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SCIENCE AS CULTURE, CULTURES OF SCIENCE

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ABSTRACT

Although controversial, science studies has emerged in the 1990s as a significant culture area within anthropology. Various histories inform the cultural analysis of science, both outside and within anthropology. A shift from the study of gender to the study of science, the influence of postcolonial critiques of the discipline, and the impact of cultural studies are discussed in terms of their influence upon the cultural analysis of science. New ethnographic methods, the question of "ethnosciences" and multiculturalism, and the implosion of informatics and biomedicine all comprise fields of recent scholarship in the anthropology of science. Debates over modernism and postmodernism, globalization and environment, and the status of the natural inform many of these discussions. The work of Escobar, Hess, Haraway, Martin, Rabinow, Rapp, and Strathern are used to highlight new directions within anthropology concerning both cultures of science and science as culture.

INTRODUCTION: SCIENCE STUDIES AND THE SCIENTIFIC "REAL"

In her 1993 presidential address to the American Anthropological Association, Annette Weiner issued a call for a refashioned interdisciplinary engagement with what she described as postmodern culture (156). The anthropology of science, she argued, is prototypic of the approaches anthropologists will need to address in the so-called new world order and to "encompass multiperspecti-

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val points of view, local and transnational sites, the representations of authors and informants, the changing velocities of space and time, the historical conditions in which capitalism is reshaping global power on an unprecedented scale, and the historical conditions of Western theory and practice" (p. 16).

Science studies, she suggested, has the potential to "position the anthropological discipline within the postmodern condition as a subject for study and as a means to rethink the potential and scope of our future studies" (p. 5). Both in terms of the discipline's contribution to the urgent late-twentieth-century conundrum of what knowledge is for and, internally, in the face of debate concerning the maintenance of a four-field approach in American anthropology, Weiner urged her audience to "develop, as some are actively doing now, the kinds of critiques that will embody scientific knowledge with the stuff of lived experiences as people everywhere are faced with growing contradictions about the way they have named and come to know the natural world" (p. 11).

Rightly cautious, Weiner described as naive the hope that practitioners within the discipline of anthropology will readily embrace such a view. Although many would support Weiner's exhortation that biological anthropology graduate students become conversant with the cultural construction of genetic research, and that future cultural anthropologists of science and technology "intensively study biological anthropology," such crossovers are fraught with controversy amid the "science wars" of the mid-1990s. Publications such as Gross & Levitt's *Higher Superstition: The Academic Left and Its Quarrels with Science* (51) express an unrestrained incredulity at the very thought of such interchanges becoming institutionalized within the academy. The idea that critical science studies could be proposed as a means of disciplinary reproduction would no doubt deepen their dismay. That science should be subjected to a form of critical social scientific inquiry challenging the supposed neutrality and transparency of objective scientific inquiry is, in their view, "the manifestation of a certain intellectual debility afflicting the academy." This "leftist" infestation is, in their estimation, matched only in subversiveness by the fact that scholarship of this variety is "being taught—increasingly—in university classes" (51:7, 9). Ill-informed and misleading though Gross & Levitt's account may be of "a startling eagerness to judge and condemn the scientific realm," their intervention underlines the visceral quality of reactions from many scientists to the critique of scientific objectivity. As Wilson puts it, "multiculturalism equals relativism equals no supercollider equals communism" (158).[1]

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[1] The term relativism is somewhat confusing. Like realism, representation, and reflexivity, it is variously defined by different scholars (2, 12, 47, 68, 69, 79–81). An important distinction is also drawn between critical approaches to science and anti-science positions (68, 69, 99).

This review builds on Weiner's argument that anthropology has unique and important insights to offer in the "science wars," for many of the same reasons it had important stakes in the "culture wars" that preceded them. Anthropology is a science and has the tools to understand science as a form of culture. The culture concept has been reshaped by the necessity for anthropology to interrogate its own knowledge practices. This same move enables anthropologists to operationalize analytical models that are understood as both cultural and scientific. Anthropology is, in other words, the preeminent discipline from which to argue that the "science wars" are not a zero-sum game.

From an anthropological vantage point, the fact that an attempt to question a foundational belief system such as science makes its practitioners feel threatened is not difficult to understand. The sense of threat precisely indexes the importance of science as a source of cultural values that are deeply felt. Science is defended so vehemently because it is cultural, not because it is extracultural.

Science studies is part of a wider set of shifts—geopolitical, cultural, economic, and intellectual—that pose a challenge to the status quo of the Western scientific establishment. Critical traditions in the sciences are themselves an excellent example of the kind of topic that science studies scholars have productively investigated. Asking "Why is there no hermeneutics of natural sciences?" Markus (99) provides a compelling answer by describing how the established structures of intertextual communication within the natural sciences produce particular kinds of social practice—including incongruity with other forms of critical exchange, such as those found in the humanities and social sciences. According to his argument, there is no self-critical hermeneutic tradition in the sciences comparable to that taken for granted by other scholars, and misunderstandings predictably ensue. In contrast, several scholars represented in Marcus (see 97), using a more conversational approach to scientists' own accounts of their knowledge practices, show a high degree of self-consciousness of the vicissitudes of intellectual life as a result of its embeddedness in a wider social, cultural, and historical context (35, 52, 97, 113). Such tensions reveal the kinds of conversations that might usefully occur in a climate less marked by defensiveness and mistrust fostered by the higher suspicions of recent science critics (51, 158).

Many of the arguments expressed in the recent "science wars" are reminiscent of Snow's "two cultures" (126), in which he foregrounded the costliness of misapprehension between the sciences and the humanities. As Hess (77:195ff) points out, Snow's characterization of the two cultures is usefully likened to Geertz's contrast between "an experimental science in search of laws" and an "interpretive one in search of meaning" (45:5), formulated in the context of a shift within cultural anthropology toward humanities-based approaches to understanding social life (45, 114). Yet no one has provided the social engineering to bridge the gap more than sporadically in the interim, confirming the tenacity of an opposition Snow described mid-century (see 112a). The two-cultures opposition itself is artifactual of scholarly traditions in the West and much less so of other intellectual histories elsewhere. The distinction is thus indexical of the specific parameters through which Western science is enculturated, or as some have put it even more starkly, how Western science is itself an ethnoscience marked by specific conventions, boundary techniques, and values (68, 69). Stakes remain high in the pursuit of a knowledge of knowledge, the nature of nature, the reality of reality, the origin of origins, the code of codes.

Although a pro- and antiscience division is often drawn between critical science studies, such as the study of science as culture by anthropologists, and so-called real science undertaken by professional scientists, this is one of many divisions, or borders, defining science that are currently breaking down (92, 93, 106). Science studies has its own groupings that divide along the faultlines of "realism" vs "relativism," the view of science as knowledge or practice, the validity of constructivist or objectivist approaches to science, and the question of where science is located (124, 150). Many of the same contentious issues seen to be at stake between critical science studies and mainstream scientific practice are in fact reproduced within science studies—an isomorphism that is often least surprising from an anthropological vantage point, which would see both intellectual traditions as derivative of a shared cultural context. In other words, certain cultural values are equally invisible within both science studies and within science itself. The claim, for example, that empiricism can be unmarked, that is, can provide an evidentiary basis that "speaks for itself," is after all a point of view, and one that may be held by science studies scholars as well as by scientists themselves. Moreover, it is a point of view with a history that establishes a cultural tradition: the tradition of "value-neutrality" or transparency. To distinguish between pure and applied knowledge, between hard and soft sciences invokes not only this value system, but the hierarchical nature of it, thus exemplifying the kind of cultural fact at issue here.

Science studies has grown rapidly since the time of Snow's address (126), and in the mid-1990s exists as a wide and diverse research initiative that is rightly characterized by its critics as comprising an established scholarly field within the academy. Science and technology studies (STS) and science policy research claim a large share of the territory (84), represented within programs at many leading universities including Cornell, Stanford, University of California at San Diego, Carnegie-Mellon, University of Pennsylvania, George Washington University, Washington University, and at equally prominent institutes of technology such as Rensselaer Polytechnic, Virginia Polytechnic, MIT, and Georgia Tech. In addition to STS and policy approaches, many programs include cultural studies approaches to science, most notably the

Center for the Cultural Study of Science and Medicine recently established at UCLA. Although science studies programs as such are comparatively new, they are preceded by long-standing scholarly traditions, notably the history, philosophy, and sociology of science. Pioneering figures in these fields, such as Popper, Lakatos, Kuhn, and Merton, who is widely credited with "inventing" the sociology of science, were, like many science studies scholars today, far from being anti-science. Indeed, they were (in retrospect, somewhat surprisingly) uncritical toward the core concepts of scientific rationality, objective truth, and logical positivism. The experimental method may have been scrutinized for its structure and function, but none of these critics relativized it as a form of inquiry.

The explicit relativization of the scientific enterprise came later, in the form of the Edinburgh school of science studies and the rise of the sociology of scientific knowledge (SSK), a rebel movement of largely British composition that declared itself the home of "radical social constructivism" toward science.[2] At stake was the project to "un-black-box" scientific rationality itself, by providing a sociological account of scientific knowledge that mirrored science in its explanatory capacity.[3] As Collins describes it, SSK promised "a kind of sociological perfection" through discovery of "the fundamental secrets of certainty," which he describes by (celebratory) analogy to "split[ting] these social 'atoms' to create a light of understanding" (16:265). Such descriptions, from scholars who described their project as a radical "relativizing" of scientific rationality, demonstrate instead how closely analogous were their own knowledge practices to those of the scientific community to which they were supposedly opposed.

Science studies critics might also have noted that throughout the heyday of the organized (Marxist) left, in the 1960s and 1970s, historians of science held firm to their convictions in the face of trenchant scholarly argument from radical colleagues, such as Joseph Needham or Robert Young. In the face of cogent argument to the contrary, historians of science continued to argue that, as one prominent representative put it:

> ...to understand the true contemporary significance of some piece of work in science, to explore its antecedents and effects, in other words to recreate critically the true historical situation, for this we must treat science as intellectual history, even experimental science (55, quoted in 163:174).

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[2] SSK and STS are only the most common of a seemingly endless brachiation within science studies, posing a problem for genealogists of SSK (16), STS (75, 79–81, 84), and feminist and cultural studies of science (32, 42, 66, 87, 106, 124, 150).

[3] SSK is claimed to have its roots variously in post-Mertonian sociology, Wittgensteinian philosophy, and Kuhn's paradigm theory (16). Other sociological traditions of science studies have drawn on ethnomethodology and the sociology of organizations (10, 25, 43, 44, 45, 129).

One suspects that critics such as Gross and Levitt would take great consolation from reading Young's introduction to *Darwin's Metaphor*, a collection of his writings compiled after his departure from Cambridge University in frustration at the refusal of his peers to engage with the social and cultural dimensions of science, in which he describes the ominous "silence" surrounding such questions (163:xi). Yet it is equally likely they would benefit from his providing them with a history of their own undertaking—in the form of a critique of critical studies of science (163). Likewise, they might advantageously reflect on Young's and others' contention that debates such as that surrounding the Human Genome Project (5) have a rich and illuminating antecedent, in the clamorous popular upheaval accompanying the advent of Darwinism in Victorian England a century ago. Young argued that such debates might well be understood to concern not only "man's place in nature," but "nature's place in man." The emotional velocity attending matters of social, political, economic, theological, and intellectual concern in that era, he contends, "provides the unifying thread and themes from Malthus to the commodification of the smallest elements in living nature in genetic engineering" (163:xiii).

In the mid-1990s, amid protests by indigenous peoples concerning patent applications on their immortal cell lines,[4] anthropologists are also recollecting shared threads and reconsidering established certainties. As a latecomer to the science studies scene, the anthropology of science has emerged as a forceful culture area, not only challenging the common-sense biologisms that comprise an "invisible" realm of Euro-American certainties but also asking what science is for, including social science. In the midst of redefining the field, fieldwork, culture, knowledge, biology, nature, and information, anthropologists have carved out a niche in science studies that is already transforming that subdiscipline as well as anthropology.[5]

Several trajectories coalesce to produce this momentum. Feminist cultural analyses of gender and kinship inform a significant literature addressing biomedicine, especially new reproductive technologies (8, 11, 29, 39, 70, 95, 102, 104, 115–121, 141, 142). Cross-cultural comparisons of Western science and indigenous knowledge systems shed light on the overlaps and disjunctures between them (3, 48, 49, 69, 79, 83, 108, 154), calling into question the claims of universality that science often makes. Ethnographies of the laboratory contribute to the understanding of cultures of science (25, 53, 88, 94, 113, 144, 149–151), while research on emergent understandings of heredity (29, 67, 71, 72, 110, 111, 113, 117, 118), immunity (64, 72, 100, 103, 105), procreation (39, 41, 46, 95, 104), and brain scanning (26–28) explore science as a popular object. Explorations of scientific culture in a transnational frame illuminate the global, national, regional, and local dimensions of scientific practice (35, 48, 49, 52, 69, 73, 74, 79, 83, 100, 139, 151, 152, 154), while debating modernism, postmodernism, metamodernism, amodernism, nonmodernism, and their discontents (2, 17, 32, 41, 61, 64, 93, 105, 109, 110, 139, 141, 142). Border crossing, annoyingly ubiquitous though it may have become personally, professionally, or otherwise, is overdetermined in the science-as-culture area (23, 24, 63, 93, 149). The site of energetic theorizing, science studies is also home to provocative debates about empiricism.

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[4] Widespread protest accompanied the discovery in 1994 of a patent application filed by US Secretary of Commerce Ron Brown for the "immortalized" cell line of a 26-year-old Guaymi Indian woman from Panama. Following international protest, the claim was withdrawn. The World Council of Indigenous Peoples has subsequently voiced opposition to any attempt to "sample" human genetic diversity, for example, as part of the Human Genome Project, until patent issues are "resolved."

[5] The anthropology of science had its "coming of age" at the 1992 AAA meetings in San Francisco, at which a series of panels on cyborg anthropology and on Haraway's work attracted huge audiences (23). Similar panels were organized in 1993 and 1994, a process of expansion chronicled in the *Newsletter of the Anthropology of Science and Technology*, which serves as a forum for scholarly exchange and information (76, 78, 78a).

ANTHROPOLOGY OF SCIENCE: HISTORICAL ANTECEDENTS

There is a direct relation between the emergence of science studies within anthropology, the reexamination of anthropology as a science resulting from the gender-based critique of the discipline in the 1970s (135, 155), and the expansion in self-consciousness about the thoroughly enculturated generic conventions of the discipline in the 1980s (12, 19, 63, 98, 114, 136–138). Postcolonial critiques of anthropology as a Eurocentric panopticon have extended the possibilities for the discipline to include its own knowledge-production practices within its scope of explanatory techniques (1, 4, 33, 108, 130, 153). Before this intellectual overhaul and retuning, anthropology "black-boxed" its own undertaking with artifactual distinctions such as that between biological and social facts.[6] Hence, for example, the distinction between descriptive and classificatory kinship invokes different orders of knowledge, distinguishing between natural (i.e. biogenetic and universal) and social (local cultural) accounts of relatedness via descent. Debates such as that concerning the "virgin birth" revolve, as Delaney skillfully demonstrates, around the "problem" of whether such beliefs denote ignorance of biological paternity

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[6] Other black boxes include distinctions such as sex vs gender, nature vs culture, race vs ethnicity, or modern vs premodern. In the history of debate about race (67, 67a, 68, 101, 132, 134), gender (133, 138, 155), primitivism (89, 90), civilization (3), and species (18, 63), there is a notable instability around both biologism and evolutionism (57, 58, 59, 163), which are now themselves critiqued as forms of taken-for-granted determinism. The history of any of these ideas is inextricable from the role of science as culture.

(19). This framing of the question, similar to that encountered in medical anthropological debates about "illness beliefs" (47), presumes the self-evident real of the biological and, by implication, the superiority of Western scientific criteria for distinguishing between emic and etic orders of knowledge, which epistemological mechanism grounds anthropology's own disciplinary claims to a social-scientific method of cross-cultural comparison and generalization (114).

At the same time, the presence of such questions within anthropology, and the work of researchers such as Horton, who compared Western scientific rationality to African conceptual systems, has long provided space for a sociology of knowledge within anthropology (83). This tradition, combining anthropological relativism with ethnographic empiricism, has begun to establish a trajectory that interrogates the history and foundations of ideas of the natural within anthropology (136, 141, 161, 162), which in turn work at a deeper level to provide, by implication if not directly, a bridge between the two cultures in anthropology. It is through this work that a less knowledge-dependent, or mentalist, view of science has emerged, along with a greater appreciation of its thorough enculturation at every layer of the onion, and likewise a thicker account of the scientization of both local and global cultures.

FROM GENDER TO SCIENCE

Much of this recent work derives from what could be described as a link, or even shift, from the study of gender and kinship to the study of science, in particular biogenetics.[7] Feminist anthropology was a critical testing ground for biologisms from the mid-1970s onward, and it is no coincidence that many leading feminist scholars are now engaged in the anthropology of science. Strathern, whose theory of culture has emerged more clearly in the 1990s as an anthropology of knowledge practices, exemplifies the gender-to-science shift in *After Nature: English Kinship in the Late-Twentieth Century* (141) and *Reproducing the Future: Anthropology, Kinship and the New Reproductive Technologies* (142). In both publications, Strathern extends Collier & Yanigisako's (14) assertion that gender and kinship studies share common ground in the taken-for-granted status accorded biological "facts" (14, 160). Characteristically lateral to her theoretical confederates, Strathern interrogates the "social and natural facts" concerns of kinship theorists as a cultural fact in their own right, revealing the hybrid character of kinship as a framing device, or "perspectival technos," characteristic of both English and Euro-American knowledge practices more generally. Importantly, this move instantiates a model of culture, described as "established ways of bringing ideas from different domains together" (142:3), through which Strathern pinpoints the cultural specificity of knowledge practices.

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[7] I am indebted to Penny Harvey for this formulation, an insight linked to what Harvey describes as the "receding horizon" effect of gender as a "subject" of study (personal communication).

Because the argument here is instructive to the discussion that follows, some elaboration is helpful. Kinship, in the modern Euro-American sense, is described well by Schneider (125), who argues it is symbolically composed of two orders of facts: relations by nature (blood relatives) and relations by law and marriage (in-laws). Such a formulation, according to Strathern, is a post-Darwinian artifact. She reminds us that Darwin "borrowed" genealogy (not a naturalized concept in the early nineteenth century; rather, in the sense of pedigree or lineage, a means of establishing ties to wealth or social status) to describe life as a system organized through natural selection, a law-like property of all living things and their Creator, in the scientific sense of Origin (18). In turn, Strathern argues, the loan is "read back": Genealogy is naturalized. The "natural" family is born, and with it, the natural relative: a vulgarity to Victorians who saw the family as a moral institution and resisted its depiction as part of nature (15). With the natural family, the natural relative, and the personalization of these depictions, there emerges a specific concept of the natural, one that can "stand for itself" as a domain of immutable, fixed, law-like propensities so that it has become commonsensical to describe the "real" parent as the "biological" one (141, 142).

This model of nature, a recent cultural invention, enabled the distinction between natural facts and social facts, which set the antipodes of a great deal of anthropological theorizing. Until recently, this presumed polarity operated as an invisible structure shaping social and cultural theory. Strathern challenged the validity of the nature-culture opposition in 1980, arguing on the basis of Melanesian materials that such an opposition was a Eurocentric presumption rather than a universal fact (136). More than any other theorist, she has pursued this theme tenaciously, returning to it again in the 1990s to rearticulate the same challenge on the basis of examples closer to home, namely the widely publicized debates concerning parenthood, procreation, and kinship in the context of new reproductive technologies. Such disputes, she argues, highlight the contingency of once taken-for-granted certainties in a domain that previously epitomized their "obviousness," namely the naturalness of biological reproduction (140–143; see also 29, 40, 41, 161, 162).

There are several relevant points from this example. The first is Strathern's contention that such conceptual shifts have cultural consequences, recoverable at the level of social practice. Britain instigated the most lengthy and comprehensive legislative process ever undertaken to adjudicate on matters of assisted procreation and heredity in the wake of these developments. The resulting

Human Fertilisation and Embryology Act, which defines a mother, a father, conception, and fertilization, goes on to codify minutiae of pedigree relating to inheritance of titles, property, and patronyms (40, 142). It is not only the integrity of the birth register that is at stake. The point is what counts as a cultural fact to both parliamentarians and to anthropologists. In this case, it is a matter of "literalization," as Strathern describes it, of cultural certainties that formed a background being made explicit in a context that transforms their significance (i.e. their ability to signify). Once nature is "enterprised up," that is, technologized and commodified, human agency and choice replace its former immutability with a new ground for obviousness (59, 110, 142) in the form of a belief in scientific progress and the logic of consumer demand.

Kinship, in this view, becomes a hybrid: a means by which certain a priori (natural) facts established a realm of the social, as what comes "after" natural facts. A concern with hybridity as a cultural "domaining" technique also characterizes the work of Haraway, indisputably a major force in shaping the anthropology of science as well as science studies generally. Like Strathern, Haraway is deeply concerned with the operations of the natural as a domain of foundational cultural practice. From a different route, Haraway also arrives at the hallowed anthropological ground of kinship theory in her recent work on the new genetics and genetic patenting, in which she describes the entry of the brand as a demarcation of kind or type, and in this sense a kinship technos (67). Trained in developmental biology and the history of science, Haraway's first publication (56) concerned the aesthetics of morphogenesis in early twentieth-century embryological research. Noting the paradigmatic importance of formal considerations in the triumph of organicism out of the long-standing debate between mechanism and vitalism, Haraway drew attention to the means by which the search for the "organizer" of embryonic development was itself (culturally) organized by visual, artistic, formal, aesthetic, and narrative forms.

Later engaged by the other paramount origin science, primatology, Haraway steadily widened her early concern with systematicity, the part and the whole, the organism-machine interface, and the science-culture matrix. In the 1980s, Haraway completed an exhaustive chronicle of primatology (63) and, through essays published in the interim (57–62, 64), radically redefined what is meant by science. For Haraway, science is culture in an unprecedented sense. From advertising to multinationals to lineages of professional patronage, science is irrevocably bound up in a wider cultural milieu, and likewise, no one in late-twentieth century technoscientific culture is immune to its interpolations.

Both Haraway and Strathern exemplify a cultural hermenetics of knowledge practices that foregrounds the constitutive role of metaphor, analogy, classification, narrative and genealogy in the production of natural facts.[8] Both also expand greatly what it is to "know," such that knowing is inseparable from being, imagining, or desiring. In an era in which genetic algorithms are themselves described as alive, the isomorphism between representation and ontology that they describe is readily confirmed in the most technical of scientific undertakings (96). As Moore notes, "science is both knowledge of the natural world expressed in naturalistic terms and the procedures for obtaining that knowledge" (107:502). This conflation of instrumental technique with the "real" it describes summarizes both the usefulness and the appeal of assessing science as a system of representation; at the same time it does not challenge science as a "way of knowing" (107). Richard Dawkins's recent claim, "Show me a relativist at 30,000 feet and I'll show you a hypocrite,"[9] is usefully revised by this approach: "Show me a person who denies that airplane design is a highly organized human social activity and I'll show you an unreconstructed objectivist." The very logic that equates "I can fly" with "science must be an unassailable form of truth" and furthermore assumes such an equation to be self-evident, all but demands cultural explication.[10]

FROM ETHNOGRAPHIES OF THE LAB TO MULTISITED ETHNOGRAPHY[11]

In the same way that Haraway and Strathern have not only redefined the possibility of studying science as culture, through innovative empirical studies that exemplify its cultural effects, other scholars have undertaken ethnographies of the laboratory that illuminate the culture of science. Traweek's pioneering ethnography of US and Japanese physicists (148) powerfully inaugurated yet another influential approach to the anthropology of science. Building on a Geertzian model of "local worlds" and anticipating the work of Latour,[12] Traweek investigates the workplaces of science-in-the-making in dialogue with the most recognizable form of anthropological ethnography. Defining culture as "local strategies of making sense" (148:ix), Traweek contrasts "beam-times" (amount of access to the particle accelerator) with "lifetimes" (the careers of individual physicists) to depict the culture of high-energy physicists as a way of life defined by shared goals, understandings, codes of conduct, definitions of time and space, and consequently of identity and self-making.

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[8] The focus on the constitutive role of metaphor, analogy, and narrative in the formation of scientific or natural facts annexes the anthropology of science to both cultural studies and cultural history. The classic work of philosopher Mary Hesse helped inaugurate this field in the late 1960s (82), from which the move to examine science as a language of nature emerges, paralleled by work on science and literature (85) and by cultural studies of science such as Haraway's, whose early work drew on Hesse's account of the role of metaphor (56). The journals *Science as Culture* and *Configurations* both publish work in these areas. In addition, the analysis of science in terms of visual culture contributes to this approach (7, 38 ,46,

[9] Dawkins' claim appeared as part of a heated debate on the pages of the *Times Higher Educational Supplement* in Britain, where, as in the United States, scientists have recently expressed outrage, imagining themselves as "monkeys in a zoo," before inquiring sociologists (*THES* 30 Sept. 1994,

[10] In referring to these debates in her acceptance speech for the Ludwig Fleck prize from the Society for the Social Study of Science, Mary Douglas disassociates the use of classification systems from questions of their truth correspondence, asking of the scientists, Why are they so defensive? (personal communication).

[11] For a review of multisited ethnography, see Marcus, this volume.

A difficulty for such studies, to which Traweek was presciently attentive, is the embeddedness of local scientific cultures in transnational associations and wider cultural meanings.[13] Anthropologists developing multisited approaches to the ethnography of science have been responsive to such concerns, investigating the multiple contexts in which technoscientific artifacts make sense in a kind of cultural hyperstack.[14] Martin, for example, tracks the discourse of the immune system in her recent ethnography of corporeality in a corporate age (105). Like Strathern, Martin seeks to understand the cultural effects produced by the loss of certain signifiers of the "natural" body. In her work on AIDS patients, corporate training programs, and lay understandings of immunity, Martin offers a portrait of the immune system as a popular concept that travels across borders, thus also offering an argument for a refashioned ethnographic engagement with (science as) culture.

In a similar vein, Rapp, in her ethnographic study of genetic screening clinics in New York City, demonstrates how multi-sited a very local dialogue can be (115–121). Chronicling the serial contexts in which highly technical and often highly charged information about chromosomes and genes makes sense in different settings and to different actors, Rapp, like Martin and Strathern, has been challenged to devise new anthropological models of culture, knowledge, ethnography, and fieldwork.

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[12] Latour's witty reprise on science-in-action, or science-in-the-making, offers a "sociologics" of scientific knowledge practices that enrolls instruments, measurement techniques, and established facts as actors or, more precisely, actants, to relocate the agency productive of the scientific "real" as a network of interconnected observers and observational devices that solidify scientific authority (92). Latour's work is influential within science studies generally, though less so within anthropology.

[13] It is interesting to note the singularity of Traweek's intervention. Not trained in a department of anthropology, though trained largely by anthropologists, Traweek sought to offset the unfamiliarity of a new anthropological field (the scientific laboratory) by reproducing familiar generic conventions in the production of a highly recognizable ethnographic monograph. It was precisely in the period the book was being written that these conventions were subjected to the critique and overhaul outlined above to produce a more reflexive anthropology. Thus, it could be said that Traweek's work instantiated the ethnography of science in the very same period that ethnography-as-science began to be dismantled. It stands as an unparalleled transitional monograph at an overdetermined junction pointing the way both to the anthropology of science and to the redefinition of ethnography.

[14] Since Traweck's original study, anthropologists of science have not focused on the lab as an internal culture to the same extent, nor has Traweek in her later work. Instead, as Traweek herself anticipates, it is the extent of crossing-over between the culture of the lab and the culture of which this culture is a part that has attracted the attention of anthropologists and, in increasing numbers, anthropology graduate students.

In the context of prenatal screening, ideas of the natural in procreation and heredity are represented as informational. In clinical settings, diagnoses of the chromosomal status of the fetus are provided as the grounds for decision-making, not on the basis of knowledge (of which decision-makers usually have little, clinically, morally, or experientially) but in terms of information (e.g. there is a positive diagnosis of X). Whereas common diagnoses such as Down's syndrome intersect widespread cultural knowledge and established medical certainty, some genetic diagnoses comprise nearly meaningless data (e.g. a gene sequence on chromosome 13 is abnormal, but its significance is unknown at present). Genetic counseling thus comprises a burgeoning translation industry, seeking to ameliorate the gap between information and knowledge.

This gap is examined elsewhere in terms of its meaningfulness (or lack thereof) on the information highway of virtual cultural space-time and in computer applications (30, 31, 36, 37, 50, 54). Virtual culture presupposes both visual culture and global culture within the new environments inhabited by users of the Internet, computer games, virtual communities, and the world-wide web. The challenge for ethnographers in these settings is representational in its thickest sense. One dilemma for ethnographers is how to represent themselves, for example, by assuming a character or several personae on-line and in interaction with other users. Ethnographic, theoretical, and textual representations of their analytic forays pose other challenges. As-yet unpublished work in this field suggests again the potential for science studies in anthropology to contribute to ongoing redefinition of the culture concept, as well as fieldwork, participant observation, and ethnographic writing.[15]

Escobar introduces the term technoscapes to ask what new forms of reality are introduced by new technology, how they are made sense of, and how they are culturally negotiated (32). Asking how cyberculture can be studied ethnographically, Escobar argues "the point of departure of this inquiry is the belief that any technology represents a cultural invention, in the sense that it brings forth a world; it emerges out of particular cultural conditions and in turn helps to create new ones" (32:211). This task is admirably undertaken in a recent volume by Hess (79) and in one edited by Marcus (97), which explore science as a multicultural field. Introducing the term technotomism, Hess outlines an approach to integrating the analysis of scientific culture with the established ways of being, seeing, and doing in diverse national traditions. This approach locates scientific objects, practices, and theories within a comparative cultural frame. Similarly, Marcus presents a collection of essays chronicling changes in international scientific culture resonant with the volatile geopolitical transformations of the post–Cold War era. Introducing scientists-in-conversation, the Marcus volume explores autobiography, open-ended interviews, and dialogue as a means of widening the range of approaches to understanding science as a situated practice.

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[15] The implosion of informatics and biologics is also the scene of an implosion of anthropology and cultural studies. Indeed, much of the anthropology of science points toward a hybrid disciplinarity or even a postdisciplinarity, such as that opened up by the fields of cultural studies, postcolonial theory, feminist and gender studies. In some senses, the anthropology of science is a misnomer, standing as it does at the conjuncture of cultural anthropology, cultural studies, and critical theory.

From a different angle, other science studies scholars have examined public skepticism toward science, counterposing the view from within science against those of audiences or communities excluded from it. Toumey explores the work of creationists, documenting the divergent traditions of historical narrative belonging to fundamentalist and secular accounts of human origins (146, 147). For Downey, whose research addresses public perceptions of scientists and engineers (21), the question becomes one of divergent systems of cultural reference in the quest for authoritative knowledge.[16] A related question arises for Marglin, in the historical investigation of the eradication of indigenous systems of variolation in India by vaccination campaigns modeled on so-called superior Western scientific precepts, a case study in the unnecessarily hegemonic and totalizing assumption that West is best (because it works better) (100). Science as the site of conflicting worldviews is also described by Hess, in evaluating the operation of truth-falsity polarities at work in the assessment of the paranormal, such as that offered in spiritualist, New Age, and pagan movements (77). In these approaches, the grounds for skepticism toward science are investigated as a means of interrogating the putative distinctiveness of the scientific enterprise.

Recent accounts of science studies addressed to anthropologists have emphasized important threads linking the study of cultures of science and science as culture (22, 23, 32, 63, 75, 80, 81, 97, 106, 150). Describing the increasing overlap between internal and external accounts of science-in-action, Martin (106) distinguishes between the citadel and the rhizome to map different approaches developed by anthropologists to study science (106). The model of the citadel draws on the Geertzian image of the old city to describe local cultures as they are lived, made real, and made sense of by their occupants. Traweek has famously described the scientific conception of their "city" as a "culture of no culture" (148:162), emphasizing the importance of a self-consciously value-free approach to nature as a law-like cipher. Whereas Traweek largely preserves the walls of the citadel, seeking to understand its self-perceived isolation from the external world as itself a cultural value, others have ventured outside the walls or, as Martin puts it, have approached the citadel as "porous and open in every direction" (106:7–8).

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[16] Taking its cue from early work by scholars such as Mary Douglas in the 1960s, and more recently from the work of Ulrich Beck, risk perception has become an important wing of science studies (2, 20, 21,159), as is the case for related debates about science and multiculturalism (13, 34, 69, 79, 91).

Science in public discourse, especially where it attends to health and public hygiene, evokes for Rabinow a shift from sociobiology, the social project of reengineering society on scientific principles (i.e. culture modeled on nature), to biosociality, a culturalization of the natural, in which it becomes artificial, and is remade as technique. This in turn suggests to Rabinow a "dissolution of the social," in which its former characterization as whole ways of life or, as in social science, as a domain (e.g. "the social") is replaced by biosociality, a term that describes a refounding of sociality through a remaking of nature-as-culture. The primary figure in Rabinow's account is the Human Genome Project, self-declaredly an attempt to rewrite the "book of man," to profer a "second genesis" by reproducing heredity and evolution as artificial technique rather than as natural fact (109–113).

MODERNITY AND POSTMODERNITY

Rabinow's portrayal follows the Foucauldian invitation to understand scientific knowledge as a key force reshaping life, labor, and language, not only in terms of how they are named, classified, or worked, but in terms of understanding such operations as power effects.[17] Hence, the renaming of life as a language, and its subjection to the scientific labor of decoding, with a view to changing it, cannot be seen as separate from the intensification of power-as-knowledge through such practices, inevitably implying concomitant changes in cultural practice, from self-making to capital accumulation strategies. Rabinow's is a broad thesis, invoking debates about modernity and postmodernity, as well as debate about risk, globalization, and new technologies.

Modernity is also at issue for Escobar, who summarizes the philosophical view that

> With modernity, organic and mechanical models of physical and social life gave way to models centered on the production and maximization of life itself,

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[17] In drawing on this Foucauldian formulation, Rabinow establishes an important link between the cultural analysis of contemporary biosciences and the conceptual history of the life sciences in France, in particular the work of Canguilhem (6, 112). This tradition has no Anglo-American counterpart.

> including the coupling of the body and machines in new ways, in factories, schools, hospitals and family homes. There began an intimate imbrication of processes of capital and knowledge for the simultaneous production of value and life (112:213).

Various terms similar to Rabinow's biosociality have been coined to describe the social and cultural consequences of technological developments, including Escobar's cyberculture or technoscapes. Implied by such terms is the notion of implosion of orders of meaning: nature vs culture, bodies vs machines, informatics vs biologics, technology vs sociality. The apocalyptic tone of such commentary is compelling to some and worrisome to others, who sense the familiar presence of a characteristically Euro-American (or modernist) oversensationalization of novelty and crisis. It is an ever-present danger in the science-as-culture field that a tendency toward hype attends closely on the heels of wonderment in the grip of the "gee whiz" factor and of anxiety in the face of rapid technological change. As Strathern cautions, the very idea of a natural relative is a hybrid, imploded, cyborg concept, and it is a Victorian invention, not a postmodern one.

All the same, the science question in anthropology is annexed closely to a host of scholarly undertakings to examine what might be described as the postnature question, which is closely allied to the debates on globalization and postmodernism (17, 65, 109, 110, 122, 123, 141, 157, 162). New and different or established and familiar are two sides of the same contextualizing process through which Euro-American knowledge practices, be they commonsensical or scientific, make sense of their objects. Whether we are post-nature or postmodern, or whether there is a greater, shared cultural consciousness that we appear to be, the cultural method remains the same. The steady production of recent scholarly reassessment of the status of "the natural" indicates, in the way of a cultural fact in itself, that its apparent contingency and vulnerability comprise a consequential shift in both knowledge of nature and the nature of knowledge.

Such shifts appear to command a great deal more attention outside of the scientific community than they do within it. Yet the gap this seems to suggest may be the consequence of defensiveness within the scientific community at, in their view, having become like laboratory mice subjected to scrutiny from above. At the level of basic analogies, language is increasingly the model for genes, understood also in terms of maps, codes, information systems, and switches. Chaos theory, autopoeisis, network and systems theory, and many other hermeneutical models in the humanities and social sciences derive from science. Such cultural objects (models) are already border-crossers, perhaps blazing new trails for their user communities. The rhizome, like the tree, unites the genealogical methods of Foucault, Deleuze, and Guattari with those of Rivers, Darwin, and many scientists practicing today.

CONCLUSION

One of the most important concerns facing anthropologists of science is how to enable their work to speak to the broadest audience of scientists, social scientists, and other scholars. It remains unclear what language is needed for this to occur. Many scientists remain unconvinced that scholars with no specialized expertise in their particular branch of highly specialized research can contribute usefully to understanding scientific problems, and they suspect that such studies are most usefully aimed instead at identifying sources of public misapprehension of scientific enterprises. Belief in the value of scientific progress, the nature of scientific truth, the necessity of scientific detachment and the existence of an external, law-like reality to which science devotes its techniques are equally adamantly viewed by many science scholars as cultural and historical artifacts of instrumental reason. To commentators from within the scientific community, such as Gross and Levitt, such a view is nonsensical and dangerous. Terms such as relativism, constructivism, and perspectivism are as inaccurate and misleading to describe approaches developed within science studies as is the notion that their activities are more than superficially cultural to many scientists. The epithet antiscience, often equated with critical science studies, raises the issue of whether scientists feel that the only valid critical tradition they will accept is an internalist form of criticism dedicated to improving results; producing more accurate knowledge; expunging impurities from the pursuit of facts; or preventing abuses, biases and other misdemeanors. Such a view preserves the core of scientific realism and the "culture of no culture" view, which denies the effects of representational techniques or the cultural values that inform them.

Anthropology is uniquely positioned to attest to the value of a multiperspectival science, which situates itself as partial in the representation of its objects. This position can be envisioned as the strong objectivity advocated by some, as the more open-ended hermeneutics espoused by others, or by both and other voices in the maintenance of an anthropological tradition characterized by ongoing internal dispute. Insofar as critical science studies position knowledge, disciplinarity, empiricism, and rationality as local culture-in-the-making, there is certain to be an ongoing crisis as to whether it is hermeneutics all the way down.

At issue in debates about multiculturalism and science is the possibility of better science, not just fewer supercolliders. Anthropology is arguably a better, more inclusive, less naively Eurocentric and even a more objective form of scholarly inquiry because of the sustained critique of its own practices that has kept it "in crisis" since at least mid-century. Were Western science to be reassessed as a cultural practice, in the narrowest and widest senses, it arguably stands to gain, in both resources and on its own terms, as an effective, predictive, useful and interested account of its objects. And were such changes to be undertaken, anthropologists are well positioned to draw on a recent history of great transformation in their own discipline and to attest to its advantages.

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