The Architecture of Authority: The Place of Law in the Space of Science

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A doctor, a lawyer, and a scientist were having a discussion about whether it is better to have a wife or a mistress. The lawyer claimed that it is much better to have a mistress than a wife; if the relationship went sour, there were fewer legal complications. The doctor said that was all wrong. It is better to have a wife than a mistress, less threat of a heart attack from the greater sexual passion with a mistress. The scientist intervened saying they were both wrong. He wanted a wife and a mistress. He could tell his mistress he was with his wife, tell his wife he was with his mistress, then go to the lab and work without interruption.

This joke circulates among physical and biological scientists, displaying with unmasked pride a different sort of pleasure than offered by wives and mistresses: pleasure taken in a professional, albeit comic, identity as a single-minded pursuer of abstract truths rather than sensual desire, pushing back the frontiers of knowledge by working on a noble and selfless quest. Of course the joke is sexist, but so too is modern science. Of course too, science is hardly selfless, and whether it is noble is for others to say. Unfortunately for those misled by our introduction, our focus is not about sex, wives, or mistresses, but about space, science, and law.

Our subject is the significance of laboratory space as the habitat of the research scientist and the place of law in those scientific spaces. Our thesis is simple. As the laboratory has been transformed over the centuries from a private place of gentlemanly inquiry to an open and accessible public arena, the forms of regulation governing the processes of production and certifying the knowledge produced therein have also

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shifted. As the authority of science has grown, ironically, it has become increasingly subject to legal constraint and regulation. The legal regulation of science is, however, "from a distance." Rather than directly controlling the behavior of scientists, science is more often regulated through the design and monitoring of the spaces of science. What had been governed primarily by conventions among gentlemen and the prerogatives of class and aristocracy have been replaced by the techniques of governmentality. Rather than the scientist inviting acquaintances to his[1] home and relying on conventional morality to secure trustworthy witnesses to scientific experiments, the contemporary research laboratory is a space governed by a network of laws, regulations, and rules helping to produce a specific kind of subject: a particular kind of scientist and a particular kind of science. In the spatial regulation of science, processes of social control are largely internalized, sustaining science and the scientists' authority for autonomy and self-governance.

Science's traditional remove from everyday life and intractability to outside control have been challenged by modern transformations in forms of governance and in the characterizations of science as dangerous. Powerfully shaping contemporary life, science is perceived to be dangerous, both in terms of its potential to produce physical harm and in its insistence upon an independent source of authority. Many legal constraints focus on material and physical dangers, and our empirical data will address the regulation of environmental, health, and safety hazards in the spaces of scientific production. Nonetheless, we must note that science is dangerous primarily because its norms and practices are indecipherable by other institutions. The law's pursuit of justice and its construction of truth, for example, do not correspond to, and are often incommensurate with, science's pursuit of empirical reality. This disconnect can be threatening when science offers empirical answers that seem to undermine the law's truths. Scientific ways of perceiving, ordering, and manipulating phenomena create the possibility that other (similarly authoritative) institutions will be unable to apprehend, no less control, those phenomena. In this sense, science is dangerous because, being indecipherable, it may incapacitate the law's, or religion's, or the economy's routinized ways of operating and construing the world. However, an important aspect of its indecipherability, especially from the point of view of law and religion, is science's claim to operate without normative commitments. Thus, by abdicating

responsibility for the social terrain attended by law and religion, it turns out, science secures a measure of autonomy for its most serious dangers.

We do not wish to suggest that the history and development of modern science has been a story of total immunity from the influences of competing social institutions. Indeed, we will argue the opposite. The law has been constitutively present, sometimes centrally so, in the expansion and organization of modern science. But, in its efforts to promote (as well as contain) the development and consequences of science, the law has, over the centuries, certified areas of scientific autonomy, putting them beyond the law's reach. Just as the liberal state derives a good part of its legitimacy from its purported separation from and protection of civil society (asserted to be prior to and independent of the state that discursively and legally constructs that divide), so too, scientific authority is in part constituted by law's deference to science's claims to discover truths that exist prior to and independent of human institutions. In other words, the law's deference to science's claim—to have access to something that is independent of its own activities—helps construct scientific authority and legitimacy at the same time as it instantiates and legitimates law's authority to regulate.

What the law regulates, constrains, and enables may be influenced, if not determined, by science's methods and conclusions, but *how* that regulation takes place, through what sorts of procedures and sanctions, are the law's specific prerogative. Thus, we manage the dangers of radiation through an elaborate system of continuous surveillance that can lead to mandatory cessation of operation or personal exclusion from work. On the other hand, we respond to the dangers of smoking by requiring notices on cigarette packages, prohibiting advertising and sale to minors, but taxing rather than prohibiting consumption for adults. And, in most American states, we respond to the dangers of sexually transmitted diseases not by providing or requiring surveillance or mandated notices, nor by monitoring the sexual practices of infected persons; we do, however, permit and certify marriages only after screening for disease. In each of these instances, the dangers have been identified through scientific research; the modes and forms of regulation are legal inventions.

By collaborating with science's authority, deferring to its truths, and its claims to have access to a world independent of itself, law enhances its own capacity and authority, including the power to regulate the pro-

duction of science. Importantly, part of this collaboration between science and law includes a recognition that the experimental method is among the central features of scientific epistemology and authority. Acknowledging that scientific facts are always revisable, the content of legal regulation drawn from scientific knowledge is also always revisable. Thus, by incorporating and deferring to scientific epistemology and methodology, law justifies the need to come back again, so to speak, with new regulations. The revisable status of scientific truths creates a platform for extending the quantity and thus the reach of law, illustrating the degree to which regulation is characterized not by its specific content, but its form.

The contemporary history of legal regulation of science is in many ways a picture of the legal constitution of laboratories. From trusts, endowments, intellectual property, as well as environmental protection and workplace safety, legal rules not only penetrate but suffuse the spaces and production of science. In its engagement with science, however, this regulatory culture is not often a Weberian model of top-down command-and-control, mandating specific acts and prohibiting others. Today, in a transformed regulatory environment, we have bottom-up self-regulation where the law identifies the kinds of spaces that demand regulation, spaces in which an organization must define for itself and its members permissible types of action and interaction. In this contemporary regime, scientists take on the mission of the law, align their interests with those of the law, and produce through this process "the content of the form." The form of regulation is itself experimental, intentionally revisable, and along the way transportable. In the course of this experimental, engaged form of self-regulation, the law extends its power and reach, perhaps to places it might not otherwise be able to enter so easily or effectively. This is the regime of modern regulation Foucault described as governmentality.

We are suggesting that law and science collaborate in a mutual constitution whereby each is transformed, and the authority of each is preserved and extended. The interaction between law and science ends up recreating the world, not only materially but also culturally and morally. Although science takes pride in its material accomplishments, it often denies responsibility for the organization of social relations it helps to constitute. The very capacity to shape the material world creates moral problems that science denies having the capacity or responsibility to solve. Nonetheless, the experimental process supporting scientific authority has become so much a part of the way Western societies think and act that human subjects and the conduct of human life itself are regarded as experiments, to be observed and manipulated just the same as physical matter.[2]

Our work shows, however, that the scientific life is not immune from the consequences of the social technologies science has spurred. Specifically, we see that as the law operates on the spaces and the forms within which science takes place, it contributes to the production of a distinctive content: a particular kind of science and a particular kind of scientist, the content of knowledge claims and the daily practices of scientists. By helping to constitute more separated spaces for science, environmental and safety regulations push the private lives of scientists out of the labs. As scientists are forced to segment their lab and nonlab activities, they become increasingly fragmented, just like other modern social subjects. Ironically, however, as the scientists conform to standardized practices, becoming more like everyone else, their claims to extraordinary objectivity and authority increase.

We will illustrate the mutual constitution of science and law through the construction and regulation of laboratory spaces in three parts. First, we refer to the standard history of laboratory construction in which what was once a private and elite space has become public and relatively democratic. Without repeating the familiar history of Enlightenment liberalism, the invention of the liberal subject, and the development of democratic cultures, we will suggest some ways in which the development and standardization of scientific laboratories is part of, and mimics, that political story in terms of science's invocation of some of the central norms of liberal democracy.

In the next part of the paper, we illustrate these processes with ethnographic data collected in a major research university. These data show that scientific spaces are defined around the contradictory issues of danger and democracy, or interdiction and access. In the final section of the paper, we will examine the processes of regulation that have emerged to define scientific practice. In particular, the constitution of space has emerged as a principal modality of governance. The creation, design, and surveillance of space has, we argue, become increasingly

important in a world of autonomous subjects. Since it does not directly challenge the autonomy of liberal subjects, the control of space operates obliquely, sidestepping issues of subject freedom even while the spaces thus constituted define and shape subjectivity and practice.

Transforming Spaces of Science and Creating Liberal Subjects of Law

Over the course of the past four centuries, science has faced a formidable epistemological dilemma. From its inception, science's claims about an objective, lawlike, natural world challenged religious truth. Whereas religious truth is based on faith, scientific knowledge derives its legitimacy from empirical observation. In other words, scientific authority has always been based upon a claim that seeing is believing. Yet very few people actually see a gas turn into liquid under pressure, or directly see the molecular structure of ribonucleic acid. Thus, although science is offered as a direct challenge to a system based on faith and trust, there is, Steven Shapin says,[3] an ineradicable problem of trust at the heart of science. "Why ought one to give one's assent to experimental knowledge claims?" Why believe what one has not seen and often *cannot* see?

A solution to this problem required that science engage in a project of self-presentation.[4] Scientific practice had to discover ways of demonstrating or representing its found truths to a public in order to obtain the legitimacy and deference, and thus effectiveness, it sought. The various solutions that have been adopted have all implicated a particular power optics, involving a designation of who can see and what can be seen. And at the centerpiece of this history is the laboratory. As Lynch has observed,[5] "There can be no doubt about the moral and epistemological significance of . . . the 'physical place' of the scientific laboratory."[6]

Up until the nineteenth and twentieth centuries, the laboratory was a "truth spot,"[7] a place in which the empirical truths of science were revealed to a select audience of gentlemen.[8] The particular location, configuration, ownership, and design of the laboratory was available—to that select audience—for inspection. The legitimacy of scientific claims about the world were dependent upon the idiosyncrasies of place and the particularistic relationship that existed between the scientist and his audience. Knowledge and truth were thus inscribed onto

the laboratory and the social ties that connected scientists, their laboratory spaces, and their public.

Over the last two centuries, laboratory architecture and culture have changed.[9] What was private and personal, identified with and occupied by a specific, socially located individual, became, with the collaboration of public authorities, more accessible, in a sense democratized, standardized, and relatively indistinguishable from other similar spaces. Laboratories have developed into vast, prototypical, universal products with interchangeable parts and equipment, unremarkable in the ease with which they are reproduced and installed in very different physical conditions and cultural locations. Their contents have been so standardized that contemporary laboratories are designed and built Lego style: a pattern module is composed of stock materials, then arranged in various configurations, most often in rows and bays, to fit a building's dimensions and each research group's desired social organization.[10] Some laboratories emphasize unfettered correspondence from one group to another, creating open passages between the rows and bays; others limit communication but nonetheless create some passages to insure safety exits. Some labs build in sets of shared, communal equipment in order to leave more space for individual workbenches, while other labs replicate each instrument, machine, and facility for every work group in order to avoid dealing with differential work and housekeeping habits.[11]

The transformation of the laboratory into an anonymous and standardized space imparts to the laboratory an epistemological authority that differs radically from its premodern antecedent. The laboratory is no longer the place where truth is lodged; it has been demoted to a backstage. Where the credibility of science in the seventeenth century rested on public demonstrations and access to private homes, the public part of science is no longer a performance in the Royal Society or a visit to a researcher's lab. It is a publication. The text becomes the new public space, open and accessible to all, in and through which the provenance of science is established. Rather than seeing the experiment, we see the report of it. We defer to the report because of what Shapin calls the "literary technology" of the scientific journal: peer review and critique, "a highly stylized machine for manufacturing credible knowledge."[12] In modern scientific practice, the validity of a claim is made and evaluated through replication, claimed and certified through writing, peer review, publication, and circulation. Truth tran-

scends its place of discovery. In short, because the laboratory has become standardized in its construction and composition, it can disappear as an epistemological marker; we can take it for granted because it is constant and universal.

Today the laboratory remains a context for scientific discovery, but it is not seen as integral to the scientific truths it yields. This alteration in the role of the laboratory reveals a much broader transformation in the role of science in society in general, and in the relationship between law and science in particular. The changing spaces of science correspond to similar changes in the social construction of knowledge and the knowing subject. Slowly over these last four centuries, science has been democratized, contributing a particularly modern source of authority. Today, education and training, not familial or political status, permit access to scientific knowledge.[13] In this regard, the development of science followed a host of liberalizing tendencies of the modern world. The development of professional laboratories corresponds with and was part of the more general liberalization of social relations, politics, and law that came with the Enlightenment. With this liberalization, the scientist qua observer is dislodged from his or her berth in the aristocratic and caste based social structures. His or her relationship to others in social hierarchies no longer grants the capacity to personally certify or endow credibility. In much the same way that scientific truth has been gradually dislodged from its place within the laboratory and resituated in abstract textual space, the scientist is dislodged from particular, limited geographic and social spaces. The knower and the known are, thus, seen as transcending any particular social arrangements.

Similarly, just as the laboratory virtually disappears from contemporary accounts of scientific discovery,[14] scientists, as embodied, historical persons, also largely disappear.[15] Contemporary critics of positivist science often find fault with this obliteration of the observer and the scientific claims to abstract, objective knowledge.[16] What is sometimes overlooked in these critiques, however, is that this epistemology of objectivity was politically subversive when it appeared in the emerging modern world. Rejecting the constraints of religion, tradition, or state, positivist epistemology both drew from and contributed powerfully to the construction of the modern liberal subject, a subject who is believed to be endowed with capacities and rights that transcend and predate any particular social arrangement.

Linking the emergence of modern science with the creation of the free liberal subject, the sociologist of science Edgar Zilsel has argued that the closed, stratified social structure of feudal Europe was anathema to experimental method.[17] The complete separation of intellectual and manual labor characteristic of feudalism precluded the experimental manipulations that lie at the heart of scientific discovery. Feminist philosopher of science Sandra Harding likewise observes,

> Science's new way of seeing the world developed from the perspective of the new kind of social labor of artisans and inventors of modern technologies. In turn, the new learning produced by experimental observation increased the economic and political importance of this kind of activity and social person. Experimental method became first possible and subsequently important because it approached the world as it could be grasped only from the perspective of a violation, a gap, a free space, in the feudal division of labor.[18]

Of course, as science became democratized—in the sense of being taken out of the restricted hierarchies of aristocracy, caste, and place—it also became increasingly professionalized. Although there were no longer any explicit legal or political restrictions on who could become a scientist, few could claim familiarity or facility with scientific techniques or knowledge. By the beginning of the twenty-first century this professionalization has become more pronounced: scientific knowledge has become even more technical, and laypersons have become even less equipped to comprehend it. Yet despite the inaccessibility of scientific knowledge for most citizens, there exists a cultural understanding of scientific knowledge as belonging to a community that extends beyond the profession of scientists. Broman has used Habermas's concept of the public sphere to explain this seeming paradox: even as scientific knowledge becomes more inaccessible to nonprofessionals lacking the educational or technical training, it is still seen as the common property of everyone. Scientists, according to Shapin, assume the role of the priests of what "we know."

Thus, the history of scientific laboratories, a history that culminates in the epistemological disappearance of lab and scientist, replicates the development and refinement of the mutual constitution of law and science. Despite the fact that science was crucially implicated and dependent upon political developments of the Enlightenment, it is precisely

through these developments that scientific practice, and the knowledge it produces, can present itself as lying beyond the social, a sphere of authoritative knowledge protected by claims of objectivity, transcendence, and universality. Without asserting any causality or direction of influence, it is sufficient to note here the remarkable salience between the Enlightenment conception of the iconographic liberal individual and the idealized conception of normal science. Just like scientific knowledge, liberalism's subject exists independently of and prior to the political order, the embodiment and carrier of rights that, just like scientific knowledge, are objective, transcendent, and universal.

As science has been increasingly understood to transcend the social and historical contexts of its production, the authority of tradition, religion, and law to confine scientific practice have been undermined. As a more open and meritocratic system of education supplanted the system of aristocratic privilege, it became more difficult to regulate science through the norms of status and gentlemen's culture. This experiential duality, an awareness of the dangers being created here coupled with deference to the processes that are creating and possibly mastering those dangers,[19] mimics legality's similarly ambiguous relationship to laboratory science. The moral and epistemological authority of science, coupled with its instrumental material successes, sustains an almost unparalleled autonomy from legal regulation of the "substance" of science. At the same time, the immediate and potential perils cannot be ignored. Science is simultaneously something wonderfully productive and beneficial, and a threat in need of surveillance and control. Science is simultaneously beyond the laboratory, in the consequences of its knowledge, and materially and concretely within the spaces where scientists work.

Governing Science

> A building is a dogma, a machine is an idea.
> —Victor Hugo

As Durkheim wrote, "the truths of science are independent of any local context."[20] Claiming to deal in universal *physical* laws, science has historically positioned itself beyond the reach of *humanly created* law. It is precisely the fetishization of science as a universal abstraction, we suggest, that opens the lab—the material space of science—as a focus of legal regulation.

As science achieved its epistemological authority as objective and universal, the laboratory became less personal and more standard. The laboratory's standardization makes the features of any particular laboratory invisible in the production of science,[21] unremarkable to the degree that descriptions of laboratories are conventionally omitted from most publications and presentations of experimental results.[22] Yet the apparent disappearance of the laboratory in contemporary accounts of science disguises its increased importance as a site and generator of truth. Rather than provenance secured by locating each step of the discovery process in a place and with a person (as, for example, is the case of the provenance for a work of art), the paradoxical provenance for scientific facts is secured by making the production of science placeless. The standardization of labs makes particularistic knowledge of each laboratory meaningless. Indeed, the intention of standardization is to eliminate the particular in determining the validity or reliability of the knowledge produced. In this way, the invisibility of the place "secures the placelessness"—the universality—of scientific facts.[23]

Ironically, it is this placelessness of scientific facts that has created an opening for law to enter and shape the practice of science. In denying any particular epistemological importance to the laboratory, science thereby permits law to claim this space as a terrain upon which it operates. In other words, through the governance of laboratory space, law plays a role in shaping contemporary science and contemporary scientists. From the contracts and trusts that establish the institutions within which science is accomplished, to the safety regime of the federal laboratory standard (a complex array of Occupational Safety and Health Administration regulations), law is as much a part of the edifice of science as the steel and glass, ducts and ventilating shafts so characteristic of modern laboratory buildings. As sociolegal scholars have discovered in studying other social and institutional sites—including workplaces, neighborhood playgrounds, schools, and hospitals, the law is "all over" the laboratory.[24] Yet here, as elsewhere, the ubiquity of law is typically overlooked. And in the final analysis, it is the failure to see the law that is all over that grants it much of its power to constitute social life.

To identify the place of law in the space of science, we have been studying scientific laboratories in several universities. The institutions we are studying are ranked among the top ten in every scientific discipline; their science faculties are world renowned, including dozens of members of the National Academy of Sciences and the American Academy of Sciences, as well as a handful of Nobel laureates. We make no

claims to be speaking about all or a random sampling of contemporary science. We are looking at elite American science. Our ethnographic practice involves regular observation, watching, listening, taking notes on what we see and hear, asking questions, collecting documents, and conducting formal interviews with principal investigators, graduate students, postdoctoral fellows, and lab directors on three campuses.

When introducing our research to the scientists we have interviewed thus far, we have been receiving a fairly standard reaction to our announced purpose of studying the connection between law and science. Most say that there will be little to talk about. According to Fred Donner, the director of one of the biomedical laboratories, the law is irrelevant to science. "Oh, there is no law here. You will be wasting your time. Of course there are OSHA and EPA regulations, but otherwise the law is not pertinent to what we do."

Despite these disclaimers, it is undeniable that university laboratories are saturated with legality. They are, of course, legal creations. Through trusts, bequests, incorporation, and property law, universities, as well as the laboratories within, are legally created entities. All research grants and contracts specify legal relationships. Although all research scientists working with grants and contracts are, according to their statements, painfully aware of the legal aspects of the funding relationships, the legal constitution of their roles as employee-scientists, as supervisors of subordinate employees (students or technicians), or as researchers themselves is less salient. In general, they become aware of these legal relationships only when a taken-for-granted prerogative of one of their roles, such as tenure, is challenged. In addition, the results of scientific research are routinely converted into legally protected property through publication, copyright, patenting, and licensing. Indeed, over the centuries, as science has become an ever more public enterprise, its products have become increasingly and more rapidly privatized.[25] Thus, scientific laboratories are legal creations in the sense that they would not exist without the contracts and trusts that created them, defined their purposes, established their boundaries, specified the statuses and obligations of the scientists, and secured the ownership of the research results.

These traces of legality are acknowledged by scientists but routinely dismissed as being external to the process of discovery itself. Although they are sometimes contentious and bitter and even more often annoying, the stipulations of labor law or even property law tend to be forgotten when scientists enter the laboratory to conduct their research. Nonetheless, legality operates less conspicuously and yet powerfully in the practice of science. In fact, law is "all over" science even as it is all over social life in general.

First, law is inscribed in what Lefebvre referred to as the spaces of representation: the signs used by the planners, architects, scientists, and other social engineers to align "what is lived and perceived"[26] with their abstraction of it. The spaces of representations are, in effect, space apprehended and conceptualized.[27] Laboratories are designed, built, operated, and inspected imagining certain types of scientific subjects and scientific practice. Those subjects and practices are shaped, in part, by the design and construction of the material laboratory spaces. To the degree that science is regarded as a public process, its spaces will be accessible; to the degree that science is conceived of as a matter of national security, it could be politically dangerous and access will be restricted.[28] Because science is routinely believed to be physically and materially dangerous, the design and building of the laboratories is a thoroughly regulated matter. Thus, through the architectural conception of the laboratory, law participates in the material constitution of laboratory science.

In addition to the abstractions of space, the law is also present in the images and symbols embodied in the physical space, communicating distinctive meanings. This is not the abstracted conception of the laboratory appearing in drawings or blueprints, but the laboratory space as it is experienced, as the aesthetic rather than instrumental imagination apprehends and appropriates it. This is the space of perception not conception, according to Lefebvre.[29] "Overlay[ing] physical space," it makes symbolic use of spatial objects. Representational space refers to the metaphors and allegorical dimensions of space that mobilize sensations and affect. "The symbolic level," however, "is where architecture itself kicks in," and "where land use rises above the level of real estate speculation" and the organization of concrete, steel, and glass is more than just a shelter from the elements. Architectural critics offer accounts of the symbolic messages of buildings; "while not quantifiable," these representational aspects of space are "as substantial as the materials from which the buildings are made."[30]

Finally, Lefebvre claims that there is not only conceived space, and perceived space, but there is also lived space, or what he calls spatial practices. By spatial practices, Lefebvre means the ways in which the

organization of space enables or constrains the conduct of life. In this dimension of social spatialization, we want to know how scientific research is conducted in these spaces. Here, we continue the focus on the perception of laboratories as dangerous spaces to ask how the legal regulation of danger has transformed the practice of scientific research. In particular, legal regulation of laboratories has led scientists to transform the routines of scientific research to manage the inherent dangers. Although success at managing the danger enhances belief in scientific mastery, the safety regime may be transforming the meaning of being a scientist at the very same time.

These three dimensions of space can be used to interpret the social significance of any particular site. Within a specific site, they may either contradict or reinforce one another. Collectively, they constitute social spaces whose foundation, according to Lefebvre, is prohibition. Social space erects

> the gulf between [the members of a society], their bodies and consciousnesses, and the difficulties of social intercourse; the dislocation of their most immediate relationships, and even the dislocation of their bodily integrity; and lastly, the never fully achieved restoration of these relations in an "environment" made up of a series of zones defined by interdictions and bans.[31]

In the modern state, prohibitions, interdictions, and bans are the province of law, in liberal regimes more often justified by the necessity of containing harm and danger than by promoting a substantial good. In fact, one of the most salient features of space as it is constructed within contemporary scientific labs is the anticipation and containment of danger: The semiotic and aesthetic representations of science are coded for danger and hazard. The science of spatial planning, reflected in architectural plans designating the size and layout of labs, is an attempt to manage the inherent danger of experimentation. Finally, scientific practice is spatialized along the transits of danger and safety that lead to a partitioning of both lives and space. In each of these constructions of dangerous spaces, law announces the danger, instructs appropriate responses, and reorganizes relationships among scientists and their science.

Alongside the expression of danger and the prohibitions it requires, the spaces of science are also coded as public, collective, that is, democratic. Thus, the social space of science is a shifting boundary whose

legally established outline comes to define in various ways the practice of science and the identity of scientists.

Public Access and Dangerous Space

The image of science as both accessible and yet dangerous is first encountered upon entering the buildings that house laboratories. Within these buildings the public-private boundary is constructed architecturally, decoratively, and legally to symbolize simultaneously its public stature and significant danger.

At the entrance to many contemporary laboratories, we see broad inviting plazas, marble vestibules, and grand staircases welcoming visitors and workers alike. These are extraordinarily well built places; they look as if no expense has been spared in terms of the durability and attractiveness of the materials, the vastness of the spaces, and the volume and density of the technical facilities and equipment.

The doors are often unlocked; guards do not police entry. The title and ownership of the building is nonetheless prominently displayed on or next to the doors. Whom to call in case of emergency is also noted. Thus, it is clear that these buildings are private and belong to some legally responsible agent. Nonetheless, the public is offered free access to these spaces.

It is not exactly clear, however, what the public gains access to when they enter. The lobbies, in fact, lead nowhere. And few people do in fact enter off the street. Most of time these vast impressive spaces are conspicuously empty, or function principally as transits through which personnel enter the space of science.

Among the marble floors and grand stairways of these lobbies, one cannot miss the art. There are commissioned murals designed as part the building itself, paintings purchased for this site or borrowed from the university museum; there are sculptures standing at entrances and in courtyards. But the art does not stop in the public spaces. Along the private corridors, on tack boards interspersed among lab equipment, amid the posters tacked on bulletin boards announcing new courses, upcoming conferences, or warning of one or another significant danger, there are watercolors, lithographs, and posters of famous and not-so-famous artists: a Renoir portrait here, a Lichtenstein abstract there, and watercolors of sailboats on the river.

Ironically, what is conspicuously absent from these open spaces is science. The boundary between public and private space, the space of

science, is marked explicitly—through signs stating that the public is not allowed beyond this point. The exclusion is not expressed in terms of personal character or eligibility. No passes are demanded, no screening devices or card readers operate. The invocation of danger is the rationale for restricting public access, and that danger is expressed literally, loudly, and profusely, the warning labels appended almost everywhere.

Along the corridors, amid the posters, sculptures, and paintings, there is an almost endless parade of warnings: "Danger, Radioactive Materials"; "Danger, do not open this door"; "Danger, never leave this door open." Some signs describe what attire must be worn in these spaces and what cannot be worn. "Do Not Enter Without Eye Protection." "Do not wear contaminated clothing outside of the lab." Or the signs include instructions about what to do in case of contamination. "BL1: This is a Level 1 Biohazard facility. In case of accident call . . ." Other signs instruct how materials are to be disposed from this space. Another sign reads "BL2: This is a Level 2 Biohazard facility. In this laboratory, . . ." continuing on to explain the conditions for entering, leaving, disposing of materials.

Yet the danger is also conveyed tacitly and implicitly by the architecture, fittings, and furnishings. There is a noticeable shift in materials from the public to the private spaces, from marble and mahogany to glass and steel. Beyond the public spaces, the perils are contained behind steel doors with small viewing windows reminiscent of the doors and passages in a contemporary prison. These are clearly sealed spaces. The danger is also symbolized by the profusion of combination locks on the doors, locks that can be opened when your hands hold samples and equipment. The constant jeopardy is represented by the row of safety showers installed along the corridors. The design of the showers seems to have varied over the years. In one very recently renovated laboratory, their presence is both announced and camouflaged, expressing the latent ambiguity one experiences in these spaces. There is a simultaneous recognition of the persistent and pervasive danger of what is going on here coupled with a sense of mastery that suggests whatever the dangers are, they are under control.

Constructing Safe Spaces

Danger is not simply constructed by policing the public-private boundary. It is constantly negotiated within the work spaces of the lab itself.

In the course of our research, we heard a story that illustrates how space is legally partitioned to manage danger. At the university, new laboratories were being created in older buildings undergoing total renovation. The chemistry department would be given additional space in the renovated area. The chair of the department worked closely with the faculty who were to move into the new spaces, collecting their wish lists for square footage and facilities.

Nine months into the planning meetings with the architects, drawings began to appear. At that point the chair discovered that there were 25 percent fewer lab benches than had been agreed in the earlier meetings. When he pressed for an explanation, the architects responded that legal regulation stipulated greater distance between the benches than the faculty had specified. Among the scientists affected, this change in design was described as a crisis. By increasing the distance between the lab benches and reducing their number, the architects had reduced the possible size, and therefore productivity, of the research groups. When the department chair presented the faculty's grievances to the architects, they responded that it was a matter of safety regulations and insisted that they could not change the designs. A monograph had been published by a professor at another university—as part of his research product—that recommended good laboratory practices.[32] When the architects had conferred with the university's attorneys, they were told that the existence of the book made it unwise to build the lab benches closer than the distance specified there. Should there ever be an accident, the attorneys claimed, the book could be cited in expert testimony, and the university might be held liable.

As Lefebvre suggested, the abstract conceptualized spaces of representation, such as blueprints, have the capacity to modify and intervene in space.[33] In this case, an imagined legal constraint was figuratively and then concretely built into the laboratory, significantly reducing the overall research capacity of these groups.

Governing Danger and Managing Self-Governance

The management of danger is not necessarily imposed from outside of science. Increasingly, safety in the laboratory has become a major part of the scientific persona. For one of our subjects, David Laslett,[34] this preoccupation with laboratory safety began with his appointment as department safety officer. This role was traditional in chemistry departments but has now spread to every department that uses any chemicals

for any activity—from cleaning paint palettes, to disinfecting animal cages, to synthesizing new molecules. Concerns with laboratory safety took on new meaning when in 1990 OSHA enacted what is known as the Lab Standard for the safe handling and disposal of chemicals in research laboratories.

The Lab Standard was created because the existing OSHA rules were designed for industrial sites and did not work well for research laboratories. Industrial sites do the same things over and over again. Because of this standardization and repetitiveness, the forms and processes of industrial safety can, like the work, also be routinized. By contrast, most scientific laboratories perform a vast array of different activities, some of them infrequently. They also typically perform these acts on a smaller scale, using smaller quantities of chemicals or other potentially hazardous materials. Because of the variation in processes and materials, it is difficult to anticipate the kinds of dangers that might be involved. "There are lots of things," Laslett said, "for which hazards are not known. They're new substances we've created as part of our research. And so research lab people said that the laws that are being applied to us really are not relevant." In other words, the dangers that attach to research laboratories are to a significant degree unspecifiable in advance. As a consequence, according to Laslett, the scientists have taken on the role of regulating themselves. Laslett describes the process.

> We tried to change the culture of safety when I took over in 1990. . . . I would say the prior situation was an adversarial relationship between the safety police and researchers and faculty. Occasionally some sort of proclamation would come through—like you can't wear shorts if you work in the lab—that people would treat derisively and ignore totally. . . . The chemists didn't have much respect for [the safety inspectors who did come by or make rules] because they weren't as smart in chemistry as we are, and they came and were saying you're not using this properly. But they didn't know what the structure and properties of the chemicals were. They would lose credibility in front of the students. It was a really bad situation.
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> We had, in a sense, to reinvent our whole safety regime. So it was an opportunity to do this differently. It's as if you're saying we're throwing out our entire legal code and rewriting it.

> The OSHA Lab Standard is an interesting performance-based law, which means that it doesn't lay out in detail [that] under the following conditions you must wear safety glasses, under the following conditions you don't. Instead, what it comes down to is it says you must appoint a person called the chemical hygiene officer and you must write something called the Chemical Hygiene Plan. And it doesn't specify what you put in there. What it does say is that this has to be effective in protecting all researchers from hazards. We're not telling you what a safe laboratory is. You are going to make up rules that make a safe laboratory. That's what the law, the federal law says. . . . They did not lay out in excruciating detail one-size-fits-all safety rules. It says, "We will allow you to . . . design your own safety plan. We may inspect and determine if it is effectively protecting people, and if it is, then it's satisfactory, but we are not going to micromanage things."
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> When the law went into effect, the first thing [we] had to do was to decide, how are we going to comply with it? Are we going to have a single safety chemical hygiene officer who would be safety czar over the entire [university], or are we going to make every PI [principal investigator], every professor, a chemical hygiene officer. . . .
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> So the most important decision we made was that safety should begin at the grass roots. . . . If we didn't enlist the people affected by these rules in the creation of new rules [it wouldn't work]. . . . The idea was that we would create a structure. The creation of the new safety rules would be done cooperatively by faculty, students, and administrators within each department. And the enforcement of compliance—monitoring the compliance and enforcing—would similarly involve not only faculty administrators and authority figures but those researchers, the people who are affected by the rules. [This was] to overcome the adversarial relationship that otherwise inevitably develops if you have people outside of the community creating rules and monitoring compliance and enforcing them.

As Laslett claimed was common, Fred Donner expressed just that resentment toward the agency that monitors the care and protection of the animals in the laboratory he directs. "Look," he said, "it's a big pain

because we want the mice healthy. People are going to want them healthy because they can't do their experiments [otherwise]. But, in addition, we have a bureaucracy that deals with making sure that we do." Because scientists have a direct interest in securing the health and safety of their experimental animals, Donner claimed, the spot inspections and detective work of the government agencies wasted time and energy.

Laslett's account of the invention of the safety regime at his university illustrates the self-regulation that is at the heart of regimes of governmentality.

> After a lot of debate we came up with a plan which would be more or less equivalent [across the university]. Every department would have its own chemical hygiene officer and plan. We felt that it was unrealistic for each individual laboratory professor to have one.

It was also not a good strategy to establish one policy for the entire university. In the past, that had not produced an effective safety system because of the hostility between the researchers and the safety professionals.

> The researchers felt that they had no stake in the creation of the laws. And the laws, any rules, tend to interfere in some way with research if only in terms of making it less convenient to do certain things. And the fact is that some of the benefits are not immediately apparent—like, I'm not going to get cancer thirty years from now. It is not necessarily easy for people to see the long-term benefits of these short-term inconveniences. The inconveniences being applied from on high, naturally people are less cooperative.

He continued, "My agenda was that if we involved everybody at the beginning making rules, they were more likely to appreciate why these are important and necessary; they are more likely to cooperate." Of course, their cooperation must be verified.

> It is very important not just to have an initial training lecture and to give people copies of these documents, it's also important that we check that they're working in compliance with it. So what we have, in our department, is a system of inspections. Every research lab (that means every group) is inspected unannounced—unannounced inspection twice a year . . . by a team consisting of one faculty member and one graduate student from the chemical hygiene and safety committee.

Not all scientists defer so conspicuously to the law's authority. Sometimes they engage instrumentally with the regulatory regime. And Laslett, despite the grassroots training and surveillance system he has created, is unwilling to bow down passively before what he calls "the regulatory czars" if it means large fines or public embarrassment for his university. When the EPA inspectors found violations, despite the efforts of the university, he participated in negotiations over several years to mitigate the violations and reduce the fines and public exposure.

At other times, some scientists express their reluctance to take the regulatory regime seriously, and go along either willingly or strategically. Laslett described some of his colleagues' reactions this way.

> Now, in the first time around, when it went into effect, there were several laboratories, three I remember, that you might say failed the inspection, where your problems were so egregious that the letter [we sent] said, "In view of these serious violations, we will be returning within a few weeks to inspect again, please correct the problems," something like that. It's a fairly positive letter. . . . In two or three cases the second inspection they [also] failed. Fortunately, the department chair at that time was a non-laboratory person, a theoretical person not as intimate with real, wet chemicals; he was particularly paranoid and very supportive. So the third letter basically says that in the event that there are still any problems with the third inspection, we will have no alternative but to order your laboratory closed to further research until these problems are corrected. And then there was a kind of postscript that federal law requires that if you have any funding from federal agencies, we have to notify them that work is ordered halted here.
>
> So Goody had a bit of a problem [in his lab]—I don't think it's there anymore—but he had on his website, for a while, a quote

from that letter. My words in that letter were that if your group had been here when the EPA did their inspection, you definitely would have been the worst lab in the department. So he actually had one of those scrolling things on the bottom of his web page [reading] "Worst Lab in the Department" . . .

Then he was supplanted by Shoemaker. When Shoemaker had a bad inspection, I said, "Oh man, Goody, I don't think you're in the lead anymore." He created a running thing which said, "We are no longer the worst lab. For the link to the worst lab . . ." etc.

Gusterson discusses the function of this kind of humor among scientists as a means of managing the emotional consequences of their work's danger.[35] Although Gusterson focuses on the work of weapons scientists whose task is to create the most horrendous and potential dangers for human bodies (as a part of an elaborate and possibly perverse security system—mutual assured destruction), the transmission and acquisition of a culture of embodied danger is generally part of the training and socialization of scientists.[36] Jokes become one of the ways in which members of a community reveal and deal with conflict and anxiety.[37] Gusterson reports that almost all the jokes he heard in a course on nuclear physics "had to do with the vulnerability of the human body and the ignorant fears of non-scientists."[38] The jokes are funny, Gusterson argues, because they are about dangers that have been mastered, such as radioactivity. Jokes about AIDS, he suggests, are not funny because AIDS is a subject "before which we feel helpless."

> The radiation jokes are funny, at least for physicists, because although radiation is dangerous, physicists feel confident that they understand radioactivity and know how to deal with it—though the jokes have an extra edge because they nag anxiously at this confidence. The jokes play with the body's vulnerability to radioactivity, teaching students to laugh both at the danger and at those who, not understanding that heavy water is not radioactive, for example, have an exaggerated fear of it.[39]

"These are jokes," Gusterson writes, "that make an elite community." Professors Goody and Shoemaker can run banners on their websites announcing the poor safety records of their laboratories because

they are confident that they have mastered the real and possibly serious dangers of chemical reactions. Thus, what their web screen crawls announce is the foolishness of those who have insisted on these legal regulations, and perhaps of the department chair, who doesn't "get wet" with chemicals in a real lab.

Discussion: Space, Power, and Transformations in Social Control

The parallel development of the liberal subject and autonomous science share a trajectory that has long been observed in Western societies, culture, and law: from status to contract, from gemeinschaft to gesellschaft, from mechanical to organic solidarity, each of these formulations marking a transition from the corporeal to the abstract. Abstractions themselves, these familiar characterizations also mark transformations in specific practices of social control that are of particular relevance to legality and especially the capacities of law to contain the dangers of modern science. These historical movements signal, first, a shift away from the direct regulation of subject persons, and, second, a shift toward the regulation of spaces, with the result that all territories, properties, sites, zones, buildings, parks, homes, movie theaters, and, of course, laboratories are imprinted with law. In this modern system, the social control of science is achieved primarily through regulation of the physical spaces where the danger resides. We have illustrated how this regulatory regime operates in some contemporary laboratories. We would like to elaborate the shape and texture of this transformation in the relationship between space, power, and law more generally.

Foucault, who has been called a cartographer of power, conceptualized modern transformations in social control as a movement from bodies to minds and spaces. According to Deleuze,[40] Foucault's entire theory of power is spatial in nature. Although space is central to Foucault's work, the role of space is not the same across the different modes of power Foucault identified. He invoked two powerful, but distinctive, spatial images to represent and contrast exclusionary and disciplinary modes of power. In the former case, he described the leper and his separation into an excluded, disqualified mass. In the case of discipline, he evoked the image of the city under siege by the plague, where the enclosure and meticulous partitioning of space allowed for the distrib-

ution of individuals to be supervised and contained. Each of these modalities of regulation relies on space to produce (in the case of the expelled leper) the pure community leached of the unredeemable, and (in the case of the ordered city) a regimented society where no one was excluded from the regulatory machinery.

In his later essays, Foucault outlined what has since been construed by his intellectual progeny as a third form of regulation, governmentality.[41] Space figures most centrally and complexly in this form of regulation. If exclusion and discipline are animated by the dreams of purity and order, this third mode of power seeks a different dream, that of freedom, or, to be more precise, a subject who can be governed through his or her freedom. The dream of a free, but governable, subject is necessitated by the paradox of power to which we have already alluded and that lies at the heart of a liberal regime: that is, governments create zones of privacy and autonomy to which they, by their own authority, are denied access. Governmentality, as a mode of regulation, is a response or accommodation to this paradox. Through an array of discursive and material practices and technologies, liberal subjects are increasingly, albeit imperfectly, governed through, rather than against, their freedom.[42]

This trick is achieved in part by the retreat and fragmentation of central governing power. We are, to use Rose's term, governed at a distance. This distance is both constitutional, in that regulation is achieved through a variety of nonpolitical experts and authorities (including medical experts, architects, human relations experts, and the media), and spatial, in that these operations are located and practiced in dispersed sites. Rather than the central tower of the panopticon, with its single shrouded watcher, governing from a distance implicates hundreds upon hundreds of experts, teachers, physicians, counselors, family planners, architects, and talk show hosts, to name but a few.

Ironically, the terminus of these distant and dispersed vectors of regulation and control, the point at which they all converge and reach their fullest expression, is the individual subject. In order that governmentality succeed as a mode of regulation, it must realize or produce subjects who are actively engaged in the very same technologies of governance as the political, scientific, medical, and ethical experts. In this sense, governmentality is both distant and, at the same time, very close. Capturing this contradiction, Mariana Valverde has described the result of this process as the despotism of the self.[43]

To achieve this outcome, those who govern must develop strategies of aligning their goals and projects with those to be governed. Rose calls this task of alignment one of "translation." The various mechanisms of translation instrumentalize political authority as freedom.

One of the primary technologies of translation involves the construction, surveillance, and regulation of space. To fully capture how governmentality works in the liberal cultures of freedom, this form of governing through space must be distinguished from the spatial practices of discipline. Disciplinary techniques involve the enclosure of space and the containment of individuals within enclaves (such as prisons, schools, barracks, rows of desks, and office cubicles). By ordering space and distributing individuals across the grids, subjects become the objects of surveillance and control. In the case of discipline, space is a *means* to achieve the disciplining of bodies. By contrast, in the case of governmentality, space itself is the *object* of governance, and individuals are incidentally (and episodically) controlled and constructed as subjects *only* as they occupy or pass through these governed spaces.

A few examples may help at this point. Recent legal battles over the rights and obligations of pregnant women to their fetuses (including the very recent case of a woman imprisoned in Massachusetts for refusing to submit to a court-ordered medical examination) exemplify the processes through which governable subjects are constructed through the regulation of space. Over the past few decades, fetuses have been constructed as persons deserving of protection from such things as maternal drinking, or in the case we just cited above, from the mother's religious convictions regarding the rejection of modern medicine. These recent cultural (and legal) interpretations of fetuses as subjects who are separate from and vulnerable to the mother depend upon other cultural constructions, in this case specifically of the womb. Petchesky has argued, for instance, that with the development of fetal imaging technologies such as ultrasound, the fetus has been represented as separate and autonomous from the mother who, in turn, has become the empty space inhabited by the new subject.[44] The famous *Life* magazine cover showing the fetus floating in space without context or connection presents a creature who is uncontained. It is through such a spatial uncoupling of mother and fetus that the absent mother "is increasingly put in the position of adversary to her own pregnancy, either by having presented a 'hostile environment' to its development or by actively refusing some medical intervention."[45] The *Life* magazine

image of the unbounded space, absent the demarcation of the environment of the womb, created a representation of an individual person deserving of protection, but at the same time dependent and incapable of self-governance. Thus, through this spatial imagery, the mother becomes the relay or the proxy for this newly constructed subject.

Constructing the fetus as an autonomous subject through the fabrication of space is a particularly rich example insofar as it illustrates the crucial role of inscription in the process of governance. According to Latour it is primarily through inscription techniques such as maps, charts, blueprints, and in this case photographs, that what he calls "immutable mobiles" from dispersed and distant places (such as the wombs of countless women) are accumulated, stabilized, made durable, and thus available for inspection and regulation. These mechanisms are "little machines for producing conviction in others." Most importantly, given the political objectives of governmentality, as our own experiences are converted through these representational devices and thus made available to our own inspections, surveillance, and judgments, these little machines (inscription techniques) produce convictions within the very subjects represented.

It is not just conviction that is produced, however. By designing space, giving it form, dimension, locating it in relation to other spaces, opening or closing access to it, and so forth, space becomes a context and resource for social action. According to Shields, "the possible, likely and habitual routines of place are thus concretized in built environments and sedimented in the landscape."[46] The parking garage with the speed bumps and tire-ripping grids promote driving at certain speeds and directions without having to make direct person-to-person appeals to drivers.

According to Valverde's history of the regulation of alcohol, the policing of saloons provides another example of this spatial modality of power.[47] In the early twentieth-century zeal to eliminate the saloon (a space thought to generate excess and immorality), efforts were made to prohibit some spatial designs and mandate others. Local licensing boards debated whether patrons should be able to stand at the bar, or what particular arrangement of furniture would be most unsaloonlike. Some argued that saloons should have large windows onto the street to foster surveillance. Others argued against windows on the grounds that the streetside viewers would be tempted or contaminated by the sight. For the most part these efforts were thwarted by the fact that

there was no consensus over the essential or defining features of a saloon. The significant point, however, is that these local regulations more or less ignored the soul of the drinker. The governing impulse was targeted upon the drinking establishment itself and only incidentally on the drinkers who would inhabit it.

This analysis points to the opportunities, routines, and escape routes offered by certain spaces to create or foreclose possibilities for sociability and consumption (in the case of the saloon), or for being and connection (in the case of the womb). And, as Shields notes, when behaviors engendered by particular environments become ritualized or conventionalized, this produces roles and identities for the individuals (or groups) inhabiting those spaces.[48]

In Western thought, dating from Bacon and Descartes, space has been understood to be an empty void that contains objects. According to this view, space exists (or can be known to exist) only where it contains objects,[49] although even then it is not reducible to them. More recent theorists, such as Lefebvre, reject this definition of space as empty, or as simply a container.[50] Lefebvre claims that space is itself a materially produced form, a concrete abstraction, similar to Marx's notion of the commodity. Space is, in this formulation, a material realization of its design and production. It is, according to Lefebvre, a condensation of the social relations of its production. Whereas the classical view of space was that it was defined by its inhabitants, Lefebvre's reconceptualization admits the opposite possibility: that spaces are capable of defining their inhabitants. Social space endows and constitutes subjectivity by presupposing certain kinds of inhabitants (however temporary or brief their habitation). In other words, space is constructed (by virtue of its siting, shape, size, dimensions, contours, openings, and relationships with other spaces) with certain practices and persons in mind.

Of course, the classical view of space as a void defined by its contents is itself a particular historical construction, the product of precisely this dialectic of spatialization. Up until the twentieth century, cities, dwellings, and other places derived their meaning and form from a long "history of habitation." These spaces bore the imprint of the lives and routines of their inhabitants. And the perfect coincidence of space and its inhabitants made it difficult to imagine one without the other.

It is precisely this history of habitation that is ruptured by the social and geographic mobility of modernity. The circulation of persons

throughout social structures and of bodies through and across geographic distances, renders older forms of regulation, in particular those encompassing modes of subjectivity and power such as discipline, more difficult. Under such conditions, it becomes much more effective to focus on the governance of space and allow the circulation of subjects.

Thus, we would propose that at the heart of governmentality is the production and control of space. Individuals who circulate through or inhabit the spaces so constructed are created as subjects enabled or disabled by the environment. Governmentality offers a solution to the difficulty of governing free subjects in the modern liberal state. Explicit moral instruction or legal prohibitions aimed at individual behaviors are partially supplanted by a form of regulation that operates from afar and somewhat obliquely. It operates by fabricating spaces designed to constitute certain types of subjects, allow for certain types of behaviors, and acknowledge certain types of truth.

Conclusions

Concerns about safety and danger have shaped the spaces and thereby altered the professional lives, consciousness, and passions of scientists. Because functions must be spatially separated—no exposing of bodies in the presence of laboratory chemicals, no putting on makeup, no ingesting food or drink of any kind—laboratories occupy more physical space for the same functions than they did in the past. In newer laboratory buildings, spaces are allocated for in-house canteens so that researchers need not travel to eateries. OSHA regulations prohibiting eating in the lab can be satisfied while the sense of work too consuming to abandon for lunch can also be sustained. Depending on the local culture, lunch/reading rooms have been allocated one per building, or one per floor or corridor, creating unexpected but productive opportunities for exchanges among members of different labs. Or, as is the case in one newly renovated laboratory, lunch/reading rooms have been attached to each investigator's laboratory, restricting rather than expanding the possibilities of serendipitous exchanges among labs. When space is at a premium, as it is in all universities, this mode of accommodating the legal ban on food in the lab means that some persons and some functions get short-changed or are eliminated entirely. In the building where lunchrooms were allocated one per investigator's

lab, emeritus professors were moved out of the building, limiting their continued interactions with the graduate students and junior faculty, cutting short their professional careers.

Fred Donner offered us additional insight on the ways in which the life and practices of experimental scientists have been transformed through these new forms of regulation.

> It used to be that all the professors' offices were, for example, ensconced in the laboratories themselves, and that was part of the general ethos, which was eating, sleeping, drinking, and making love in the laboratories. It was all allowed. Or if it wasn't allowed, people did it anyway. I mean they lived their lives in the lab. Now there's none of that. . . . Offices, as you can see, are cauterized from the laboratories, and if I see somebody eating, smoking, or doing anything in the labs, they get fined one hundred dollars. It's tough.

If the seventeenth-century chemist Robert Boyle brought chemistry into his father's, sister's, and his own living quarters, twentieth-century scientists brought, as Donner reports, their entire lives and selves into the lab. As our introductory joke implies, the life of a scientist is supposed to be a life devoted almost entirely to science; nonprofessional aspects of life are sublimated to science. Indeed, Donner confesses that the laboratory life, or life in the laboratory, was part of why he became a scientist. He says, "I liked the life; I was a lab rat. I enjoyed being in the lab." However, because of legal mandates and rules concerning health, safety, and environmental protection, the characteristic features of modern science and scientists have been transformed, and that way of being a scientist is no longer possible. What was a life enacted almost entirely within the laboratory has now been fragmented through the partitioning and legal regulation of laboratory space. Shapin concludes that the house of experiment is now a place where no one resides.[51]

Exploring the laboratory as an object of governance and as a spatial means to regulate the dangers of science within liberal democracy, this paper makes two moves. First, it shifts the focus of governance from the liberal individual (who is made vulnerable to surveillance and control through freedom) to an institution (which is made both dangerous and vulnerable through its claims of autonomy and universality). Second, we conceptualize governmentality as an ensemble of spatial processes

that in many ways operate alongside the subject—individual or institution—who is then "free" to circulate within the regulated spaces.

We argue that precisely because the laboratory plays a crucial role in the production and governance of science, it has become an important locus for the legal regulation of science and the various material and cultural dangers science poses. As laboratories are designed, surveilled, and monitored by literally hundreds of discrete legal rules, scientists themselves—as embodied historical subjects who eat, drink, sleep, and make love—are increasingly dislodged from these spaces. By helping to constitute more separated spaces for science, legal regulations push the private lives of scientists out of the labs, stripping scientific practice of some of its more personal and idiosyncratic aspects. Law works here, as elsewhere, to standardize and homogenize differences. In this instance, however, it may contribute to, rather than undermine, the authority of science and scientists, as personal and idiosyncratic characteristics create vulnerabilities in science's claims to impersonal, placeless universality.

Ironically, however, because scientists no longer understand the laboratory as an "authenticating place" (that is, a unique place that imparts truth through its specific location, design, or content), legal regulation of space has been able to operate with a minimum of resistance. In other words, it is the increasing invisibility of the laboratory in the epistemology and moral authority of science that has enabled law to govern science "at a distance." The project of governing science from a distance has been enabled by the efforts of scientists themselves to construct science as an abstraction, a practice that lies beyond the reach of law. Thus, dislodging truth from the laboratory, or locating it only incidentally therein (because any similarly appointed lab would do), has opened within the "space of science" a "place for law."

NOTES

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1. We note that science has remained a gendered occupation to a greater degree and far longer than many other professions.

2. Egon Bittner, "Technique and the Conduct of Life," *Social Problems* 30 (1983): 249.

3. Steven Shapin, "The House of Experiment in Seventeenth-Century England," *Isis* 79 (1988): 373.

4. Stephen Hilgartner, *Science on Stage* (Palo Alto: Stanford University Press, 2000).

5. Michael Lynch, "Laboratory Space and the Technological Complex: An Investigation of Topical Contextures," *Science in Context* 4 (1991): 51.

6. Inquiry into the epistemological and moral significance of space is growing. See for example John Brigham's forthcoming study of courthouse architecture.

7. Tom Gieryn and David Brian, "Authenticating Places," paper presented to meetings of the American Sociological Association, 1999.

8. Shapin, "House of Experiment."

9. P. Gallison and E. Thompson, eds., *The Architecture of Science* (Cambridge: MIT Press, 1999).

10. The standardization of modern laboratories should not be exaggerated to suggest that there is no variation among individual labs or between different fields of science. Our reference to Lego style is meant to highlight the fact of sufficient standardization such that the pieces that are put into most labs can be purchased from catalogs of mass-produced items. Some subjects, for example, organic chemistry and many areas of bioscience, are much more standard than others because the tools of these fields are fairly universal and interchangeable. Physical chemistry and physics labs tend to be idiosyncratic—some might say chaotic—in their layout rather than arranged in rows and bays. Here the construction of the equipment is often a major part of the scientist's invention. Thus standardization may affect parts of the building more than the contents, but, as we have said, this varies by field. See note 14 below.

11. Tom Gieryn, "Biotechnology's Private Parts (and Some Public Ones)," in *Making Space for Science: Territorial Themes in Shaping of Knowledge*, ed. Crosbie Smith and Jon Agar (New York: St. Martin's Press, 1998).

12. Shapin, "House of Experiment."

13. As we suggested briefly above, science continues to be a highly gendered profession (Sonner and Holton 1995, Schiebinger 1999, Reports of the Committees on the Status of Women Faculty, MIT 2002). It is even more stratified by race. Stratification by social class, which had characterized science for

centuries, is no longer strong. Thus, in making our historical comparison, we can mention an increasing social accessibility in contrast to the material inaccessibility of the laboratory. The rationale and the consequence of this inaccessibility have changed, however, so that exclusion is also democratic, based on danger and contamination rather than class and gentlemanly status.

14. The laboratory—in the sense of the pieces and parts that can be dislodged from the building shell and walls and could be metaphorically shaken out—are usually not described in publications unless the design is highly unusual. The specific apparatus developed by an investigator is, however, often described in some detail, especially if it is a new invention. In many instances, however, there will be separate publications in a vehicle such as the *Review of Scientific Instruments* that deal solely with the apparatus. In some areas of physical science, especially where the techniques are part of the invention, it is rare not to have a description of the apparatus and its use in making the measurements. "To be sure, these descriptions are often insufficiently detailed for exact replication of a measurement, but in fact it is often the case that others will copy an innovative technique," Jimmy Lloyd explained to us, although scientists may have to design the apparatus themselves. Thus, like the standardization of the laboratory space, representation of the apparatus in publications varies by field and discipline. In general, it is not a central part of the publication unless the techniques or instruments are new. See notes 22 and 23 below.

15. Of course the scientist does not disappear from science. In terms of prestige, the naming of discoveries, functions, awarding of prizes, science pays abundant homage to its great men [*sic*]. These honors (prizes, biographies, immortality) accrue to, and as far as we can see are enjoyed by, embodied human beings, the scientists. When we say that the scientist disappears, then, we refer here to the fact that personal authority or biography is not relevant for the authority of an observation and that the observation stands independent of the person observing. Indeed, much of the practice of science works to strip it of these human individual markers (Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* [Beverly Hills, Calif.: Sage, 1979]; Bruno Latour, *Science in Action* [Cambridge: Harvard University Press, 1988]).

16. Dorothy Smith, *The Experienced World as Problematic: A Feminist Method*, Sorokin Lecture No. 12 (Saskatoon: University of Saskatoon, 1981); Nancy Hartsock, "Political Change: Two Perspectives on Power," in *Building Feminist Theory: Essays from Quest*, ed. Charlotte Bunch (New York: Longman, 1974).

17. Edgar Zilsel, "The Sociological Roots of Science," *American Journal of Sociology* 47 (1942): 544–62.

18. Sandra Harding, *The Science Question in Feminism* (Ithaca, N.Y.: Cornell University Press, 1986); Pierre Bourdieu, "The Specificity of the Scientific Field and the Social Conditions of the Progress of Reason," in *The Science Studies Reader*, ed. Mario Biagioli (New York: Routledge, 1998).

19. Bittner, "Technique."

20. Émile Durkheim, *Selected Writings*, edited and translated by Anthony Giddens (Cambridge: Cambridge University Press, 1972), 88.

21. We do not suggest that laboratories are unimportant to the production of science. Quite the opposite: Laboratories are essential vehicles for the production of science. We emphasize only that the laboratory is no longer synonymous, as it once was, with the science. Today, it is the place where science is produced; it is not science.

22. An important exception illustrates the general point (see notes 10 and 14 above). In presentations of experimental results, chemists and physicists present information and images on the laboratory design and apparatus of their research only when it is part of their invention, a singular and particular aspect of the experimental design. Most often, however, presentations and publications contain little or no reference to the technologies and physical circumstances of the experimental apparatus, rarely enough that would enable the necessary replication. That detailed technical information must be secured through personal communication. This development stands in marked contrast to the early scientific publications of the Royal Society. Referencing Shapin's work on the early laboratories and Royal Society proceedings ("The House of Experiment"), Gieryn remarks how those early accounts in the Royal Society publications "were prolix—packed full of every little detail about how an experiment was done, often with expensive engravings of the apparatus, enabling the informed reader to become a 'virtual witness' via a reading of the fact text. But over time, the scientific paper became less explicit in narrating every detail, and more laconic about how an experiment was conducted or with what equipment—shorthand codes were devised, and many particulars were assumed to be so obvious to peer readers that mention of them could be safely dropped. In effect, the amount of technical knowledge needed to read a scientific journal was enlarged significantly as actual descriptions of the bones of experiments became ever more brief" (Tom Gieryn and David Brain, "Authenticating Places," paper presented at the American Sociological Association, 1999, 4).

23. Tom Gieryn, "Model Farms as Truth-Spots," paper presented to the Society for Social Studies of Science, October 29, 1999.

24. Austin Sarat, "'. . . The Law Is All Over': Power, Resistance, and the Legal Consciousness of the Welfare Poor," *Yale Journal of Law and the Humanities* 2 (1990): 343.

25. Jason Owen Smith and Walter W. Powell, "To Patent or Not: Faculty Decision and Institutional Success at Technology Transfer," *Journal of Technology Transfer* 26, no. 10 (2002): 99–114; Walter Power and Jason Owen Smith, "Universities and the Market for Intellectual Property in the Life Sciences," *Journal of Policy Analysis and Management* 17, no. 2 (1998): 253–77.

26. Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson-Smith (Oxford: Blackwell, 1991), 38.

27. Ibid.

28. H. Gusterson, *Nuclear Rites: A Weapons Laboratory at the End of the Cold War* (Berkeley and Los Angeles: University of California Press, 1996).

29. Lefebvre, *The Production of Space*, 38.

30. Herbert Muschamp, "A Rare Opportunity for Real Architecture Where It's Needed," *New York Times*, October 22, 2000, Arts and Leisure, 1, 38–39.

31. Lefebvre, *The Production of Space*, 35.

32. Cf. S. J. Rosenlund, *The Chemical Laboratory: Its Design and Operation: A Practical Guide for Planners of Industrial, Medical, or Educational Facilities* (Park Ridge, N.J.: Noyes, 1987).

33. Lefebvre, *The Production of Space*, 42.

34. The names of all subjects are pseudonyms.

35. Gusterson, *Nuclear Rites*.

36. Emily Martin (1992) has made a similar argument concerning the cultural understandings of bodily danger among American doctors in *The Woman in the Body: A Cultural Analysis of Reproduction* (Boston: Beacon, 1992 [2d ed.]).

37. A. R. Radcliffe-Brown, "On Joking Relationships," in *Structure and Function in Primitive Society* (New York: Free Press, 1965).

38. Gusterson, *Nuclear Rites*, 115.

39. Ibid., 117.

40. G. Deleuze, "Un Nouveau Archiviste," *Critique* 274 (March 1970): 195–209 (quote appears on p. 209), quoted from Rob Shields, *Places on the Margin: Alternative Geographies of Modernity* (Routledge, 1991, 30).

41. Michel Foucault, "Governmentality," in *The Foucault Effect: Studies in Governmental Rationality*, ed. Graham Burchell, Colin Gordon, and Peter Miller (Chicago: University of Chicago Press, 1991), 31.

42. Nikolas Rose, *Powers of Freedom: Reframing Political Thought* (Cambridge: Cambridge University Press, 1999).

43. Mariana Valverde, *Diseases of the Will: Alcohol and the Dilemmas of Freedom* (Cambridge: Cambridge University Press, 1998).

44. Rosalind Pollack Petchesky, "Fetal Images: The Power of Visual Culture in the Politics of Reproduction," *Feminist Studies* 13 (1987): 263.

45. Ibid., 287. See Eileen McDonagh (1996) for an elaboration of this construction of pregnancy that turns the interpretation of an adversarial relationship against its more common purpose to privilege the fetus. McDonagh describes pregnancy as an assault, invasion, and habitation of a woman's body by another person. Eileen McDonagh, "From Pro-Choice to Pro-Consent in the Abortion Debate: Reframing Women's Reproductive Rights," in *Studies in Law, Politics, and Society*, edited by Susan S. Silbey and Austin Sarat, vol. 14 (1994), 245–90; McDonagh, *Breaking the Abortion Deadlock: From Choice to Consent* (New York: Oxford University Press, 1996).

46. Rob Shields, *Places on the Margin: Alternative Geographies of Modernity* (New York: Routledge, 1991).

47. Valverde, *Diseases of the Will*.

48. Shields, *Places on the Margin*.

49. F. K. Harre, introduction to *The Natural Landscapes of Canada*, ed. J. B. Bird (Toronto: Wiley, 1972).

50. Lefebvre, *The Production of Space*.

51. Shapin, "House of Experiment."