

CHAPTER 8

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IN A CONSTITUTIONAL MOMENT: SCIENCE AND SOCIAL ORDER AT THE MILLENNIUM

NEW WORLDS TO ORDER

Strolling east along the splendid swath of Constitution Avenue, beyond the recessed lawns of the White House, diagonally across from the back entrance to the National Gallery of Art, the visitor to Washington, D.C. will be drawn to a building whose soaring Corinthian columns signal the presence of something exceptional within. Inside, under the hushed central rotunda of the National Archives of the United States, the now-curious visitor may take her place in the slow-moving line of tourists for a brief glimpse of the three documents that anchor the American state: the Constitution, the Bill of Rights, and the Declaration of Independence. Encased in thick, greenish, helium-filled, bronze and glass frames, elevated on a marble pedestal, the faded parchments are barely readable in the dim, protective light. It is hard to linger long enough to decipher the script; the guards take care to keep the line moving. But the entire setting – the heroic murals,¹ the sober display cases around the circular gallery, the inlaid floor and monumental architecture – encourages a feeling of reverence. This is no ordinary public space; it is the closest thing to a holy of holies in this brashly populist, secular republic.

Yet the ironic observer would note more than a touch of incongruity in the deferential encounter between the spectators and the objects of their veneration. The soft lighting and expensive, high-tech display (the documents descend into an impregnable vault by night) are theater at its postmodern best. The nation whose representatives stream by in all their heterogeneity of sex, race, religion, color, and attire is scarcely recognizable as the one whose blueprints the documents register. Fewer than half the visitors to the National Archives could have voted in the polity contemplated by the founding fathers who look gravely down from their painted murals (Keyssar 2000). Among the visitors are people whose admission to American citizenship would have occasioned a skeptical raising of the eyebrow, if not a shiver of fear, among the sedate gentlemen who wrote those grand, nation-building texts. Their genius, if we choose that term, seems in retrospect to have lodged in what they left unsaid – in a choice of words so flexible that it accommodated an onrush of diversity and change which the authors' imaginations could scarcely have apprehended.

While the written Constitution sits enshrined in glass and stone – and, fittingly, inert gases – it is the practices of government based on the founding texts that have done the most to ensure the republic's survival. For more than two hundred years, the thrust and parry of American political life have been directed toward filling the blanks left open by those historic documents. Judicial decisions played a central role. Early in the nineteenth century, Chief Justice John Marshall's bold decisions in *Marbury v. Madison* and *McCulloch v. Maryland* affirmed the power of judicial review and of Congress to make necessary and proper laws. In the process, Marshall helped establish the proposition that significant political innovation can occur without explicit constitutional reauthorization. Closer to our own day, other landmark rulings of the high court, such as *Brown v. Board of Education of Topeka* on school desegregation and *Roe v. Wade* on abortion rights, have struggled to redefine the rights of persons whose color, gender or, in the case of the unborn, physical invisibility deprived them of status in eighteenth century political life. Still more recently, some credit Chief Justice William Rehnquist with envisioning and carrying through a fundamental reorientation in favor of states' rights on issues such as sovereign immunity and separation of church and state. Between the legal milestones of judicial review and school desegregation, a bloody civil war was fought to cement the origin myth of a nation conceived with such brilliant foresight that its founding principles have survived intact, even though the texture of its public life has changed beyond recognition.

The reality of American politics belies the felt continuity of the founders' vision. Judicial creativity, however, has not been the only instrument of fundamental reform. Over two centuries, American state-society relations have been deeply affected by inventiveness in quite another quarter – science and technology. The principles underpinning the American state were drafted by representatives of a pre-industrial, almost pre-scientific, agrarian society. Since their day, revolutionary changes have occurred in the organization of commerce and industry (Ratner, Soltow and Sylla 1979), spurred by radical shifts in transportation, communication, medicine, finance, and manufacturing. Railroads once thickly webbed the country and then largely disappeared, replaced by highways and, eventually, the aerial routes of civil aviation. Telegraph and electric power lines (Hughes 1983) formed prototypes for today's virtual communication networks. Nuclear power came and went (maybe to return), while the Internet gave newspapers, telephones, and even television a run for their money. Holistic thinking about the environment became fashionable, linked to the growth of ecology, the discovery of chemical hazards, and the birth of commercial biotechnology. Meanwhile, in medicine, human beings were increasingly seen as composites of separately treatable body parts, mental states, genes, tissues, and organs. Technology revolutionized the conduct of war, as the United States, along with a handful of other nations, acquired the capacity to destroy humanity, and earned therewith a vastly stronger hold on the imagination of its citizens.

Since the scientific revolution, the legal and political institutions of the United States, as of other major powers, have changed in keeping with shifting perceptions of the natural world and the capacity to intervene in its processes. So, too, have citizens' self-awareness, expectations of each other, and the norms that reflect these altered perceptions. This coupled development of natural and social orders has, if anything, gained speed and salience as the world narrows. Science and technology, I will argue in this essay, are playing a constitutive role in determining how power will be exercised – and,

equally important, constrained – in the emerging global order. In particular, the entanglement of science and technology in three processes of globalization are broad and deep enough, in my view, to merit the label 'constitutional': the redefinition of self, identity, and community; the appearance of the consumer as a political agent, asserting rights claims against commerce and industry; and the certification of 'global' knowledge for use in supranational governance. Through these three prisms, we can see how previously taken-for-granted roles of citizens, corporations, and social movements, as well as their relationships with governmental institutions, are being reconceptualized. Human engagements with science and technology, I suggest, are altering the very foundations of identity, citizenship, and sovereignty, thus silently laying the groundwork for constitutional governance in the 21st century.

Understanding these phenomena is critically important for legal and political theory, but standard analytic tools in these fields need to be supplemented by perspectives from the systematic study of science and technology. In place of the structural formalism and epistemological realism that have marked much orthodox legal and political scholarship, science studies offers a dynamic, constructivist, practice-centered approach that is better suited to analyzing the distributed processes of global constitution-making. Below, I begin by reviewing the contemporary discourses of constitutional change, noting their commonalities and differences. I then reflect on the understandings of law and lawlike processes in the science studies literature, and the treatment of science and technology in legal and constitutional doctrine. With these discussions in place, I turn to the three most prominent nodes at which science and legal order are joined in processes of co-production: identity-making; consumption and citizenship; and global knowledge production. In concluding, I address the implications of these developments for democracy in a post-national future.

HOW CONSTITUTIONS CHANGE

As the United States takes its first uncertain steps across the threshold of a new millennium, one senses that constitutional changes are abroad in the world. Some perceive it in the waning of federal authority and the growing popular alienation from institutions of national governance (Sandel 1996; Nye, Zelikow and King 1997).² The extraordinary U.S. presidential election of 2000 confirmed these fears for many: a polled-to-death public split its votes with such stunning accuracy that a statistician from Mars could plausibly have modeled the American electorate as millions of coins tossed in unison (Jasanoff 2001). Europeans deplore the 'democratic deficit' in European Union (EU) institutions (Eder and Kantner 2000) and growing voter apathy in national elections. Others worry that the rise of transnational legal regimes and bureaucracies will sap national autonomy and jeopardize national welfare (Darman 1978; consider also President George W. Bush's retreat from the Kyoto climate change accord so as to protect the American economy³). Theorists of sovereignty have focused on the displacement of the state by multinational corporations and global media that have rendered normal modes of participation and politics increasingly irrelevant. Still others see the issue in terms of the formation of new identities and grassroots alliances, creating social movements that do not respect the geopolitical claims of the nation-state. Indeed, as the attacks of September 11, 2001 in the United States so horrifically demonstrated, the devolution of

power to non-state actors has shaken fundamental presumptions about what makes a state a state.

Does all this turmoil point only to the decay of existing orders or also to a more optimistic future for constitution-making? It is clear, particularly in the era of globalization, that it is not necessary to hold a formal convention in order to rewrite the fundamental presumptions that bind people to their political authorities. As U.S. experience indicates, radical shifts in social order do not have to originate with, or even be confirmed by, explicit constitutional amendment. Britain's 'unwritten constitution' offers an even clearer example. On the world stage as well, revolutions can and do happen without the benefit of constitutional ratification – as when the Cold War's bipolar order collapsed in 1989. But how do old constitutional dispensations change, and how do new ones emerge? Let us look at three sets of responses, at the levels of national, regional, and global politics. While each offers valuable insights into processes of constitutional change, I suggest that there is need for a fourth model, more suited to times of emergence and more respectful of human involvement with science and technology. This last, I will argue, is a bottom-up approach to constitution-making that has particular significance for global governance in the 21st century.

American history offers an instructive starting point for thinking about constitutional change. In more than two centuries, the U.S. Constitution has undergone only the barest modifications⁴; the text the founders wrote is still the text that schoolchildren study and the Supreme Court pays homage to. Constitutional rights are regarded as among the most cherished elements of national life – to be held, as far as possible, constant, and defended against the corrosive effects of time and social change. Not everyone, however, sees this continuity as real, let alone as reason for bemoaning the end of constitutional creativity. Bruce Ackerman (1983, 1991, 1998), in particular, has influentially argued that the apparent durability of the constitutional order is a major achievement of America's living democracy. At three 'constitutional moments' – the Founding, Reconstruction, and the New Deal – Ackerman believes that revolutionary reform was achieved through inspired but 'unconventional' adaptation of existing institutions and practices. Politicians actuated by transforming ideals successfully claimed to speak on behalf of 'the people' and repositioned the building blocks of government to fit their grandly unorthodox visions.

A different constitutional challenge confronts Europe. Here we have not so much the problem of an ossified, and ossifying, founding text as a search for doctrines to legitimate rule at a higher level than the nation-state. The European constitutional debate is, in this respect, particularly relevant to global constitutionalism. It springs from a similar well-spring of concern: the interests of peace, security, and economic stability seem increasingly to require stronger integration across countries, via new supranational institutions; yet, the cause of democracy seems to be better served through the communal structures long cultivated by nation-states, and hence to favor at best intergovernmental accords (Goldmann 2001, 1–3). This predicament has given rise to more than one school of thought. It has made some European constitutional scholars insist on a minimalist approach, based on carefully prescribed, formal powers delegated to the supranational organs by participating nation-states. This formula would locate the European constitutional framework within the treaties constituting the EU. Reluctance to expand constitutionalism beyond such intergovernmental arrangements stems from a perception, espe-

cially among German scholars, that 'Europe' remains for now a notional political space. It lacks a common language or traditions and common media of communication that would enable a fully *European* democracy to form. Pressing for a closer union strikes these observers as unrealistic and threatening to democratic principles (Grimm 1995).

Against the 'constitution deniers,' another school of thought favors a more positive approach to European constitutionalism. The aim of such an exercise, according to Neil Walker (1996), would be to seek out and address in a coherent fashion three sets of questions about the structure of the EU. These concern the logic of the Union (intergovernmental or supranational), the 'democratic deficit,' and the degree of allowable variation among member states. Walker (1996, 288) does not minimize the difficulty of this task: "How, then, is it possible to develop the agenda for the construction of a constitutional identity for a novel political order which draws upon structural principles which are equally capable of resisting reversion to the old sovereign state and progression to a new sovereign superstate?" The answer for him and other modest constitutionalists of the EU lies in developing a mid-range of concepts, such as subsidiarity, that will permit new ways of bridging law and politics. Empirical contexts for this discussion will be found in the intricacies of market integration, currency-making, border security, and comitology rules.

Despite its structural ambiguities and potential, the EU remains at bottom a union built on the sovereign will of nation-states. Globalization connotes something altogether different. It points to the emergence of an ordered political realm that, by definition, supersedes nations. If such a transcendental formation is indeed in the making, can it, too, be said to rest on constitutional foundations? Michael Hardt and Antonio Negri (2000) emphatically answer 'yes' in their ambitious thesis that what we are witnessing at the turn of the millennium is not globalization but the birth of 'Empire.' The order that is coming into being is not, on their account, a Bretton Woods-style piecing together of separate national sovereignties, with power consolidated in international institutions such as the United Nations system. Rather, it more nearly resembles the ancient Roman Empire, a world-formation with its force-fields lying outside the control of even the United States, the only genuine superpower.

The new global Empire, according to Hardt and Negri, has its own constitutional order, but its elements are far different from the institutional building blocks that U.S. or European politicians play with at Ackerman's 'constitutional moments.' Expressing the will of the people has little to do with the constitution of Empire. Hardt and Negri view the imperial constitution as something immanent and unstoppable, almost apocalyptic. It descends from the historian Polybius' theory of Roman government, which saw power as institutionally divided among three centers of action: force with the monarchy; justice and virtue with the aristocracy; and discipline and distribution with the people, or the demos. In modern constitutional systems, these authors argue, this ancient triad was replaced by the functionally tripartite structure of the executive, the judiciary, and the legislature. Now, however, we are caught in another transition – this time toward a 'hybrid constitution' (Hardt and Negri 2000, 316–19), in which the old governmental functions are so networked and distributed as to operate simultaneously everywhere, and therefore nowhere.

The constitutional theater for Hardt and Negri (2000, 319) is an 'imperial non-place.' The transformation they describe occurs almost independent of political will, in defiance

ality, and without discernible ties to social practice or agency. All this is as alien to the temper of Ackerman's analysis as it is to the debates about European constitutionalism. If Hardt and Negri, the theoreticians of *Empire*, take the high road of constitutional action, the U.S. and European debates can be seen in some ways as taking the low road. Legal traditions, whether in Europe or the United States, view constitutional change in more situated terms, which are in principle more congenial to scholarship in science and technology studies: lodged in particular texts, mobilized by particular actors, implemented by particular institutions of law and politics.

Nothing in one respect all the constitutional discourses we have considered thus far have in common that differentiates them from most work on the practices of science. Constitutional theorists mostly conceive of change as coming from above, whether through Hardt and Negri's imperial structural realignments, Europe's self-abnegating sovereign states, or Ackerman's inspired judicial and political innovators. But – parallel to Kuhn's (1962) famous argument about scientific revolutions – deep social change also come about through countless smaller adjustments and accommodations that structure the basic organization of power. Both kinds of change marked the end of the millennium: the former attracted more notice, but the latter may prove more democratic and durable. Many of these incremental movements were tied in crucial ways to developments in science and technology.

The role of science and technology in the making and unmaking of political order has been largely neglected by political theorists. To be sure, American conventional wisdom attributed the Soviet system's downfall to a form of technology policy: specifically, to President Reagan's determined pursuit of the Strategic Defense Initiative ('Star Wars'), and the resulting costly intensification of the arms race in the 1980s. But this is just our story of a bankrupt Soviet state further impoverished in search of a bankrupt technology is just another change rung on the all-too-familiar theme of technological determinism: just as 'good' technology drives progress so 'bad' technology, in the Soviet case, brought disaster. Nor have attempts to explain the end of the Cold War in logical terms proved more satisfying. The fall of the iron curtain was heralded as the 'end of history' (Fukuyama 1992), signifying the demise of the planning state (Scott 1991) and the universal acceptance of the market as the only viable template for economic and social organization. But the stark dichotomy between state and market drawn by many political commentators scarcely does justice to the incredibly complex infrastructures that grew up to undergird both in the modern era. Characteristically, too, deterministic, single-variable explanations of the Soviet system's collapse have offered insights into the diversity of post-revolutionary orders that sprouted on the dustbins of an abandoned ideology.

Overall, political accounts of the Cold War's end have displayed little of the subtlety discernible in recent scholarship on technological change (see, for example, Smith and Wessely 1994). Yet the tools developed for the study of large technological systems could readily be adapted to the analysis of such massive social achievements as a state or an industry, whether they succeed or fail (Latour 1990). Such constructs, no less than power plants or power plants, are pieced together from myriad material and social elements that work more or less well together; survival depends on the harmonious functioning of the parts with the whole. Either progressive innovation or radical breakdown originates, on this account, at multiple points in the system, through agents who

question power by political or other means (scientific claims, for instance). Of interest then are the circumstances that permit revolutionary ideas to form and to spread through systems built on other expectations – possibly achieving constitutional status.

What kinds of futures, or communities, are likely to be imagined, and by whom, as we move from a world organized along strict ideological divisions to one where the market now seems rampant? If commitment to nationhood was the glue that held together the dominant cultural identities of the nineteenth and twentieth centuries (Anderson 1991 [1983]), how will the socially and politically significant identities of the coming decades be organized and cemented? How will the new technologies of desire – biological, digital, miniaturized to the nano level – affect identity and agency in the societies of the twenty-first century? With threats of annihilation temporarily in abeyance, and with hunger and poverty receding in many parts of the world, on what basis will people articulate their needs and demands in relation to the formal structures of government? If unwritten and emergent rules of constitutional dimension are beginning to operate in the post-cold-war order, where can we observe these rules being crafted?

Clearly, it is not sufficient to look for answers only in the high politics of globalization, as enacted in international treaties or articulated in the expansion and management of global markets. To comprehend the new constitutional settlements that may be appearing at this historical moment, we must also focus on the ways in which civil societies are responding to novel, technologically mediated possibilities of prediction, manipulation, and interconnectedness. First, however, we must position this analysis with respect to two other relevant bodies of thought: the discussion of constitutionalism in science and technology studies, and the discussion of technoscientific change in legal scholarship.

SCIENCE STUDIES AND CONSTITUTIONAL LAW: MINDING THE GAP

Given the centrality of scientific knowledge and technological artifacts in contemporary life, it is reasonable to think that the basic ordering commitments of modern societies will be found not only in legal texts, but also, tacitly expressed, in the very organization of life around the products of human ingenuity and knowledge. Constitutional ideas should be embedded in people's collective imaginations and practices, built into their material culture, and worked out in innumerable daily routines that draw upon resources derived from science and technology. Order may emerge not merely, or even mainly, when positive law bestows it or a court affirms it, but also when people assume that they have the capacity and the right to change their behavior in fundamental ways, and act accordingly. Thus, there may be emergent, quasi-constitutional rights that no court has declared nor legislature has decreed, but that are created through altered popular conceptions of what sorts of people we have a right to be, or what we have a right to demand from our ruling institutions. In technologically advanced societies, such changed expectations are commonly associated with transformations in scientific knowledge and advances in technological capability.

To date, however, academic literatures have done relatively little to probe these structuring effects. The theme of scientific and technological progress is not new, of course, any more than its dialectical counterpart, the theme of humanity's problematic adjustment to its own inventions. Both have figured in significant streams of work –

analytic, imaginative, minatory, prescriptive – over at least two centuries. On the positive side, are innumerable biographies of inventors and scientists, celebrations of their discoveries, and tales of science's triumph over adversity and disease. On the negative side are many forebodings. Mary Shelley's 1816 'ghost story,' *Frankenstein*, brilliantly captured the terror of runaway scientific ingenuity; today, her concerns persist, under the headings of playing god, flirting with doomsday machines or surrendering to forces outside the creator's control. Philosophers and political theorists have warned of the dangers of hyperrationality and its corrosive effects on deliberation, civic engagement, and individual liberty (Habermas 1975 [1973]; Bauman 1991). The human sciences in particular, as Michel Foucault's oeuvre compellingly documents, can function as disciplinary tools by which governmental power is dispersed throughout society, although these sciences may also open up new possibilities for human creativity (Foucault 1971 [1966], 1979). Still another line of work reflects on the risks and uncertainties of new technologies, and how they permeate the social structures of modernity (Giddens 1991; Beck 1992 [1986]). From outside the western world have come denunciations of science and technology as instruments of dominance, even of violence (Shiva 1993, 1997; Visvanathan 1997). Together, these explorations have done much to destabilize the myth of scientific and technological progress, but in one respect they lack the power of the popular narrative: they reveal deep problems of governance in technological civilization, but they provide few insights into how good orders are achieved. Criticism undoes the complacency of unreflective optimism, but it does not rebuild confidence.

Work in science and technology studies has begun to change this picture by documenting – very generally – how the products of science and technology not only influence but are also shaped by human norms and institutions (Jasanoff et al. 1995). Technological objects, such as ozone holes, genes, smart bombs, computers, climate models, and Dolly, the category-defying sheep cloned from the cells of an adult 'mother,' are all seen by S&TS researchers as repositories of human commitments about what counts as 'good,' whether in reasoning, in making things, or simply in living with one another (Latour and Woolgar 1979; Bijker, Hughes and Pinch 1987; Latour 1988, 1993; MacKenzie 1990; Haraway 1991, 1997). The deployment of technological artifacts engages with and reshapes our perception of social order at many levels: for instance, by redrawing the boundaries between humans and non-humans or nature and culture (Calton 1986, 1987; Latour 1993); by altering fundamental notions of identity (Haraway 1997); and by challenging settled expectations of liberty and autonomy (Jasanoff 1995a).

Among S&TS scholars, Bruno Latour has been perhaps most explicit in calling attention to the constitutional dimension of these human accommodations with the products of science and technology. In his important 1993 monograph, *We Have Never Been Modern*, Latour described the considerable work that human societies do to 'purify' their world of technoscientific hybrids into separate spheres of nature and culture. He termed the resulting settlement 'constitutional' because it deals with one of the most fundamental divisions of social experience: that between 'us' humans and 'other' non-humans, be they animate or inanimate. For Latour the metaphysician, the world of objects is always full of social meaning and normative power. A mundane object such as a speed bump (or a 'sleeping policeman') performs, as its colloquial name implies, functions that are essentially human, albeit rendered without human consciousness. Yet, by locating this

construct of earth and asphalt squarely in the domain of inert nature, we, the agents of modernity, set aside any need to reflect on the thing's moral status or the nature of its relationship with us. The world, Latour implies, would be an altogether different place, maybe more terrifying and less ordered, if technological objects were continually reinvested with human characteristics, as nature habitually was in pre-modern societies.

Provocative though these insights are, the regime of sharp demarcations that Latour attributes to modernity markedly contrasts with the fluidity and ambiguity of technoscientific constructs noted by other S&TS scholars (Cambrosio, Keating and Mackenzie 1990; Haraway 1991, 1997; Moll and Law 1994). Like any universalizing theory, Latour's notion of purification fails to account satisfactorily for the divergences one finds among quasi-constitutional understandings in different times, locations, and cultures. Nature is not perceived in the same way by all modern industrial or industrializing societies: different lines are drawn between humans and other species, and different assumptions are made about the degree of interconnectedness between environment and society. Not surprisingly, when it comes to accepting or rejecting particular technological achievements, disparate ideas of what is 'natural' or morally right drive social responses, leading to divergent appraisals of the same processes or artifacts (see, for example, Jasanoff 1995b; Gaskell et al. 1999). In short, the mechanics of demarcation beg for elucidation within specific social, political, and legal contexts. One may ask, in particular, what role prior institutional commitments (including those embedded in formal constitutional law) play in the simplification of hybrid networks into the reductionist framings of *social* and *natural*. Put differently, Latour's constitutional settlement plays itself out in a curiously ahistorical, unsituated, and impersonal space. His constitutionalism is a philosopher's abstraction. To obtain a more textured picture of the ordering power of technoscience, we need to undertake a more grounded inquiry.

Regrettably, legal studies do not instantly provide the hoped for solutions to questions opened by work in science studies. S&TS writings are consistent with the views of a handful of legal scholars working on the intersections of law and technology – for example Lawrence Lessig (1997) on the architecture of information systems, James Boyle (1996) on intellectual property, and Frederick Schauer (1998) on privacy and the Internet – although there has been little systematic conversation between these parallel strands of analysis. For the most part, legal scholarship, limited perhaps by the law's institutional commitments to resolution and finality, has been slow to incorporate the findings of scientific and technological contingency that S&TS research has elaborated over the past thirty years.

There is, accordingly, a noticeable lack of fit between legal discourse and the preoccupations of science studies. Constitutional interpretation makes do with conceptions of liberty, property, human identity and welfare that predate the industrial revolution, let alone today's dazzling developments in genetic, environmental, and information sciences and technologies (Schauer 1998). Rulings that aim specifically to take account of scientific and technological developments – for example, in cases about reproductive privacy, the rights of non-traditional parents, the prolongation of life, the ownership of human tissues, the nature of risk, or the legal status of non-humans (Stone 1974) – show little evidence of engagement with the social and cultural histories of these changes. Indeed, in seeking to defend the fundamental character of constitutional categories, courts and legal commentators often downplay the extent to which our understandings of

nature, society and the self have been transformed by two centuries of scientific and technological change.

What makes this lack of reflection on science and technology more puzzling is that legal theory has been hugely influential in bringing to light some of the hidden normative assumptions that underpin supposedly neutral legal rules. Modern versions of Legal Realism, for instance, have refocused the understanding of Realism away from the indeterminacy of rules toward understanding the often-disguised substantive choices embedded in even relatively determinate rules (Fisher, Horwitz and Reed 1993; Fried 1998). Feminist jurisprudence has exposed the gender-based assumptions that undergird much legal doctrine in areas such as property and family law (Bartlett 1990). The Critical Legal Studies movement stressed the ideological contingency of legal propositions that courts often take to be natural and inevitable (Kelman 1987; Kairys 1990). With regard to economic decisions, scholars have questioned the neutrality and inevitability of the 'baselines' against which constitutional questions are considered. Cass Sunstein (1993) concluded, for example, that the legal distinction between state action and private action presupposes (and hence reinforces) a certain state-created *status quo* that established the boundaries of the *private* to start with.

Despite these turns toward self-reflexivity, legal scholars have not by and large extended their deconstructive and skeptical analysis to the ways in which legal power interacts with the authority of science and technology. An unexamined positivism still marks much writing about scientific evidence, as exemplified by a stream of work criticizing judges, juries, Congress, regulatory agencies, and not least the public for failure to heed the standards of 'good science' (Huber 1991; Breyer 1993; Foster and Huber 1997). Such critiques are often accompanied by triumphalist and historically untenable accounts of technological progress, which represent the law as an awkward impediment to the enlightened march of science. Even at its most sensitive, legal scholarship tends to treat science and law as independent sources of authority. The two domains are often seen as distinct 'cultures,' with divergent objectives, destined to clash when they occupy themselves with disputes over norms and policy (Schuck 1993; Goldberg 1994). There has been little systematic research on the ways in which modes of authorization in science and the law build upon, mimic or incorporate one another (for some exceptions, all stemming from science studies, see Wynne 1982, 1988, 1989; Smith and Wynne 1989; Jasanoff 1998a,b), even though the historical record suggests that the two cultures have supported each other for centuries in patterns of mutual construction, stabilization, and reinforcement (Shapin and Schaffer 1985; Ezrahi 1990; Shapin 1994; Porter 1995).

More generally, traditional legal inquiry generally takes for granted the boundary between nature and society or knowledge and norms. Laws and rights are held to one side as proper subjects of legal analysis; science and technology on the other side are thought to lie outside the domain of legal expertise. Rights are interpreted as preexisting technology, or at least as lying in an altogether separate normative domain, rather than as being constituted in significant part through technology. Much of the literature on science, technology and the law has thus been framed rather unproblematically in the language of technological determinism. Echoing decades-old ideas about culture lagging behind its own inventions (Ogburn 1922), law today is frequently seen as lagging behind technology, desperately trying to bridge the gaps created by rapid scientific and technological advances. Thus, genetics and genomics are thought to have leapt ahead, opening

new eugenic possibilities, while the law laboriously puzzles out how to protect individual autonomy. Family law is chronically seen as trying to catch up with reproductive technology. According to one account, "genetic testing has made determining paternity simple, even routine ... But in most states, the law has not caught up with the science" (Lewin 2001). Similarly, the Internet's almost infinite capacity for copying and dissemination is seen as overwhelming the rights of creative authorship. On the whole, technology is conceived of as a threat to rights, which therefore need to be protected through vigilant enforcement of constitutional norms. The analysis of science and technology in the politics of globalization demands more deftly manipulable conceptual categories.

CONSTRUCTIVE CONSTITUTIONALISM

I have argued thus far that the constitutional formations of the era of globalization are growing not only from roots in law and politics, but also from human accommodations with science and technology. Neither science studies nor legal theory offer fully satisfying models of sustained inquiry into the ordering effects of technological change. The former has insufficiently engaged with cultural specificity and institutionalized power, while the latter has underemphasized the contingency of knowledge and the law's own role in underwriting science and technology. To find a way forward, we need to step outside the perimeters of current theory and look more closely at the ways in which actors are constructing the present world. Let us return to basic constitutional notions and ask how they are playing out in the global diffusion of science and technology.

In charting this territory, it is best to work with a flexible notion of constitutionalism that is not tied to specific institutional arrangements or codes of law. Constitutions are at bottom balance wheels between power and its abuse. They are devices for ensuring "a form of rule which both empowers a government to carry out the range of functions associated with the modern interventionist state and excludes arbitrary and despotic forms of rule" (Walker 1996, 270). In the post-national era, we may extend this notion of constitutional order by including, in the class of possible rulers, not only governments but other forms of authority that also have power to control people's lives. But the heart of constitutionalism remains the preservation of balance: between enabling and constraining power, and between individual and societal demands. Under each heading, constitutional jurisprudence clarifies and codifies certain communally sanctioned norms regarding what is worth protecting, for and against whom, by what means, to what extent, and through what processes. Laurence Tribe (1978) has referred to these principled substructures as 'models' of constitutionalism. These models, needless to say, respond to developments in science and technology by taking on board changing conceptions of such norms as 'unreasonable search and seizure,' 'privacy' or 'property rights' – all of which are affected by technologically mediated changes in human and social capability.

Yet, this account of constitutionalism leaves untouched certain fundamental ontological problems that are central to the law. What kind of entity, after all, is the state, whose powers constitutions seek to delimit, and what sorts of beings are the individuals whose rights are protected against improper state action? Other puzzles flow from these. Where do judicial beliefs about how to answer these questions stem from? How are the ideas held by courts connected to broader currents of public knowledge and understanding, or to that special branch of knowledge called science? And on what basis should

courts decide when some models of constitutional decisionmaking, such as regard for settled expectations or governmental regularity (Tribe's Models III and IV), come into conflict with novel expectations arising from science?

It is here, at the level of constitutionalism's most elementary conceptual units, that we can profitably begin to inquire into the influence of science and technology. To tease out the connections, it is essential to look beyond the formal principles laid down in legal texts and elucidated by courts. We must ask instead how norms of constitutional relevance are tacitly constructed in the daily hum of technological societies: norms that are embodied in technological standards and practices, hardened into material instruments and artifacts, entrenched within professional discourses, and legitimated through public policy. Areas of rapid technoscientific change, as in the fields of genetics, informatics, and environmental science, offer specially promising sites for this kind of interpretive inquiry. Of particular interest are current debates about the self and its entitlements, the rights of the citizen-consumer against centers of private (market) power, and the legitimacy of supranational institutions of knowledge and governance.

Self, Identity, Community

When the *New York Times* criticizes the law for lagging behind science, what normative position does it seek to convey? We know that paternity can be determined today on the basis of almost foolproof, biological tests that indicate whether a given child is the progeny of the man alleged to be the father.⁵ A series of cases involving such tests have come before the U.S. courts, in the form of claims by 'fathers' who discovered their lack of biological kinship to their supposed offspring, sometimes after years of living together in a trusting family relationship. In ruling on these claims, courts have juggled in different ways with the values of genetic and social kinship, support for minor children, respect for reproductive freedom, protection of economic rights, and deterrence of fraud. Not surprisingly, the outcomes look chaotic, more like *ad hoc* accommodations to the facts of the case than like principled rule-following. What principle could possibly explain why a Texas court denies a man visitation rights, but requires him to pay child support for children who are not biologically his (Lewin 2001)? Proponents of the 'law lag' theory would prefer to cut through this tangle and write the scientific 'truth' of paternity unambiguously into the law. Biology should define paternity.

Such an argument not only elevates technological (or technoscientific) determinism to a normative principle (technology *should* drive the law), but it misconceives the subtlety of the connections among science, law, and human agency in constitutional cultures. The novel meanings of selfhood, identity, and community that mark this period of social ferment owe their shape as much to the legal and political contexts in which they originated as they do to breakthroughs in science and technology. These new configurations reflect our ability to see and explain human identity and behavior in altered ways, with the aid of new scientific categories and instruments. But, equally, they are a product of our ability to imagine and enforce preferred identities through culturally sanctioned legal and political means. The Texan 'father' who wished to withdraw support from his no longer biological children – but who might have wished to keep on visiting them – was asserting a sense of kinship that was simultaneously biological and social. His rights were not already present in transcendental form, ready to be 'declared' by a court or

conformed to the dictates of science. Rather, like all the newly indeterminate fathers of the genetic testing age, he was a player in a complicated ritual to redefine the meaning of paternity in a time when biological kinship can be dissociated from social kinship at any point in a family's existence. Genetic information, even in this simple context, does not determine identity so much as it enables new identity claims to unfurl.

In other cases, individuals have seized upon genetic information as an instrument of liberation or for building more complex identities and group affiliations. Their behavior confounds the theme of genetic determinism that was current in film and fiction long before the birth of the cloned sheep Dolly at a Scottish research station in February 1997. The older 'technoscientific imaginaries' of genetics were colonized by fears of state control. Aldous Huxley (1946) gave these fears their classic articulation in *Brave New World*, where people were classified and bred for characteristics esteemed by those in power. Throughout the 1980s, academic writing on the coming genetic revolution similarly dwelt on the risks of manipulation and control in connection with techniques of genetic screening, testing, and gene therapy. In the 1990s, however, the reception of genes into culture followed a more complicated script, as people actively asserted claims based on seeing themselves through newly available genetic lenses. Science and law blended into unexpected projects of social action.

Disease groups were perhaps the most prominent, though not the only, early adopters of genetic technology (Callon 1999). The discovery of genes for heritable breast cancer (BRCA1 and 2) led women activists in Britain and the United States to demand greater access to genetic tests and genetic counseling. PXE International, a citizen group committed to finding a cure for the inherited disorder *pseudoxanthoma elasticum* (PXE), participated in the isolation of the disease-causing gene, set up its own blood and tissue bank, and in an unprecedented move, even filed for a patent on the gene (Smaglik 2000). And in August 2001, stories circulated of a privately held corporation, the San Francisco-based DNA Copyright Institute, that had urged stars and celebrities to copyright their DNA so as to prevent commercial entrepreneurs from producing genetic copies of their valuable 'original' selves. In all these cases, genetic knowledge was appropriated as an added resource for people's self-expression, not as a weapon of control by the state.

To be sure, the possible negative consequences of reading people genetically did not disappear from view, but neither did those potentially affected passively await subjugation. Genetic exploitation emerged as a new front in the longstanding liberation struggles of workers, women, and ethnic and racial minorities against oppression by dominant economic and political interests. Rhetorics of piracy, colonialism and genocide, for example, were invoked and extended in protests by indigenous peoples' organizations against researchers engaged in bioprospecting for rare, medicinally active plants or in devising protocols for sampling human genetic diversity (Reardon 2001). In these cases, social groups claiming fundamental legal rights – representation, equality of treatment, access to various state-sponsored benefits – were created, or reconfigured, through the strategic intertwining of genetics and the law.

Technoscientific activity beyond the life sciences also contributed to movements of self-expression and resistance. One of the darkest manifestations was the apparently self-willed conversion of human beings into missiles and weapons on September 11, 2001, and in the subsequent rash of Palestinian suicide bombings in Israel. These acts,

conducted outside the bounds of 'normal' war, turned the narrative of technological progress into a mockery of itself, transforming people into objects, freedom into destruction, and sites of communal life into sites of carnage. That technology can kill was not the novelty here. Rather, it was the rational subject's purposeful embracing of an object-identity, and the resulting human-weapon's denial of compassion, pity or regard for its accidental victims or itself.

Other developments were less uniquely horrible. Information technology substantially lowered the barriers to worldwide communication and thereby facilitated creative processes of identity transformation. Instantaneous electronic communication and the spread of the personal computer made it possible to mobilize communal passions or communal loyalties, cutting across established lines of social identification in unpredictable ways. In cyberspace, states no longer enjoyed a monopoly on the channels of communication. The Internet diluted the power of national governments to command the 'imagined communities' of their citizens (Anderson 1991 [1983]). All manner of organizations could now control a piece of virtual territory, from disease-based groups like PXE International to the Taliban, the Islamic fundamentalists who ruled Afghanistan until after the terrorist attacks of September 11. Using electronic media, non-state actors bypassed the entrenched power of orthodox print and television media to build new group identities and affiliations, supplementing the ties of nationhood.

Some highly stable identities ceded ground, or became blurred, as new opportunities for self-identification were delineated. In the realm of gender, for example, 'transgendered' identities, neither male nor female, were said to have gained ground in the 1990s, partly assisted by the Internet:

The movement's coalescence, which members say began over the last five years and accelerated in recent months, has gained particular momentum from the Internet, with its ability to connect far-flung people and afford them a sense of safety. On-line groups that began by swapping tips on using makeup and obtaining hormones now also spread word of the latest victims of violence and the next political protest (Goldberg 1996).

The success of various resurgent ethnic fundamentalisms – Jewish, Islamic, Hindu – can similarly be attributed, in part, to the ability of interests back home to tap into the memories, grievances, and (not least) deep pockets of the far-flung representatives of national diasporas (Anderson 1994). New hybrid categories of nationhood (e.g., Non-Resident Indian or NRI) have emerged, extending citizenship outside the borders of the nation-state.⁶ Controversies over female Muslim students' right to wear head coverings in French schools or British Muslims' demand for access to state-funded, religious schools illustrate some of the more prosaically constitutional dimensions of these developments.

Corporate Rulers, Consuming Citizens

Redefinitions of individual identity and community form only one strand of quasi-constitutional change in which science and technology are centrally implicated. A second important thread is the assertion of some of the rights of citizenship by consumers against powerful corporations. There is a growing sense that today's formal constitutions do not offer adequate conceptual tools for ordering relations between individuals and private corporations, particularly when corporate operations extend across many national

boundaries. Once again, action from below, by potential consumers of technoscience, has underlined the problems and focused attention on the need for solutions.

U.S. constitutional jurisprudence long since recognized that corporate power may not be exercised in ways that thwart legitimate public goals. Even property rights are not held to be sacrosanct if asserting such rights would unacceptably burden the public's lawfully sanctioned liberties. Thus, in his historic 1946 opinion in *Marsh v. Alabama*, holding that a company town could not prohibit the distribution of religious literature on its premises, Justice Hugo Black observed that

Ownership does not always mean absolute dominion. The more an owner, for his advantage, opens up his property for use by the public in general, the more do his rights become circumscribed by the statutory and constitutional rights of those who use it. Thus, the owners of privately held bridges, ferries, turnpikes and railroads may not operate them as freely as a farmer does his farm. Since these facilities are built and operated primarily to benefit the public, and since their operation is essentially a public function, it is subject to state regulation (citations omitted).⁷

In the great burst of civil rights decisionmaking of the 1950s and 1960s, the Court held that property rights claims could not subvert overriding national goals such as racial desegregation.⁸ Cases like these went some distance toward problematizing the boundary between state and corporate action – or between politics and the market. They recognized that claims of private ownership and enterprise are not alone sufficient to justify restrictions on protected public liberties, and that corporate power, when exercised in statelike fashion, needs to be curbed as much as the power of the state.

In formal constitutional jurisprudence, the sense of what constitutes an impermissible constraint on liberty is tied to structuralist notions of power and jurisdiction. The private owner of a company town, or a bridge or railroad operator, or an inn-keeper controls a piece of physical space – like a mini-state – and hence may not deprive persons using those premises or property of fundamental liberties. There is no hint in these cases that technological innovation, historically seen as a motor of progress, can function in ways that equally threaten liberty, without dominion over physical space. Upstream production and marketing decisions by corporations may constrain human behavior down the line as thoroughly as infringements of constitutional rights by the state. By the time products arrive on the market, irreversible ordering commitments have already been built into them that may deprive consumers of important freedoms. Such innovation and design decisions are not open to public questioning or other forms of accountability under existing legal regimes; if anything, they are protected against scrutiny by confidentiality rules and intellectual property rights. The market – which only comes into play when products are already on line – therefore does not function as a good surrogate for democratic control. But cracks have begun to appear in this system as users and consumers assert a more audible voice in the governance of scientific and technological production.

In the aggregate, corporate initiatives in areas like biotechnology, computing, personal communication, surveillance, tourism, and transportation – let alone weapons of mass destruction – hold the potential for a deep restructuring of human behavior. Corporations, too, have in many instances adopted the rhetoric and symbols of statehood, helped along by accidents, deregulation, and management failures that weakened the credibility of states. Thus, DuPont, a U.S.-based multinational chemical company,

sought to legitimate itself to wider publics in the late-1990s in terms that straddled the line between product advertising and political campaign pledges. On its website, DuPont embraced the language of sustainability, promising to leave the world no worse off for future generations.⁹ A carefully orchestrated barrage of advertisements, built on the slogan 'To Do List for the Planet,' pitched DuPont as a concerned citizen of the world, ready to use its technical know-how (the company's own term was 'knowledge intensity,' as opposed to 'capital intensity') to make life better for untold millions. Like the Hobbesian state committed to defending people against the perils of nature, DuPont promised to protect a global populace against hunger, pollution, and the vagaries of the climate; at the same time, in an appeal to well-heeled consumers, it promised self-cleaning clothes, self-sealing automobile paint, and a material that combines Lycra (a DuPont exclusive) with leather to ensure a poured-on fit. This was no offer to sell a better mousetrap, subject to the laws of supply and demand. DuPont asserted the power and claimed the privileges of an imperial state.

If corporations have taken on the symbolic, rhetorical, and behavioral attributes of states, small wonder that people have found it desirable to assert themselves as citizens against these new centers of power. The idea that major technological shifts should not be undertaken without citizen involvement steadily gained ground in the last decades of the twentieth century. The anti-nuclear protests of the 1970s and 1980s were early indicators of this change in consciousness. The incipient, large-scale commercialization of biotechnology provided further impetus for experimentation with forms of participation and governance. The term 'technology assessment' was taken off the shelf, given a dusting, and harnessed to procedural innovation, particularly in Europe, ironically at the very moment when the United States, a pioneer in this field, dismantled its congressional Office of Technology Assessment (Bimber 1996). Citizen juries, consensus conferences and public referenda were held with varying policy impacts in countries such as Britain, France, Denmark, Japan, and Switzerland (Joss and Durant 1995; Marris and Joly 1999).

By no means all of the deliberative experiments were orchestrated by governments. The politics of biotechnology in the 1990s offers a prime example of newly emancipated consumer behavior. In numerous episodes of resistance against research in plant genetics, activists tore up plots planted with genetically modified (GM) crops. Occurring in both the North (e.g., Britain) and the South (e.g., India), these demonstrations manifested growing reluctance on the part of environmentalists and farmers to accept scientists' assurances that their research was beneficial or even trustworthy. While most biologists continued to insist that agricultural biotechnology posed no threats to human health or the environment, reports of possible risk spread like wildfire through national and international media. In one case, reports by a U.K. scientist that rats experimentally fed GM potatoes showed developmental abnormalities triggered massive consumer rejection of GM products, and changes in British policy toward imports and labeling (Gavaghan 1999; Masood 1999). In another case, a U.S. researcher's finding that pollen from GM corn harmed monarch butterfly larvae received worldwide press, even though both scientists and industry dismissed the study design as too badly flawed for use in risk assessment. Nonetheless, when so-called anti-globalization forces took to the streets in Seattle, Washington and elsewhere around the millennium, monarch butterfly images and costumes provided an instantly understandable, semiotically powerful critique of biotechnology. Demonstrators in effect asserted the right to draw their own scientific

inferences, overriding the credibility judgments of expert peer reviewers. Demonstrations, street theater, and consumer boycotts gave evidence that technological innovation was framed as an instrument of governance, requiring ratification by publics as well as experts. By visibly wrapping themselves in the mantle of the monarch butterfly, protesters signaled that industrial research and development could no longer be regarded as off-limits to public review and criticism.

One particular assertion of consumer-citizenship may be read in the future as emblematic of this period of constitutional ferment. This was the case of Monsanto and the so-called 'Terminator gene.' In 1998, a barely known, small cotton seed company called Delta and Pine Land (D&PL) patented a technique to switch off the reproductive mechanism of agricultural plants, thereby rendering the seed sterile (Service 1998). The company hoped that this technology would help protect the intellectual property rights of agricultural biotechnology firms by taking away from farmers the capacity to reuse seed from a previous year's genetically modified crop. Though the technology was still years away from the market, rumors leaked out of a deal by Monsanto to acquire D&PL. Such a partnership could have had enormous implications for both the speed of technology development and its worldwide distribution.

At this point, the technology's corporate sponsors lost control of the situation. The activist organization Rural Advancement Foundation International (RAFI) launched a highly effective international campaign against the technology. RAFI's executive director Pat Roy Mooney is credited with having invented the inspired label 'Terminator technology,' a name that at once translated a complex technoscientific achievement into easily accessible terms and, as in the monarch butterfly case, subverted the distinction between expert and civic technology assessment. Focusing on Monsanto's role, the RAFI campaign gathered support from a network of powerful actors, including the Consultative Group on International Agricultural Research and the Rockefeller Foundation, whose president, Gordon Conway, reportedly talked Monsanto's chief executive officer, Robert Shapiro, into publicly backing down from the company's commitment to 'Terminator technology.' In piecing together transnational politics, civil society activism, popular technology assessment, and enforced accountability from a corporate giant, this episode captured an essential moment in the transition to a global constitutional order.

In sum, these events, which uncomprehending policymakers sometimes dismissed as outbursts of a new Luddism, can be seen as trials in post-national deliberative democracy. They bypassed the electoral process, focused on technology's regulative impacts, and contested the notion that capital-intensive (or, as in the case of DuPont, knowledge-intensive) corporations should have complete leeway to determine the courses of technological innovation.

Empires of Knowledge

Historians of imperialism have pointed to the central role played by knowledge creation and appropriation in the formation of the nation-state and, later, in the extension of state power to the governance of vast, dispersed territories in the name of empire. These efforts took the form of classifying people and places, enumerating and keeping watch on them, and making histories or museums of native practices (Anderson 1991; Cohn 1996). From these efforts were born a host of new human and social sciences, such as

anthropology, comparative law, geography and cartography (Foucault 1971 [1966]). Analysts of modernity have called attention to the one-sided nature of these activities. The resources and authority needed to produce imperial knowledge rested, for the most part, in the hands of the rulers, and the facts created through their scientific strivings bore, frequently, only a schematic relationship to the lived realities of those being governed (Scott 1998). Postcolonial studies and the emphasis on the subaltern perspective have offered a salutary corrective to colonial sciences, and some recent work has pointed to the complicated, mutually constitutive relationship that sometimes existed between the knowledges of the rulers and the ruled (Storey 1997).

One does not need the special context of colonialism to recognize, as many scholars in science and technology studies have done, that knowledge-making is an instrument of power, and that the scientific workplace functions as a key site for the production of social and political order. Representing the natural world is understood by philosophers and sociologists of science as a way of intervening in it (Hacking 1983; Latour 1983, 1988; also Jasanoff et al. 1995). Visual displays of natural phenomena draw on historically and culturally situated traditions of representation; in a double hermeneutic move, they also sway people's imaginations, and with this their affective selves and capacities for community-building (Fyfe and Law 1988). Methods of measuring and standardizing social or natural phenomena help create the very things they seek to characterize, while concealing the subjective judgments that enter into measurement systems (Foucault 1979; Carson 1993; Porter 1995; Bowker and Star 1999). By consolidating the means of representation in esoteric places, such as laboratories or field stations or archives, the controllers of these 'centers of calculation' form themselves into 'obligatory passage points' in high modernity's exercises of power (Latour 1988, 1990). How do these insights bear on our present era of tacit and unwritten constitutional change?

Globalization offers an obvious entry point. It is talked about in many ways, by journalists, academics, and social activists. For some, the nub of globalization is in the global extension of the free market, with the attendant transmission of capital, ideas, people, and material things around the world, whether it is intellectual property law, Islamic fundamentalism, or Microsoft and Coca Cola (Friedman 1999). For others, more sociologically inclined, it is in the formation of places and subjectivities, cities for instance, that violate or hybridize older social categories and identifications (Sassen 1991). Still others have seen it in the emergence of new kinds of politics, from the rising influence of non-state actors in international negotiations (Haas 1990; Keck and Sikkink 1998) to the production of 'human rights' as a shared, if contested, discourse (Ignatieff 1997). Hardt and Negri (2000), as we have already seen, prefer to replace the concept of globalization with that of Empire. Increasingly, too, television and the Internet have become central players in both the definition and critique of globalization. In these media, action becomes text, readable and indefinitely reproducible; the local becomes global; and the lowly can assume (if only for fifteen minutes of fame) the ancient power of the monarch to command the public gaze. Televised and multiplied, a citizen protest in Seattle or a lethal attack on New York's twin towers acquires, at least for a time, the revolutionary force of a *Communist Manifesto*.

But what of the place of scientific knowledge in all this din of making and unmaking? Does science, despite its contingent, often provisional character have the power to move beliefs, forge alliances, and underwrite norms of global application? Some have

argued that this is precisely what has happened in the context of environmental decisionmaking, where knowledge of the biosphere's limited resources and of human interdependence with nature has helped build global coalitions around norms of environmental stewardship (Haas 1990). Similarly, economists would credit the spread of economic knowledge and understanding during the twentieth century with the defeat of socialism at the century's end. The completion of the Human Genome Project at the millennium produced few immediate surprises, but the project's directors used the occasion to preach a new humanism based on the now scientifically grounded observation that, under the skin, human beings are really all the same.

Despite their surface plausibility, claims such as these only open the way to further inquiry for students of science and technology. If scientific knowledge is in fact traveling freely around the globe, what are the social formations and processes that enable its frictionless transfer? If a system of global governance is quietly taking shape, then what knowledge resources has it gathered to itself and where are its centers of calculation? Is there evidence of a new knowledge class that has transcended earlier political divisions and constituted itself as a transnational ruling elite? And if the politics of knowledge historically played itself out in national settings according to well-established rules of testing and credibility, what comparable processes, if any, are arising in arenas of global knowledge-making?

While extended answers to these questions are beyond the scope of this paper, there are many indications that old settlements about where knowledge ends and politics begins are everywhere being reopened and challenged. At the institutional level, we see the rise of a mass of expert bodies of global jurisdiction whose work merges the cognitive and the normative. Constituted under disparate international treaties in areas such as environment, arms control, and international trade, these bodies have the power to certify knowledge and to draw boundaries between acceptable and unacceptable knowledge claims. For the most part, these global experts have operated with traditional notions of what constitutes 'goodness' or reliability in science, accepting published, peer reviewed articles as their gold standard. But the legitimacy of judgments reached on such a basis is often highly contested. Unrest over the technical determinations of bodies like the Intergovernmental Panel on Climate Change or the World Trade Organization attest to the fact that the preconditions for credibility and expertise on a worldwide scale are still very much in flux (Miller and Edwards 2001).

Accompanying the proliferation of new expert institutions is a diversification of what we may call 'global sciences.' These include relatively new additions to the human sciences, such as various forms of risk analysis for estimating global environmental and social hazards; also observable is a cluster of global accounting systems grouped under names like 'sustainability science,' 'vulnerability science,' 'integrated assessment' or 'ecosystem services.' The rise of modeling and simulation, enabled by massive increases in computing power and by sophisticated imaging techniques, has provided a further enormous boost to the ambition of knowing the world in its entirety. A central feature of these 'sciences' is the hybridization they demand of older categories of the natural and the social – violating in this respect the line posited by Latour as modernity's foundational achievement. Self-referential, the new earth sciences constitute the very realities they purport to represent. Their credibility depends not on experimental demonstrations to peer communities, as in the 'pure' fundamental sciences, but on the construction of

legitimizing practices, such as 'extended peer review,' that require assent from diverse disciplinary and social groups, expert as well as lay.

From a political standpoint, then, the once distinct practices of peer review in science and participation in politics are merging at the global level into novel procedures for ensuring the accountability of scientific and industrial research (Dickson 1984; Gibbons et al. 1994; Nowotny 2001). There are increasing demands for ethics in science, particularly with rapid advances in the human capacity to manipulate the basic biological material of plants and animals. In however inarticulate a way, world politics seem to be rejecting the idea of value-free knowledge and asking for scientific inquiry to make its goals and presumptions more explicit. These and similar developments attest to the erosion of old agreements concerning the objectivity of science and its autonomy from politics. They highlight linkages between knowledge-creation and the institutionalization of power in a globalizing world.

CONCLUSION: TOWARD POST-NATIONAL DEMOCRACY

Out of the ashes of the twentieth century the phoenix of a global civil society is struggling to resurrect itself. While constitutional theorists have tied globalization largely to macro-economic and political forces, science and technology must equally be seen as linchpins of the emerging global order. Networks of new knowledge and its material embodiments are helping to frame and stabilize some of the basic elements of a global political system, such as the rights, privileges, and identities of the world's citizens and the powers of major global actors. I have argued that the totality of these changes is constitutional in scope, both enabling and constraining new political formations. Through science and technology, seen as profoundly *social* institutions, many parts of the world today are engaging in what amounts to a tacit constitutional convention. On the table are the nature of the human self, the relations of consumers and corporations, and the certification of knowledge in the conduct of global politics. In all three spheres, the initiative for generating new organizing principles lies not only with corporate and governmental actors, but also in the hands of ordinary citizens and in the proliferating networks of non-governmental associations. In this respect, the emergence of a supranational world order (the 'Empire' of Hardt and Negri) is not inconsistent with continued assertions of human agency.

Realignments of global magnitude will take generations to accomplish, and the contours of the eventual settlements remain but dimly discernible and hard to predict. Let us not forget that it is a contingent as well as an unwritten constitution whose birth we are witnessing. Nevertheless, a few generalizations can be ventured. First, science and technology have not simply deterministically constrained people's freedoms, within limits ordained by preexisting constitutional rights. Rather, **science has provided resources that can expand the meanings of identity and community and help redefine the zone of individual autonomy that sits at the heart of all constitutional systems.** For good or for ill, science and technology are important aids to human self-expression, not merely iron cages within which a passive humanity languishes imprisoned by forces beyond its control.

Second, without much fanfare or explicit acknowledgment, recognition is growing that **technology is an instrument of governance, no less powerful in the hands of private**

or public actors than laws and regulations are in the hands of government. All kinds of spontaneous experiments are underway to see how far and to what extent consumer-citizens may have a say in the very earliest stages of technological innovation. These range from seemingly irrational, bottom-up acts of resistance, like destroying field trial sites planted with GM crops, to more considered, often top-down exercises in public and political consensus-building on new technologies. Whatever their merits may be, these disparate approaches suggest that the narrative equating technological progress with democracy has come under profound questioning. Technology's claims to benevolent rule must be argued and won today, not simply assumed as they were in older paradigms of development and technology transfer. Publics worldwide want a say in determining what kinds of futures they should live, and as RAFI's successful campaign against the Terminator gene demonstrated, they are sophisticated enough to see that these futures will be substantially shaped by corporate investments in technology.

Third, **science's role in underwriting the global constitutional order is associated with new forms and forums of deliberation.** These range from more participatory peer reviewing bodies to Internet sites at which the truth of scientific claims is exposed to public scrutiny. Less visibly perhaps, controversies such as those over agricultural biotechnology are challenging scientists' autonomy over the definition of standards of evidence and proof. The fact that findings rejected by mainstream science can exert a powerful pull on global political action should not be interpreted as a sign of public indifference to the truth. Rather, it demonstrates that a new political question has emerged on civic agendas: When is knowledge reliable enough to support collective action? The answer to that question is not seen as lying within the exclusive preserves of scientific authority.

In sum, **one of the basic principles of modernity that will surely be reformulated in the course of global consolidation is the sharp disjunction between science and politics, and the separation of processes that secure the authority of scientific claims from those that safeguard the legitimacy of government.** Norms of accountability that previously held only between citizens and the state are being extended to experts, with a consequent need for forums in which experts can defend their judgments to wider publics. We observe as well demands for a more 'socially robust' objectivity in science – for facts that can sustain themselves through testing by diverse social groups, rather than solely on the basis of their claimed correspondence to physical reality.

To date, all these changes remain inchoate and uncodified, lodged in diffuse and inarticulate social practices whose collective impact has yet to be felt in the citadels of organized power. To have constitutional force, they should in some sense be explicitly authorized, but by what institutions, organized according to what legitimating principles? The European constitutional debate sets both an encouraging and a cautionary example in this respect: encouraging in pointing to the prospect of an ordered supranational polity; cautionary in delineating the considerable pitfalls that lie in the path of its achievement. Yet, recognizing the very possibility of constitutionalism from below, founded on human creativity and craft, is a prerequisite for its eventual uptake into the practices of politics, law, and governance. It is a first step toward imagining a constitutional order in which the rights of *knowing* citizens – *homo sciens*, beside *homo economicus* – are explicitly acknowledged and given their place in the sun.

All these transformations, finally, demand new kinds of engagement from the social sciences. Disciplinary boundaries based on conceptual categories that are themselves in

flux seem ever less appropriate to characterize, let alone analyze, the moving frontiers of global social change. Legal scholarship and political theory in particular will need to accommodate more reflexive avenues of inquiry from newer, transboundary fields such as science studies. The reward, one hopes, will be a richer scholarship of the actual – a re-theorizing of the changes happening in the world about us, and a discovery of new ways to reflect upon, and perhaps intervene in, the courses of scientific and technological change.

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NOTES

- ¹ The two murals represent Thomas Jefferson presenting the Declaration of Independence to John Hancock, President of the Continental Congress, and James Madison presenting the Constitution to George Washington, President of the Constitutional Convention.
- ² The complaint that Americans no longer trust their governing institutions grew in force through the 1990s, along with observations about the public's declining participation in national elections. According to a poll conducted in the summer of 2000, for example, 43% of registered voters said they would watch no part of the Republican convention and 38% said the same for the Democratic convention. The corresponding figures for 1996 were 23% and 21% (Source: Vanishing Voter Project, Joan Shorenstein Center, Kennedy School of Government, Harvard University).
- ³ 'George Bush's Global Warming Speech', *Guardian Unlimited*, February 14, 2002, <http://www.guardian.co.uk>.
- ⁴ There have been only 27 constitutional amendments since the formation of the United States, the most recent in 1992, restricting the power of Congress to raise its members' salaries. Bruce Ackerman (1998, 490–1) has questioned the validity of this enactment, which separated national assent from assent by the states by about two centuries. The failure of the Equal Rights Amendment in the 1970s, despite the growing strength of the women's movement, offers one measure of the resistance to formal constitutional change.
- ⁵ While few question the biological validity of paternity testing using DNA markers, the reliability of the results may vary widely depending on the proficiency of the testing institution. On the standardization of genetic testing practices, see Arthur Daemmrich (1998).
- ⁶ NRI's enjoy a number of benefits designed to capture some of their foreign earnings for the Indian state. These include a variety of tax and investment advantages and special visa privileges.
- ⁷ *Marsh v. Alabama*, 326 U.S. 501 (1946), p. 506.
- ⁸ In *Heart of Atlanta Motel, Inc. v. United States*, 379 U.S. 241 (1964), the Supreme Court held that a motel serving interstate travelers could not deny accommodation to African-Americans on the ground that its services were purely local in character. See, also, *Evans v. Newton*, 382 U.S. 296 (1966) ("Where private individuals or groups exercise powers or carry on functions governmental in nature, they become agencies or instrumentalities of the State and subject to the Fourteenth Amendment," p. 299).

- ⁹ The statements have altered in interesting ways over the years. In September 2001, the company posted a statement on sustainable growth that began as follows: "DuPont is on a mission to achieve sustainable growth, which is defined as increasing shareholder and societal value while decreasing the company's environmental footprint" http://www.dupont.com/corp/overview/glance/sus_growth.html. Three years earlier, in 1998, the website offered the following DuPont commitment: "We affirm to all our stakeholders, including our employees, customers, shareholders and the public, that we will conduct our business with respect and care for the environment. We will implement those strategies that build successful businesses and achieve the greatest benefit for all our stakeholders without compromising the ability of future generations to meet their needs" <http://www.dupont.com/corp/environment/commitment.html>.

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PART III

STS – EMERGENCE OF A FIELD