised about socioeconomic impacts and insisted instead on using a narrow interpretation of health risks as the sole criterion for evaluating the acceptability of the product for use in milk. Thus, the agency yoked a narrowly scientistic orientation toward regulation to the general political commitment to free markets, and in 1993 it approved the commercial use or rbGH in the United States (Kleinman and Kinchy 2003).

The trajectory of rbGH regulation in the EU provides a valuable contrast. In the EU, years of debate and several temporary moratoria focused on the likely socioeconomic impacts of rbGH. The European Commission argued that commercialization of rbGH would run counter to the longstanding Common Agricultural Policy, which in part aimed to protect small-scale farming in EU countries. The Commission justified several temporary moratoria during the 1990s using this rationale. However, in 1996 Monsanto and Elanco challenged the Commission's position in the European Court of Justice, and in 1998 the Court ruled that socioeconomic regulation was inconsistent with international (neoliberal) trade agreements. rbGH could only be prohibited for narrowly technical reasons of health and safety. With evidence of the debilitating effects that rbGH can have on dairy cows, the Commission had a justification that would meet neoliberal muster, and EU ministers voted in favor of a permanent ban on rbGH in December of 1999.

In both cases, debate over the social impacts of new technologies was closed down, and social regulation ultimately was marginalized in favor of narrow considerations of technical risk (as also occurs in other regulatory fields; see Wynne 2005; Winickoff and Bushey 2010). However, if neoliberal globalization were homogenous in its effects, the EU's policy process on rbGH and other agricultural policies would mirror that of the United States. Instead, forces in the European Union pushed persistently for the social regulation of rbGH and, despite international pressures toward neoliberalism that prevented the implementation of explicitly social regulation of rbGH in the European Union, opponents of the substance were able to align a discourse of scientism with opposite results from those achieved in the United States. Similarly, during the 1990s, in the wake of the Mad Cow Disease scare, the European Parliament considered new ways to ensure that European food was uncontaminated enough to prevent health problems.

The Biosafety Protocol, adopted in 2000, suggests yet a different outcome in the regulation of agricultural biotechnology (Kleinman and Kinchy 2007) and illustrates another dimension to the unevenness of scientism. Signed by 159 nations, the Biosafety Protocol is an international agreement that seeks to protect biodiversity and environmental health by regulating the transport and use of living organisms modified by biotechnology. Although not a party to the negotiations, the United States and its allies persistently pushed for a policy that would mirror US agricultural biotechnology regulation. This US-led group of countries, representing the world's major producers of agricultural biotech products, argued

for (in our terms) a fusion of neoliberalism and scientism that would limit regulation of biotechnology. However, an array of countries from the global South and a number of non-governmental organizations (NGOs) opposed this approach and instead argued for a protocol that would place socio-economic regulation of agricultural biotechnology front and center. Negotiations over the Protocol began in 1995 and ran across five years and seventeen meetings. While the structure of negotiations provided space for countries from the global South and their NGO allies to push for socioeconomic regulatory provisions, the requirement that the final agreement reflect a consensus put the balance of power in the hands of countries that are leaders in the agricultural biotechnology market. Without their acquiescence, a comprehensive agreement on socioeconomic regulation would have been effectively meaningless. Thus, pressure from the United States and its allies led the socioeconomic provisions to become progressively weaker during the five years of discussion. The final provision requires that social regulation be consistent with international agreement. The provision likely means that any social regulation must be consistent with free trade agreements, and because social regulation is an explicitly interventionist approach to markets, the provision may mean that social regulation is impossible. At the same time, this case suggests that neoliberalism and scientism can be delinked, because some advocates of social regulation argued for the scientific assessment of likely social impacts.

A final valuable comparative case is Austria's regulation of agricultural biotechnology. Unlike those countries considered above, Austria has established a policy requiring that regulators ascertain likely socioeconomic impacts before commercialization of new biotechnologies can move forward. The socioeconomic regulatory provision of the Austrian Genetic Engineering Act of 1994 prohibits licensing of genetically engineered products if they will impose "an unbalanced burden on society" or entail unacceptable social, economic, or moral costs (Seifert and Torgersen 1997: 302). Austrian industry favored neoliberal regulations of the type developed in the United States, but the legislation was adopted when a coalition government took power in 1990. Under pressure from social movement organizations, the coalition was compelled to resolve the matter before Austria entered the European Union. The provision on social regulation is unambiguous, but it was apparently part of a compromise which entailed more economically liberal regulation in other areas.

As the examples summarized in this section suggest, the effects of neoliberal globalization are not monolithic and cannot be reduced to simplistic formulas such as "deregulation." But in general there is an increasing tendency toward scientism and the technocratic and elitist politics associated with international and corporate-led globalization and influence on regulatory bodies. Yet, this tendency coincides with emergent alternatives such as social regulation and even reappropriations of scientism that create spaces for greater levels of civil society participation. One source of the openings is that despite the efforts of its architects to make it appear to be positivist and unambiguous, at a legal level, the language of regulatory science remains murky, for the meanings of "risk assessment," "risk prevention," and "risk mitigation" are interpreted in courts and by nation-states in different ways (Halfon 2010).

In parallel with efforts toward the privatization of regulation, shifts from government-based regulations to industry standards, and a few examples of deregulation, there is also some evidence of increased autonomy of international organizations that emerges in part due to trade liberalization, the globalization of the economy, and the repeal of national governmental regulations. The field of technology regulation that has developed at the international level has become increasingly coercive, while at the same time industry has become intimately involved in shaping the regulation of technology-intensive industries and in structuring international agreements to weaken efforts to promulgate state-based regulation. These dynamics are uneven. Neoliberalism in the regulatory field is both contested and constructed differently in diverse legal and geographic contexts, with its effects most evident in the United States and less so in the European Union. While industry and its allies in states and regional and international governing bodies clearly have the upper hand, oppositional politics have also shaped international regulations, both challenging and using the language of science. We turn next to a fuller discussion of these processes.

Social movements and the epistemic modernization of science

A growing body of literature has suggested the importance of social movements for health, environmental, and other scientific and technical issues (e.g., Allen 2003; Brown 2007; Clark 1998; Epstein 1996; Frickel 2004; Hess 2007; Klawiter 2008; McCormick 2009). In turn, the increasing role of social movements and NGOs in science and technology issues is part of a broader "epistemic modernization" of the scientific field (Hess 2007), which has facilitated new forms of public participation via consensus conferences, community-based research, participatory research, science shops, and other deliberative and participatory institutions. At the same time, activists have also gone outside of these forms of politics, staging demonstrations and other forms of direct action that put pressure on governments, international governance bodies, and international corporations involved in science-based regulation and production. *Epistemic modernization* is intended to capture the shifts in the governance of science that have involved escalating levels of scrutiny by civil society actors toward scientific research and technology regulation, the growing permeability of the scientific and industrial fields to both partnerships with and opposition from various civil society actors, and the increasing legitimacy and institutionalization of such relationships through innovative collaborative arrangements and new forms of governance.

Epistemic modernization has its roots in the "unbinding" of the relationship between scientists and the authority of science (Moore 2008). Prior to the conclusion of World War II, social protest and other civil society challenges to the state were rarely characterized by critiques of science and technology. Beginning in the 1950s, however, a host of new concerns about technologies, such as the possible dangers of thalidomide, fluoride, and nuclear fallout, gained prominent public attention. In the 1960s and 1970s, citizen activists and scientists alike became increasingly skeptical of view that an unfettered research enterprise, new technologies, and technocratic forms of governance were optimal for providing social benefits. Since 1980, the

unbinding of scientists from scientific authority has greatly amplified and diversified. Patients, groups affected by environmental problems that result from industrial production, religious groups and many others increasingly debate and contest scientific knowledge, drawing on their own knowledges and those of experts. Scientists themselves represent a wide range of positions on any given public technoscientific debate, offering more possibilities for partnerships with activist groups, governance groups, and NGOs.

As more technologies that implicate bodies, cultural identities, and the environment circulate around the world under neoliberal trade arrangements, science has become implicated in a wide array of social movements of the right and left, from large professionalized national networks to small under-resourced community groups. The extraction, manufacturing, and distribution of goods under neoliberal globalization have often harmed communities culturally, environmentally and in terms of health. In the name of "free trade," many of the protections from the harms of industrial production that had been legally mandated in many western countries were either weakened, or were never put in place by multinationals that sought less restrictive geographical areas around the globe (see Pellow 2007).

This section builds on the two previous sections. Here we argue that neoliberal globalization has meant an increasing focus on the market and industry as a target of social movement action, new political partnerships between scientists and lay people that are in part driven by the scientization of the regulatory field, and new forms of stakeholder governance. The results of these challenges and forms of engagements are not uniform: as with the other shifts that we have documented, here we see unevenness in outcomes shaped, in part, by the flexibility of the meanings and uses of science under neoliberal globalization.

Markets and industries as targets

As regulatory functions have shifted from national governments to international bodies or industry organizations, social movements have followed the politics into the new arenas. Many social movements have become ever more transnational in scope, a feature that social movement studies has recognized in general (Buttel and Gould 2004; Wood and Moore 2002; Wood 2005; Della Porta and Tarrow 2005; Keck and Sikkink 1998). Less well understood is the diversification of social movement targets. Although governments and international governmental organizations remain targets, activists have also increasingly targeted industry directly to demand changes in the practices and policies of multinational corporations (Schurman and Munro 2004; King and Soule 2007; Bonnano and Constance 2007, 2008; Weber et al. 2009). One form of relationship to industry is the industrial opposition movement, such as those opposed to genetically modified food and nuclear energy (Levidow and Carr 2009; Wright and Midderndorf 2007). Although these types of movements can be seen in earlier periods as well, we contend that the form that they take in the contemporary period of neoliberal globalization is distinctive.

One key distinction is that the arenas of political debate in which social protest now takes place are constituted by international industries, international NGOs, and loci of political adjudication that are transnational. In the 1960s, if a US citizen

group wanted to protest environmental damages by a manufacturer, it would likely petition a US corporation in the US courts, but it would have difficulty finding scientists to serve as expert witnesses. But in the contemporary era of neoliberal globalization challenges to markets and industries look different. For example, in 1999, eleven Mexican community organizations formed Consejo Estatal de Parteras y Medicos Indigenas Tradicionales de Chiapas (CEPMITC) to oppose a $2.5 million dollar bioprospecting program initiated by the University of Georgia (UGA). Working with their UK-based commercial partner, Molecular Nature, Inc., the University of Georgia hoped to use local knowledge and scientific surveys to discover new commercially viable biological products. Using the language of scientific ethics, CEPMITC made the case that UGA had not received permission from relevant communities. When UGA and their commercial partner tried to form a new NGO, PROMAYA, that they hoped would be able to provide such permission, CEPMITIC undertook two years of lobbying the Mexican and US governments and protests against UGA and Molecular Nature, Inc., with assistance from several international NGOs and sympathetic scientists. CEPMITIC prevailed in 2001, and the UGA project was terminated (Barreda 2003; see also Hayden 2003). The forms that this contestation took, and the array of actors it involved, represents a new form of challenge to industry under neoliberal globalization.

Another way that science-based political contestation has changed in the context of neoliberal globalization involves the emergence of "alternative industrial movements." Alternative industrial movements include two movement sub-types. One sub-type is certification movements, in which local and transnational social movement organizations work to change industry production standards and marketplace labeling. The movements for dolphin-safe tuna and the fair trade movement are two examples (Conroy 2007). Certification movements work with the private sector to certify products as meeting certain social and environmental goals (e.g., social justice, sustainability). In these movements, challengers often shift over time from being stridently oppositional to having partnership in the construction of new science-based standards to guide the certification process. Because of power differentials that often characterize negotiations between social movement organizations and private firms, the potential for cooptation is high. Moreover, because certification movements are consumer-based, they are in some ways consistent with the neoliberal ideology of high levels of individual consumption based on market choices. They may thus have little effect on overall levels of consumption or on the broader system of exploitation and profit, while encouraging consumers to use scientific standards that make ever finer distinctions about the effects of purchases on labor, the environment, and consumers' bodies (Cohen 2003; Steigerwald 2006; Szasz 2007).

The second sub-type of alternative industrial movement is the technology- and product-oriented movement (TPM). Rather than seeking to reform existing industrial practices, the goal of these movements is to support the development of *alternative pathways* to industrial production through new products, such as complementary medicine, organic food, or open-source software (Hess 2007). TPMs may include civil society organizations that have advocacy roles as well as entrepreneurial orientations to the pioneering of new technology. By carrying out politics either by directly focusing on firms as targets of social change or by building alternative

products and market certification schemes, to some degree social movements can be seen as acquiescing to the neoliberal view that markets can often solve political problems better than government policy. Here too, the potential for cooptation is enormous, and our research suggests that it is not uncommon for the alternative technologies and products of the TPMs to undergo redesign via a complementarization process as they are mainstreamed into existing industries. However, by carrying politics directly into the marketplace, social movements can also challenge neoliberal nostrums such as Friedman's (1970) argument that "the social responsibility of business is to increase its profits." Furthermore, by politicizing issues such as product standards and design, social movements can draw public attention to the need for regulations and thus help open up political opportunities for government intervention, as the case of anti-GMO maize mobilizations in Mexico shows (Kinchy 2010).

New political partnerships

A second transformation of social movements with respect to science and neoliberalism involves the problem of how to respond to scientism in regulatory policy. As discussed above, regulatory policy is often framed in narrow terms that tend to exclude general social considerations and may require considerable technical expertise to interpret the rules. The situation presents a dilemma for social movements and other civil society organizations that want to influence the policy process. These movements and organizations may choose to remain on the outside and argue for a broader basis for regulatory policy, such as social regulation, but in doing so they may be excluded from the policy process and lack any influence on a decision. Alternatively, they may seek to develop the needed expertise to participate in a regulatory decision-making process, but to do so they need to build partnerships with scientists. Here, the decision to acquire technical expertise is related to the scientism of regulatory policy settings, which in turn is indirectly related to neoliberalism in that it limits the scope of government intervention in the economy to narrow, technical grounds that favor industry (see Ottinger 2010).

Even when movements generate partnerships with firms that are organized through voluntary regulations, they may still be unequal players in a field defined by the expertise of firms. For example, the 1992 Convention in Biological Diversity reframed the commercialization of biological products as an "ethical" issue that required that communities whose biological products were used benefit in some way. Yet corporations that seek partnerships with groups whose biological resources they want to use often generate their own scientific definitions of "products," "benefits," and "communities" and frame the ethical issue in terms of charity rather than justice and equity. Activists often find themselves in a position of contesting the scientific frameworks that international regulations have set in place, but without the kind of input or transparency that state-level regulation required or allowed (Hayden 2007).

In other cases, movements that adopt a position in opposition to industry but (in the view of activists) also in the broader public interest will tend to find that the scientific field is characterized by substantial pockets of "undone science" (Frickel et al. 2010; Hess 2007). To address undone science, challengers adopt various strategies that have been identified in science studies. First, activists themselves

may undergo training in which they come to acquire a degree of expertise that enables them to engage the policy issues (Epstein 1996; Klawiter 2008; Nelson 2011; Clarke et al. 2009). Second, activists may recruit scientists to help them in specific research projects via community-based research, and citizen-scientist alliances (Brown and Zavestoski 2007; Brown et al. 2006; Brown 2007). In the process, scientists and activists may form "shadow mobilizations," or loosely structured social networks that span disciplinary and institutional boundaries to tie variously positioned professionals to movement constituencies, social movement organizations, state regulatory bodies, and one another (Frickel 2010, 2011). For example, groups of farmers, scientists, and regulators have begun to generate an Africa-wide network that proposes alternatives to the monoculture, export-based, agriculture model favored by the WTO and the Bill and Melinda Gates Foundation. Organizing around the idea that farmers have knowledges that should be shared so that collective, rather than private, benefits incur, these groups are working to reorganize both knowledge and governance in Africa by creating new science-based treaties and laws that recognize social as well as property rights (Mushita and Thompson 2008).

Activists working in large civil society organizations with substantial resources, such as some of the environmental organizations, may have the resources to fund "civil society research" on their own (Hess 2009b). These arrangements have emerged in response to the weakening of state and supra-state governance of the harms from industrial and others forms of production and distribution and the simultaneous movement of harmful products beyond the geographic boundaries where they were produced.

The strategies summarized above suggest that activists are capable of responding to the increasing but uneven scientization of regulatory policy, but in doing so they encounter a dilemma that is parallel to the one described for intervention in markets: operating within a framework of scientistic regulation can result in policy changes advocated by the activists, but it can also mean accepting a narrowly defined basis for technology regulation, and in this sense, the strategy can unintentionally contribute to scientization. This said, it is also possible both to participate in scientistic technology politics and attempt to discredit them by pointing to alternative bases for regulation such as social regulation. As we noted earlier in the discussion of regulation, because the scientization of regulations can be ambiguous, challengers have openings that they can exploit.

New forms of stakeholder governance

Another area of change involves the role of movement groups in new institutions of governance that have developed under neoliberalism, including international regulatory groups and NGOs. As activists step into public policymaking processes where technical knowledge is being debated, many claim to represent a broad public or general interest, with some apparent success. In general surveys of public trust, NGOs tend to have greater credibility than elected political officials and the media, and slightly higher credibility than business (Edelman 2008), and the development of NGOs into trusted entities representing a broad public interest may be seen as a positive development. However, a more critical reading suggests, to some degree,

the failure of the liberal model of democracy, in which elected political leaders and their appointees are representatives and guardians of the public good. Here, we encounter another connection between the scientific field and neoliberal globalization: the shift from government to stakeholder governance.

By *stakeholder governance* we mean the shift in political decision-making from official government bodies to extragovernmental bodies of stakeholders. Under government decision-making, there is a premise that the authority ultimately rests on elected political officials. Even if much decision-making occurs in regulatory agencies by appointed officials, ultimately they are accountable to a public interest as defined by elected officials who must pass the test of periodic voter approval. Government-based decision-making can also make use of deliberative institutions, such as consensus conferences, in which laypeople are selected on a random basis and asked to spend some time learning about an issue and then giving a report (see Barns 1995; Kleinman, et al. 2007).

The new institutions of "governance beyond the state" have a Janus quality (Swyngedouw 2005). On the one hand, they may enable greater public participation and representation of conceptions of the public interest beyond those defined by industry. For example, stakeholder governance has been used effectively in grassroots ecosystem management governance in the western United States, where environmentalists, ranchers, regulators, and local governments have sometimes been able to broker agreements that resolve longstanding stalemates (Weber 2003). Furthermore, in international governmental and standards-setting organizations, where, as we argued above, regulatory decision-making has grown in influence, there are no directly elected political officials. In such circumstances stakeholder forms of governance are the only available mechanism to air versions of public interest at odds with those of global industry.

On the other hand, even where government is subjected to open elections and attends to public opinion via opinion polls or consensus conferences, industry often has a high level of influence over the political process due to intense lobbying, high levels of campaign contributions, and control and influence over the media. For its part, stakeholder governance shifts decision-making from governments and institutionalizes participation by industry groups. In this sense, it is consistent with the neoliberal goal of shifting policy solutions to markets. Furthermore, the effectiveness of stakeholder governance is highly dependent on who controls which stakeholders get to participate, who has the power to adjudicate disagreements, and how the outcomes of such participation translate into policy. Consequently, processes can be set up to favor market-oriented solutions in contrast with outcomes from the standard, governmental political process. At best, activists may find it possible to combine participation in stakeholder forms of governance with outside opposition (Hess 2010). At its worst, such organizations may find that their participation in stakeholder governance mechanisms legitimates a process that is undemocratic and an outcome that is not aligned with their understandings of the broader public interest. Participation in such fora may also divide movements over strategic issues of maintaining opposition on the outside that attempts to delegitimate stakeholder processes and outcomes, versus attempting to have some influence on the inside even if that means accepting unwanted compromises.

In considering the relationship between neoliberal globalization and the field of social movement and civil society participation in science and technology, we suggest three developments. First, social movements themselves have undergone a change in response to the relative tightening of political opportunities for government intervention in the economy. While not giving up on public policy as an avenue for social change, activist groups have diversified their targets of social change to include direct engagements with industry. Those relations can include industrial opposition movements, with the traditional repertoires of protest and civil disobedience now turned directly on industry, and alternative industrial movements, with their emphasis on entrepreneurship, certification, and partnership with industry. Second, movement groups have in some cases responded to the scientization of regulatory policy by becoming more actively involved in the construction of technical expertise. Third, social movement groups have become part of the new institutions of stakeholder governance, which themselves are subject to complex cross-currents: they displace traditional government but can also amplify traditional government with new avenues for democratic participation; in turn the democratic participation by stakeholders can be coopted by industry groups that wish to pursue a neoliberal agenda with respect to government policies.

Conclusion

We have explored a number of changes in the relationship between science and society from the 1970s to the present, examining the relationship between those changes and the broader economic and political trends associated with neoliberal globalization. We have emphasized the unevenness of the intersection of neoliberal globalization and science while identifying some of its major forms and trends. Previous theory traditions in the sociology of science that maintain a specific focus on the internal dynamics of the scientific field—the institutional sociology of science associated with Robert Merton and the constructivist "sociology of scientific knowledge"—have had relatively little to say about these issues. Although a broader literature in science and technology studies (STS) has explored political sociological issues such as science-government and science-industry relations, there is little analysis that considers the broader nexus of science, government, industry, and social movement relations from the perspective of the historical changes associated with neoliberal globalization. The framework for a political sociology of science presented here fills this gap, in part by drawing on insights and perspectives from political sociology, the sociology of social movements, and economic and organizational sociology. The result is an analysis of the scientific field that charts changing relationships with industry, government, and civil society and has the potential to contribute to diverse fields of sociological theory.

The project of a political sociology of the scientific field under neoliberal globalization requires developing a new family of concepts linked to the formulation of new empirical research problems. We have delineated three central areas of attention: the knowledge economy and the changing practices of academic and industrial R&D, the construction and institutionalization of new regimes of science-based technology regulation, and the changing face of social movement and civil

society participation in scientific and technological decision-making. Within those central problem areas, we have identified particular changes, such as the asymmetric convergence of academic and industrial R&D, the scientization of regulatory policy, and the unbinding of scientific authority from scientists.

Our analysis suggests that science and science-oriented regulatory policy in the neoliberal order cannot be characterized by a simplistic formula that assumes the hegemony of large multinational corporations. Although neoliberal globalization has entailed the reformulation of policies and markets that favor new political economic arrangements dominated by global capital, we believe such analyses must recognize the relative autonomy of the scientific field. The new forms of asymmetric convergence both increase and decrease the autonomy of the scientific field, depending especially on what variable is chosen and whether one is looking more at academic or industrial R&D. Likewise, the value placed on science entrepreneurship creates both new opportunities and new restrictions for scientists. In the regulatory field, the shift of regulatory policy to international organizations has entailed some opening of those organizations to promote stakeholder forms of governance, including civil society participation, but it has occurred within an order that tends to construct trade liberalization as the paramount value. Likewise, at a national level, regulatory policy for science-based industries has involved the use of scientism to restrict social regulation, but a comparative perspective suggests that the relationship between scientism and social regulation may reflect distinctive historical pathways. Finally, in civil society we see new patterns of relationship with industry and the scientific community that both elaborate on neoliberal practices and challenge them. The new patterns include direct relations between social movement organizations and industry, either via the traditional oppositional politics of protest or via the new partnerships associated with certification movements and technology and product-oriented movements. They also include participation in the new regimes of stakeholder governance and scientistic regulation, which to some degree reinforce those regimes while also challenging their content and premises.

A political sociology of the contemporary scientific field draws attention to countervailing pressures, from industry and the "right hand" of the state on one side, which is concerned with issues of technology transfer and industrial competitiveness, and from civil society and the "left hand" of the state on the other side, with its goal of supporting science that serves a broad public interest. We do not naively propose that the countervailing pressures are, by any means, balanced; nor do we suggest that new forms of stakeholder governance in technology regulation and science policy will ultimately prove more democratic than representative government. Instead, we contend that attention to countervailing processes of historical change should be at the center of a political sociology that explores the problem of science in an era of neoliberal globalization. In turn, these conflicts are part of the broader societal construction of neoliberal globalization in contested fields of struggle. Future work must be attentive to the character of these struggles and the tools that agents use when they engage in it. We have suggested a family of concepts and empirical problem areas that may help guide future research, and we urge scholars to search for concepts beyond the traditional STS arsenal—in other words, to explore the value of concepts also drawn from organizational, economic, and political sociology and the sociology of social movements. Thoroughly compre-

hending the relationship between science and neoliberal globalization will, we believe, require close attention to the dynamics and social organization of power and resource allocation.

Although this essay is intended as a theoretical contribution to the literature, we believe a political sociology of science can also address important policy implications. By helping to clarify how neoliberal ideology and policies have shaped the scientific and regulatory fields, and by outlining the specific forms of oppositional politics that have emerged in response, we hope to contribute an improved understanding of both the power and appeal of globalization as well as strategies for challenging it.

References

Albert, M. (2003). Universities and the market economy: the differential impact of knowledge production in sociology and economics. *Higher Education, 45*(2), 147–182.

Allen, B. (2003). *Uneasy alchemy: citizens and experts in Louisiana's chemical corridor disputes*. Cambridge: MIT.

Association for University Technology Managers. (2000). *Licensing survey, FY2000: Full report*. Deerfield: Association of University Technology Managers.

Barns, I. (1995). Manufacturing consensus: Reflections on the UK national consensus conference on plant biotechnology. *Science as Culture, 12*, 199–216.

Barreda, A. (2003). Biopiracy, bioprospecting, and resistance: Four cases in Mexico. In T. A. Wise, H. Salazar, & L. Carlsen (Eds.), *Confronting globalization: Economic integration and popular resistance in Mexico*. Sterling: Kumarian.

Berman, E. P. (2008). The politics of patent law and its material effects: The changing relationship between universities and the marketplace. In T. Pinch & R. Swedberg (Eds.), *Living in a material world: Economic sociology meets science and technology studies* (pp. 191–213). Cambridge: MIT.

Biermann, F. (2002). Institutions for scientific advice: Global environmental assessments and their influence in developing countries. *Global Governance, 8*(2), 195–219.

Bonnano, A., & Constance, D. (2007). Agency and resistance in the sociology of agriculture and food. In W. Wright & G. Midderndorf (Eds.), *Food fights* (pp. 29–43). University Park: Penn State University Press.

Bonnano, A., & Constance, D. (2008). *Stories of globalization: Transnational corporations, resistance, and the state*. College Park: Penn State University Press.

Boroush, M. (2008). New Estimates of National R&D Expenditures Show 5–8% Growth in 2007. (www.nsf.gov/statistics/infbrief/nsf08317, accessed January 21, 2009).

Bourdieu, P. (2001). *Science of science and reflexivity*. Chicago: University of Chicago Press.

Bourdieu, P. (2005). *The social structures of the economy*. Malden: Polity.

Brown, P. (2007). *Toxic exposures: Contested illnesses and the environmental health movement*. New York: Columbia University Press.

Brown, P., McCormick, S., Mayer, B., Zavestoski, S., Morello-Frosh, R., Gasior-Altman, R., et al. (2006). A Lab of Our Own: Environmental causation of breast cancer and challenges to the dominant epidemiological paradigm. *Science, Technology and Human Values, 31*, 499–536.

Brown, P., & Zavestoski, S. (Eds.). (2007). *Social movements and health*. London: Blackwell.

Busch, L., & Bain, C. (2004). The transformation of the global agrifood system. *Rural Sociology, 69*(3), 321–346.

Buttel, F., & Gould, K. (2004). Global social movement(s) at the crossroads: Some observations on the trajectory of the anti-corporate globalization movement. *Journal of World Systems Research, 10*(1), 37–66.

Campbell, J., & Pederson, O. (Eds.). (2001). *The rise of neoliberalism and institutional analysis*. Princeton: Princeton University Press.

Castells, M. (1996). *The information age: Economy, society, and culture. Volume 1. The rise of the network society*. Oxford: Blackwell.

Chase-Dunn, C., & Hall, T. (1997). *Rise and demise: Comparing world systems*. Boulder: Westview.

Clark, A. (1998). *Disciplining reproduction: Modernity, American life sciences, and 'the problems of Sex'*. Berkeley: University of California Press.

Clarke, A., Shim, J. K., Shostak, S., & Nelson, A. (2009). Biomedicalising genetic health, diseases and identities. In P. Atkinson, P. Glasner, & M. Lock (Eds.), *The handbook of genetics and society: Mapping the new genomic era*. New York: Routledge.

Colyvas, J., & Powell, W. (2007). From vulnerable to venerated: The institutionalization of academic entrepreneurship in the life sciences. *Research in the Sociology of Organizations, 25*, 219–259.

Cohen, L. (2003). *A Consumer's republic: The politics of consumption in postwar America*. New York: Knopf.

Conroy, M. (2007). *Branded! How the 'Certification Revolution' is transforming global corporations*. Gabriola Island: New Society.

Croissant, J., & Smith-Doerr, L. (2007). Organizational contexts of science: Boundaries and relationships between university and industry. In J. Wajcman, E. Hackett, O. Amsterdamska, & M. Lynch (Eds.), *The handbook of science and technology studies* (pp. 691–718). Cambridge: MIT.

Davis, M. (2006). *Planet of slums*. London: Verso.

Della Porta, D., & Tarrow, S. (Eds.). (2005). *Transnational protest and global activism: People, passions, and power*. Lanham: Rowman and Littlefield.

DiMaggio, P. J., & Powell, W. (1983). The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*, 147–160.

Donoghue, F. (2008). *The last professors: The corporate university and the fate of the humanities*. Bronx: Fordham University Press.

Duggan, L. (2004). *The twilight of equality? Neoliberalism, cultural politics, and the attack on democracy*. Boston: Beacon.

DuPuis, M. E., & Goodman, D. (2005). Should we go 'home' to eat? Toward a reflexive politics of localism. *Journal of Rural Studies, 21*, 359–371.

Edelman, R. (2008). Edelman Trust Barometer 2008. (www.edelman.co.uk/files/trust-barometer-2008.pdf. Accessed January 21, 2009).

Epstein, S. (1996). *Impure science: AIDS, activism, and the politics of knowledge*. Berkeley: University of California Press.

Etzkowitz, H., Webster, A., & Healy, P. (1998). *Capitalizing knowledge: New intersections of industry and academia*. Albany: State University of New York Press.

Ferguson, J. (2006). *Global shadows: Africa in the neoliberal world order*. Durham: Duke University Press.

Forman, P. (1987). Behind quantum electronics: national security as a basis for physical research in the U.S., 1940–1960. *Historical Studies in the Physical Sciences, 18*, 149–229.

Foucault, M. (2008). *The birth of biopolitics: Lectures at the college de France, 1978–1979*. London: Palgrave-Macmillan.

Fournier, M., Germain, A., Yves, & Maheu, L. (1975). The scientific field of Quebec: structure, functioning, and functions. *Sociologie et Societes, 7*, 119–132.

Frickel, S. (2004). *Chemical consequences: Environmental mutagens, scientist activism, and the rise of genetic toxicology*. New Brunswick: Rutgers University Press.

Frickel, S. (2010). Shadow mobilizations for environmental health and justice. In J. Banaszak-Holl, S. Levitsky, & M. N. Zald (Eds.), *Social movements and the transformation of U.S. health care* (pp. 171–187). Oxford: Oxford University Press.

Frickel, S. (2011). Who are the expert activists of environmental health justice? In B. Cohen & G. Ottinger (Eds.), *Engineers, scientists, and environmental justice: Transforming expert cultures through grassroots engagement*. Cambridge: MIT (in press).

Frickel, S., & Moore, K. (Eds.). (2006). *The new political sociology of science*. University of Wisconsin Press.

Frickel, S., Gibbon, S., Howard, J., Kempner, J., Ottinger, G., & Hess, D. (2010). Undone science: charting social movement and civil society challenges to research agenda settings. *Science, Technology, and Human Values, 35*(4), 444–473.

Friedman, M. (1970). The social responsibility of business is to increase its profits. *New York Times Magazine*, September 13, p. 32.

Gautney, H., Dahbour, O., Dawson, A., & Smith, N. (2009). *Democracy, states, and the struggle for global justice*. New York: Routledge.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London: Sage.

Habermas, J. (1970). *Toward a rational society: Student protest, science, and politics*. Trans. by Jeremy Shapiro. Boston: Beacon Press.

Halfon, S. (2010). Confronting the WTO: intervention strategies in GMO adjudication. *Science, Technology & Human Values, 35*, 307–329.

Haufler, V. (2001). *A public role for the private sector: Industry self-regulation in a global economy*. Washington: Carnegie Endowment.

Haufler, V. (2006). Global governance and the private sector. In C. May (Ed.), *Global corporate power* (pp. 95–105). Boulder: Lynne Rienner.
Harvey, D. (2005). *A brief history of neoliberalism*. Oxford: Oxford University Press.
Hayden, C. (2003). *When nature goes public: The making and unmaking of bioprospecting in Mexico*. Princeton: Princeton University Press.
Hayden, C. (2007). Taking as giving: Bio-science, exchange, and the politics of benefit sharing. *Social Studies of Science, 37*, 729–758.
Hendrickson, M. K., & Heffernan, W. D. (2002). Opening spaces through relocalization: Locating potential resistance in the weaknesses of the global food system. *Sociologia Ruralis, 42*(4), 347–369.
Hess, D. (2007). *Alternative pathways in science and industry*. Cambridge: MIT.
Hess, D. (2009a). *Localist movements in a global economy*. Cambridge: MIT.
Hess, D. (2009b). The potentials and limitations of civil society research: Getting undone science done. *Sociological Inquiry, 79*(3), 306–327.
Hess, D. (2010). The environmental, health, and safety implications of nanotechnology: environmental organizations and undone science in the United States. *Science as Culture, 19*(2), 181–214.
Hessen, B. (1971). *The social and economic roots of Newton's principia*. New York: Howard Fertig.
Hirst, P., & Thompson, G. (1999). *Globalization in question: The international economy and the possibilities of governance* (2nd ed.). Malden: Blackwell/Oxford.
Jasanoff, S. (2004). Ordering knowledge, ordering society. In S. Jasanoff (Ed.), *States of knowledge: The coproduction of science and social order*. London: Routledge.
Jasanoff, S. (2007). *Designs on nature: Science and democracy in Europe and the United States*. Princeton: Princeton University Press.
Keck, M., & Sikkink, K. (1998). *Activists beyond borders*. Ithaca: Cornell University Press.
Kevles, D. (1997). *The physicists: The history of a scientific community in modern America*. New York: Vintage.
Kinchy, A. (2010). Anti-genetic engineering activism and scientized politics in the case of 'Contaminated' Mexican maize. *Agriculture and Human Values, 27*(4), 505–517.
Kinchy, A., Kleinman, D. L., & Autry, R. (2008). Against free markets, against science? Regulating the socio-economic effects of biotechnology. *Rural Sociology, 73*(2), 147–180.
King, B., & Soule, S. A. (2007). Social movements as extra-institutional entrepreneurs: The effect of protest on stock price returns. *Administrative Science Quarterly, 52*(3), 413–442.
Kingsbury, B., Krisch, N., & Stewart, R. B. (2005). The emergence of global administrative law. *Law and Contemporary Problems, 68*(3–4), 15–61.
Klawiter, M. (2008). *The biopolitics of breast cancer: Changing cultures of disease and activism*. Minneapolis: University of Minnesota Press.
Kleinman, D. L. (2003). *Impure cultures: University biology at the millennium*. Madison: University of Wisconsin Press.
Kleinman, D. L. (2010). The commercialization of academic culture and the future of the university. In H. Radder (Ed.), *The commodification of academic research: Science and the modern university* (pp. 24–43). Pittsburgh: University of Pittsburgh Press.
Kleinman, D. L., & Kinchy, A. J. (2003). Why ban bovine growth hormone? Science, social welfare, and the divergent biotech policy landscapes in Europe and the United States. *Science as Culture, 12*(3), 375–414.
Kleinman, D. L., & Kinchy, A. J. (2007). Against the neoliberal steamroller? The biosafety protocol and the social regulation of agricultural biotechnology. *Agriculture and Human Values, 24*(2), 195–206.
Kleinman, D. L., & Vallas, S. (2001). Science, capitalism, and the rise of the 'knowledge worker': the changing structure of knowledge production in the United States. *Theory and Society, 30*, 451–492.
Kleinman, D. L., Powell, M., Grice, J., Adrian, J., & Lobes, C. (2007). A toolkit for democratizing science and technology policy: the practical mechanics of organizing a consensus conference. *Bulletin of Science, Technology, and Society, 27*(2), 154–169.
Knorr-Cetina, K., & Mulkay, M. (Eds.). (1983). *Science observed*. Beverly Hills: Sage.
Levidow, L., & Carr, S. (2009). *GM food on trial: Testing European democracy*. London: Routledge.
Lind, A. (Ed.). (2010). *Development, sexual rights and global governance*. New York: Routledge.
Lindne, L. F. (2008). Regulating food safety: the power of alignment and drive towards convergence. *Innovation: The European Journal of Social Science Research, 21*, 133–143.
Livermore, M. (2006). Authority and legitimacy in global governance: Deliberation, institutional differentiation, and the Codex Alimentarius. *New York University Law Review, 81*, 766–801.
Marginson, S., & Considine, M. (2000). *The enterprise university: Power, governance, and reinvention in Australia*. Cambridge: Cambridge University Press.

McCormick, S. (2009). *Mobilizing science: Movements, participation, and the remaking of knowledge*. Philadelphia: Temple University Press.
McMichael, P. (2000). *Development and social change: A global perspective*. Thousand Oaks: Pine Forge.
Merton, R. (1973). *The sociology of science*. Chicago: University of Chicago Press.
Miller, C. (2004). Climate science and the making of global political order. In S. Jasanoff (Ed.), *States of knowledge* (pp. 46–66). London: Routledge.
Moore, K. (2008). *Disrupting science: Social movements, American scientists, and the politics of the military, 1945–1975*. Princeton: Princeton University Press.
Mushita, A., & Thompson. C. (2008). Agricultural Biodiversity: African alternatives to a 'Green Revolution.' *Development* 488–495.
Nelson, A. (2011). *Body and soul: The Black Panther Party and the fight against medical discrimination*. Minneapolis: University of Minnesota Press.
Noble, D. (1977). *America by design: Science, technology, and the rise of corporate capitalism*. Oxford: Oxford University Press.
Ong, A. (2006). *Neoliberalism as exception: Mutations in citizenship and sovereignty*. Durham: Duke University Press.
Ottinger, G. (2010). Buckets of resistance: standards and the effectiveness of citizen science. *Science, Technology, & Human Values, 35*(2), 244–270.
Owen-Smith, J. (2005). Dockets, deals, and sagas: commensuration and the rationalization of experience in university licensing. *Social Studies of Science, 35*(1), 69–97.
Peck, J., & Tickel, A. (2002). Neoliberalizing space. *Antipode, 34*(3), 380–404.
Pellow, D. N. (2007). *Resisting global toxics: Transnational movements for environmental justice*. Cambridge: MIT.
Portes, A. (1994). When more can Be less: Labor standards, development, and the informal economy. In C. Rakowski (Ed.), *Contrapunto: The informal sector debate in Latin America* (pp. 113–129). Albany: SUNY.
Portes, A., & Roberts, B. (2005). The free-market city: Latin American urbanization in the years of the neoliberal experiment. *Studies in Comparative International Development, 40*(1), 43–82.
Post, D. (2005). Standards and regulatory capitalism: the diffusion of food safety standards in developing countries. *Annals of the American Academy of Political and Social Sciences, 598*, 168–183.
Powell, W., Owen-Smith, J., & Colyvas, J. (2007). Innovation and emulation: lessons from the experiences of U.S. universities in selling private rights to public knowledge. *Minerva, 45*, 121–142.
Rabinow, P. (1996). *Making PCR: A story of biotechnology*. Chicago: University of Chicago Press.
Routledge, P., Nativel, C., & Cumbers, A. (2006). Entangled logics and grassroots imaginaries of global justice networks. *Environmental Politics, 15*(5), 839–859.
Sassen, S. (2000). *Cities in a world economy: Sociology for a new century*. Thousand Oaks: Pine Forge/Sage.
Schmitt, J. (2000). Inequality and globalization: Some evidence from the United States. In D. Kalb, M. van der Lind, R. Staring, B. van Steenbergen, & N. Wilterdink (Eds.), *The ends of globalization* (pp. 157–168). Lanham: Rowman and Littlefield.
Seifert, F., & Torgersen, H. (1997). How to keep out what we don't want: an assessment of 'Sociolverträglichkeit' under the Austrian Genetic Engineering Act. *Public Understanding of Science, 6*(4), 301–327.
Schurman, R., & Munro, W. (2004). Fighting frankenfoods: industry structures and the efficacy of the anti-biotech movement in Western Europe. *Social Problems, 51*(2), 243–268.
Sklair, L. (2001). *The transnational capitalist class*. Oxford: Blackwell.
Slaughter, S., & Leslie, L. (1997). *Academic capitalism: Politics, policies, and the entrepreneurial university*. Baltimore: The Johns Hopkins University Press.
Slaughter, S., & Rhoades, G. (2004). *Academic capitalism and the new economy: Markets, state, and higher education*. Baltimore: Johns Hopkins University Press.
Smith, J., & Bandy, J. (Eds.). (2005). *Coalitions across borders: Transnational protest and the neoliberal order*. Boulder: Rowman & Littlefield.
Smith-Doerr, L. (2004). *Women's work: Gender equality vs. hierarchy in the life science*. Boulder: Lynne Rienner.
Stehr, N. (2002). *Knowledge and economic conduct: The social foundations of the modern economy*. Toronto: University of Toronto Press.
Steigerwald, D. (2006). All hail the republic of choice: consumer history as contemporary thought. *Journal of American History, 93*, 385–403.
Stiglitz, J. (2007). *Making globalization work*. W.W. Norton.
Strathern, M. (Ed.). (2000). *Audit cultures: Anthropological studies in accountability, ethics, and the academy*. London and New York: Routledge.

Swyngedouw, E. (2005). Governance innovation and the citizen: The Janus face of governance-beyond-the-state. *Urban Studies, 42*(11), 1991–2006.
Szasz, A. (2007). *Shopping our way to safety*. Minneapolis: University of Minnesota Press.
Valdiya, S. (2010). Neoliberal Reform and Biomedical Research in India: Globalization, Industrial Change, and Science. Ph.D. dissertation, Science and Technology Studies Department, Rensselaer Polytechnic Institute.
Vallas, S. P., & Kleinman, D. L. (2008). Contradiction, convergence, and the knowledge economy: the co-evolution of academic and commercial biotechnology. *Socio-Economic Review, 6*(2), 283–311.
Vogel, D. (2008). Private global business regulation. *Annual Review of Political Science., 11*, 261–282.
Weber, E. (2003). *Bringing society back in: Grassroots ecosystem management, accountability, and sustainable communities*. Cambridge: MIT Press.
Weber, K., Thomas, L. G., & Rao, H. (2009). From streets to suites: how the anti-biotech movement penetrated German pharmaceutical firms. *American Sociological Review, 74*(2), 106–127.
Winickoff, D. E., & Bushey, D. (2010). Science and power in global food regulation: the rise of Codex Alimentarius. Science. *Technology and Human Values, 35*(3), 356–381.
Winickoff, D., Jasanoff, S., Busch, L., Grove-White, R., & Wynne, B. (2005). Adjudicating the GM food wars: science, risk, and democracy in world trade Law. *The Yale Journal of International Law, 30*(1), 82–123.
Winter, M. (2003). Embeddedness, the new food economy and defensive localism. *Journal of Rural Studies, 19*(1), 23–32.
Wood, L. J. (2005). Bridging the chasms: the case of People's Global Action. In J. Smith & J. Bandy (Eds.), *Coalitions across borders* (pp. 95–117). Lanham: Rowman & Littlefield.
Wood, L. J., & Moore, K. (2002). Target practice: Community activism in a global era. In R. Hayduk & B. Shepard (Eds.), *From ACT UP to the WTO: Urban protest and community building in an era of globalization*. New York: Verso.
Wright, W., & Midderndorf, G. (Eds.). (2007). *Food fights: Producers, consumers, and activists challenge the global food system*. University Park: Penn State University Press.
Wynne, B. (2005). Risk as globalizing 'Democratic' discourse? Framing subjects and citizens. In M. Leach, I. Scoones, & B. Wynne (Eds.), *Science and citizens: Globalization and the challenge of engagement* (pp. 66–82). London: Zed.

Kelly Moore is Associate Professor of Sociology at Loyola University-Chicago. She is the author of *Disrupting Science: Social Movements, Science and the Politics of the Military, 1945–1975* (Princeton University Press, 2008) and co-editor, with Scott Frickel, of *The New Political Sociology of Science: Institutions, Networks, and Power* (Wisconsin 2006). Her current research projects include a study of the effects of neoliberalism on US nutrition programs and funding in the United States between 1970 and 2010, and an investigation of how people use expert knowledge in everyday life.

Daniel Lee Kleinman is Professor and chair of the Department of Community and Environmental Sociology at the University of Wisconsin-Madison, where he is also the director of the Robert F. and Jean E. Holtz Center for Science and Technology Studies. His book *Science and Technology in Society: From Biotechnology to the Internet* (2005) was recently translated into Chinese. Among his current projects is "Codes of Academia and Industry," a study of the changing extent of the commercialization of university culture and "academicization" of industrial science in the United States between 1960 and 2000. He is also collaborating on a study of the social and biological causes of colony collapse disorder, the epidemic of honey bee death.

David Hess is Professor of Sociology at Vanderbilt University. His most recent books are *Alternative Pathways in Science and Industry* and *Localist Movements in a Global Economy*.

Scott Frickel is Associate Professor of Sociology at Washington State University where he studies the intersections of environment, knowledge, and politics. In addition to numerous journal articles and book chapters, he is the author of *Chemical Consequences: Environmental Mutagens, Scientist Activism, and the Rise of Genetic Toxicology* (Rutgers 2004), which was awarded the 2005 Robert K. Merton Book Award, and with Kelly Moore is co-editor of *The New Political Sociology of Science: Institutions, Networks, and Power* (Wisconsin 2006). Current research projects include a study of the social production of ignorance that focuses on the regulatory response to Hurricane Katrina in 2005, a study of expert networks in environmental justice movements, and with James R. Elliott a comparative history of ecological restructuring in four US cities (1955–2005).