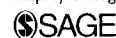




Journal of Health and Social Behavior
51(S) S120–S132
© American Sociological Association 2010
DOI: 10.1177/0022146510383493
<http://jhsb.sagepub.com>



Medical Sociology and Technology: Critical Engagements

Monica J. Casper¹ and Daniel R. Morrison²

Abstract

In this selective review of the literature on medical sociology's engagement with technology, we outline the concurrent developments of the American Sociological Association section on medicine and advances in medical treatment. We then describe theoretical and epistemological issues with scholars' treatment of technology in medicine. Using symbolic interactionist concepts, as well as work from the interdisciplinary field of science and technology studies, we review and synthesize critical connections in and across sociology's intellectual relationship with medical technology. Next, we discuss key findings in these literatures, noting a shift from a focus on the effects of technology on practice to a reconfiguration of human bodies. We also look toward the future, focusing on connections between technoscientific identities and embodied health movements. Finally, we call for greater engagement by medical sociologists in studying medical technology and the process of policy-making—two areas central to debates in health economics and public policy.

Keywords

medical practice, bodies, epistemology, feminist science and technology studies, symbolic interactionism, biopolitics, embodied health movements

The Medical Sociology Section of the American Sociological Association was founded in 1959, at the turn of a decade that had witnessed tremendous advances in medical technology. Cardiopulmonary resuscitation was innovated, and the first pacemaker was developed. Penicillin was chemically synthesized in the 1940s, ushering in an era of mass production of antibiotics. Salk fashioned a polio vaccine in 1952, and by 1955 it was being distributed to American schoolchildren (Oshinsky 2005). The first kidney transplants were performed, and dialysis was innovated to treat kidney failure. Heart transplants followed. Scientists researched the birth control pill in a shifting context of sexual politics, successfully but under ethically dubious conditions (Briggs 2002). The price of hospital care doubled in the 1950s, and national health expenditures grew to 4.5 percent of the gross national product (GNP) (Starr 1982). Health insurance companies began to spread across the

United States, inaugurating employer-based benefits, and limited private coverage for people who could afford it (Murray 2007; Quadagno 2006).

In 2009, 50 years later, health care accounted for 16 percent of the gross domestic product (GDP), the highest ratio among industrialized nations (Robert Wood Johnson Foundation 2009). And according to the American Public Health Association, approximately 47 million Americans (many employed at least part-time) were uninsured. The new millennium brought expanded use of genetic

¹Arizona State University

²Vanderbilt University

Corresponding Author:

Monica J. Casper, New College of Interdisciplinary Arts and Sciences, Arizona State University, P.O. Box 3710, Phoenix, AZ 85069–7100
E-mail: Monica.Casper@asu.edu

technologies, growth in nanotechnology, diffusion of knowledge produced by the Human Genome Project (HGP), a booming transnational pharmaceutical industry, new reproductive technologies, standardization of care, and escalating visualization and digitalization of medicine. The twenty-first century ushered in biomedicalization across sectors (Clarke et al. 2003, 2010), new health movements (e.g., Brown et al. 2004; Brown 2007; Epstein 1996, 2008; Klawiter 2004, 2008), and translational research (the practical application of scientific research) (Wainwright et al. 2006)—alongside ongoing contention about U.S. health care. The 2008 election of President Obama, whose campaign platform emphasized health reform, deepened public debates.

Across the half-century lifespan of the Medical Sociology Section, during which sweeping changes have impacted American society as a whole, technologies have changed dramatically, too, from large “machines at the bedside” to tiny pills and devices that enter into and transform human bodies, and information technologies that have altered if not restructured health care provision. These have been central to health care practices and financing (or lack thereof), politics of reform, health outcomes, and scholarship. Medical sociologists have investigated both the category of technology writ large and specific drugs, devices, digital innovations, and technical practices such as neonatal intensive care (e.g., Anspach 1993; Zetka 2003). Many scholars explore the essential “nature” of technology; contestation surrounds the term and its application to specific devices, techniques, and practices (Nye 2006).

The substantive and theoretical questions medical sociologists have pursued are as complex and capacious as the shifting technological landscape itself—far too extensive to fully document here. In offering a half-century “snapshot” of research on biomedical technology, we briefly profile three major foci: how technologies have reshaped medical practices; how technologies have reconfigured human bodies and our conceptions of them; and how technologies have been crucial to the emergence of new health social movements. While there has been major work on medical technologies, until the turn of this century sociologists did not attend thoroughly to technical aspects of medical practice. Only within a theoretical paradigm in which technology was considered peripheral could we get an account of the social transformation of American medicine that little discusses the role of key technologies (much less science) in professionalization (Starr 1982).

THEORETICAL DEVELOPMENTS

Part of our charge for this issue of *JHSB*, and the ASA session from which it originated in 2009, was to articulate our key findings about technology. Yet *what* we know is inextricably bound up with *how* we know. Technologies have varied across 50 years; so, too, have theories, concepts, and methods for understanding them. Thus, we cannot discuss shifts in our knowledge about technologies without chronicling the myriad ways in which scholars have approached the topic. These epistemological developments have contributed to our collective knowledge about technology, advancing medical sociology while also broadening its connections to other scholarly areas. Concepts such as medicalization and biomedicalization and a range of perspectives (e.g., symbolic interactionist, feminist, constructionist, and social movement approaches) have significantly reconfigured what “technology” means, under what conditions, and for whom.

In the mid-twentieth century and beyond, nascent sociologists of health and medicine were interested in the impact of particular technologies, as medical professionals used them “at the bedside” (Reiser and Anbar 1984). These technologies, often framed as external to meatier intellectual topics, were studied to understand the social order of medical work and the people who engaged in it as practitioners and patients. The focus was not on technology per se, but rather on the practices altered by introduction of new devices. Theoretically, the goal was to elucidate the contours of biomedicine itself, and not necessarily the tools of the trade or their unique, varied technical histories (e.g., Strauss et al. 1985).

Medical technologies have long been criticized as one form of medicalization (Zola 1972), a potentially dehumanizing process that restricts the autonomy of both experts and nonexperts as they confront pain, suffering, and death. Illich (1975) claimed that interventions intended to make sick people well in fact made sick people sicker, turning progress into pathogenesis. Technologies designed to alleviate symptoms of disease, according to this view, prolong suffering needlessly, and at exorbitant cost. Illich’s concern with iatrogenic diseases, medicalization, and the high costs and profits of pharmaceuticals and medical devices remain with us, and they constitute a subtext of contemporary debates about health care. Other scholars of the political economy of health care extended these debates (McKinlay 1984; Navarro 1986). Medical machinery now monitors fetuses

during delivery, while magnetic resonance imaging (MRI) maps our brains—each technology one step in the process of defining (or divining) the normal and the pathological (Canguilhem 1991; Foucault 1994, 2008).

Further developments, such as more complicated understandings of medicalization and stratification, were spurred by women's health movements of the 1970s (Lorber and Moore 2002). Feminist scholarship has both celebrated and critiqued the medical profession and its practices and technologies (Clarke and Olesen 1999; Ruzek, Olesen, and Clarke 1997). These studies underscored power relations embedded in medical technologies, and their differential impact on women relative to men. Indeed, research on women's health has long emphasized that health care is stratified (Ginsburg and Rapp 1995), as are medicalization experiences (Bell 1995, 2009; Riessman 1983). Some women (usually white, middle-class women) receive too much care and unnecessary interventions while many other women (especially poor women and women of color) receive too little. This chronic tension has provided diverse perspectives on, and varying levels of appreciation for, women's health care.

Symbolic interactionists, rooted in pragmatism and the Chicago School, created an early and vital home within the sociology of medicine. These contributions have focused, in part, on social interactions within medicine (e.g., hospitals, clinics, nursing homes) as forms of work (Strauss et al. 1985). This approach led to surprising findings about ways in which doctors, nurses, and other health professionals make the work of others easier, for example smoothing out ruffled emotions or preparing families for bad news (Star and Strauss 1999; Strauss 1988). Symbolic interactionists also analyzed medical practices in terms that highlight processes instead of outcomes. From Glaser and Strauss's (1965) early work on dying, to Charmaz's (1991) portrait of chronic illness, to Timmermans's (1999) study of cardiopulmonary resuscitation (CPR), symbolic interactionists have documented and theorized medical work, technologies, and care, refreshing such stalwart sociological concepts as trajectory.

Strauss and colleagues analyzed uses of machines for diagnosis and treatment, including laboratory tests, mobile x-ray machines, and heart rate monitors, as well as the growing army of technicians who do the "articulation work" between human patients and medical technologies (Strauss et al. 1985; Wiener et al. 1997). Chronic illness,

they found, led to a growing reliance on medical technologies for monitoring and maintaining health. The major thrust of this research investigated the role of technology in changing practices. How, for example, did doctors, nurses, and patients respond to new technologies? How did technologies affect patients' illness experiences? What was the relationship between technologies and new systems of professional knowledge? How did technology impact conceptions of the patient and his or her illness? These questions continue to drive sociological research on health care technologies (Conrad and Gabe 1999; Franklin 2007).

Working at the intersection of medical sociology and science and technology studies, scholars developed other concepts (Clarke and Star 2007). For example, Star and Griesemer (1989) theorized boundary objects, or those objects (such as fetuses, genes, and brains) whose meanings are common and flexible enough to be intelligible across social arenas, but distinct and obdurate enough to carry specific localized meanings. Cultural and material characteristics of these objects, both within and across social arenas, make shared understandings, collaboration, and work itself possible. For example, Williams et al. (2008) show how human embryos as boundary objects link the biomedical worlds of embryonic stem cells and pre-implantation genetic diagnosis. Similarly, Fujimura's (1988, 1996) notion of "bandwagons" in clinical research made possible new understandings of the theory and method packages that clinicians and scientists use in advancing their work. And Clarke and Fujimura's (1992) theoretical elaboration of "the right tools for the job" offered new material, symbolic, and institutional parameters for locating technologies in practice. This body of work allowed scholars to see how previously invisible technologies *work* in the practical accomplishment of science.

Scholars have also generated new ideas about classification as an organizing concept for scientific and biomedical practice, and they also have shown how classification systems are themselves technologies. By unpacking the processes by which classification systems are created and sustained, Bowker and Star (2000) demonstrate the social and political impulses that animate these. Their work also illustrates the ways in which messy, complex practices are conceptually narrowed in order to "fit" within existing knowledge systems. These classification systems as technologies are crucial for organizing knowledge and practice. For example, proposed revisions to the

Diagnostic and Statistical Manual of Mental Disorders (DSM) would remove Asperger's Syndrome, placing it under the more general "autism spectrum disorders" (ASD). Such changes have real consequences for patients, who often define themselves as distinct from people with autism (Grinker 2010; Tanner 2010).

Timmermans and Berg (2003) critique evidence-based medicine as a type of technology that provides (or claims to provide) "gold standard" care. Similar classification practices occur for large-scale projects, such as the "International Classification of Diseases," "Nursing Interventions Classification" (Bowker and Star 2000), and the DSM (Horwitz 2002). Clarke and Casper (1996; see also Casper and Clarke 1998) focus on practices of reading and classifying pap smears. Simple diagnostic practices allow many tests to be analyzed per day, while at the same time rendering classification more difficult for lab technicians who meticulously examine specimens and slides. Classification schemes thus attempt to make sense of nebulous biological material (Keating and Cambrosio 2002, 2003).

Clarke and colleagues (2003, 2010) reformulated a central concept in medical sociology—medicalization—that was not routinely associated with technology, turning our attention toward contemporary, cutting-edge forms of "biomedicalization." This term encompasses both old and new practices, such as genome-wide association studies, nanoscale medicine that upends common sense distinctions between organic and inorganic matter, and devices made to alter electrical signals within the brain. To some degree, biomedicalization brings us full-circle to earlier notions of medicalization (Zola 1972; Conrad 2005, 2007), but the concept is updated and expanded theoretically for the twenty-first century. Biomedicalization is inflected with characteristic symbolic interactionist and science and technology studies attention to (1) processes and knowledge, (2) an interweaving of medicine with science, (3) recognition of vertical and horizontal integration of health care markets and biocapital, (4) introduction of nascent technologies and reinventions of the old, and (5) new organotechnical configurations of human bodies (Cooper 2008).

Finally, medical sociologists have taken up Foucauldian concepts, including biopolitics, to theorize individual health in relation to governmentality and governance (Armstrong 1995; Cooper 2008; Waldby 1996, 2000). Others have utilized Foucault's notion of biopower to underscore the productive capacities of human bodies

(Hatch 2009; Waldby and Mitchell 2006). While Foucault's work has been highly influential, he did not address the specific role of technologies (e.g., tests, prosthetics, drugs) in and on biopolitical processes. Rather, he focused on knowledge as a kind of social apparatus or technology that shaped systems of governance and attempted control over life. He described other social technologies, such as the panopticon, a prison system designed such that one guard could survey all prisoners without himself being seen (Foucault 1995). This form of governance, with its imagined (or real) surveillance, ultimately affected notions of human health and well-being. More recent Foucauldian work considers twenty-first century technologies in relation to new discursive and institutional formations, and the consequences of these for human bodies and lives (Casper and Moore 2009; Lakoff 2005; Talley 2008).

In sum, in mid-twentieth century theoretical paradigms, technologies were often black-boxed. That is, the object of analysis was not technology per se, but rather practices surrounding the technology and people who both used it and on whom it was used. Political, economic, and early feminist perspectives recognized the intensely political valence of technologies, yet these perspectives saw technology as fairly static. Technologies were conceptualized as inert, ahistorical objects, uninteresting in and of themselves but with a dynamic capacity to reshape social practices and reorganize human bodies. Symbolic interactionist, feminist, and science and technology studies approaches, while highlighting practices, began to focus on technologies themselves. Previously black-boxed medical technologies were dissected and their historical, cultural, and political innards examined. In newer approaches, there is vivid and sustained recognition that technologies, health care practices, bodies, and identities are continually and mutually shaped, with innumerable consequences for human lives.

KEY FINDINGS

Impact of Technologies in and on Practice

Over the past 20 years, a major shift has occurred in the organization and goals of medicine, in which technical innovations have reshaped the contours of practice (Clarke et al. 2003, 2010). Medical sociologists have engaged with technology, using a "technology in practice" perspective, akin to the "science in practice" perspectives utilized by science and

technology scholars (Pickering 1992). They have shown how professionals, patients, and others interact with and through medical technologies (and with each other via technologies) while also showing how new and old technologies influence health care practices and other aspects of social life. Through these interactions, new meanings and categories—of patienthood, humanity, disease, risk, and health—are forged. These shifts mark a move from enhanced control over external nature to the harnessing and transformation of internal nature, often rebuilding life itself (Franklin 2000; Rose 2007), along with its fundamental properties.

Thompson (2005), for example, shows how women undergoing in vitro fertilization mobilize different forms of argument, reflection, and dialogue to account for success or failure. Instead of lacking agency, we see agency made operative through objectification. This “ontological choreography,” as Thompson (2005) termed it, describes the development of actions and ideas that link persons with (and through) reproductive technologies in domains of practice. Dumit (2003), by contrast, shows how positron emission tomography (PET) brain imaging technologies are used to bolster professional accounts of “knowing” human types or persons, tracking the technology from development to implementation to cultural impact. These studies are exemplary in their descriptions and analyses of people and medical technologies interacting.

The history of ultrasound is also revealing. Ultrasound was developed for detecting icebergs after the sinking of the Titanic, expanded into naval warfare during World War I, and later used in manufacturing of metals (Yoxen 1987). Early twentieth century practitioners believed ultrasound could destroy tumors, and subsequent use grew exponentially between the 1930s and 1950s. Visual mapping of the body was infinitely more appealing as the hazards of x-rays became known (Caufield 1989). In the 1970s, ultrasound was central to the emerging field of fetal medicine as clinicians attempted to locate the “unborn” patient, thus advancing the field and playing a key role in the evolution of fetal surgery (Blizzard 2007; Casper 1998). Critics debate benefits vis-à-vis measurable risks, yet ultrasound has become a normal, even highly anticipated part of prenatal care in the United States, offering pregnant women their first “baby” snapshots to hang on the refrigerator (Taylor 2000). Ultrasound has significantly transformed medical practice, creating new forms of work (e.g., increasing the need for sonographers)

across the past half-century; making possible new cultural meanings of fetuses, pregnancy, personhood, life, and patienthood; and altering public and private perceptions of what “good” mothers should do (e.g., abstain from alcohol, certain recreational activities, and sex) (Burri and Dumit 2008; Casper 1998; Oakley 1984; Taylor 2008).

In the new millennium, other technologies have become part of medical practice, transforming routine procedures, shifting contexts of care, and generating new meanings of expertise. For example, health care systems have increasingly relied on the Internet to connect patients and doctors across long (and even short) distances. Hospitals of all sizes and resource levels use electronic medical records to store patient information and log medical records, prognoses, and outcomes. These records have multiple uses beyond simple record-keeping. For example, genome-wide association studies integrate genetic information from patients with de-identified medical records in a search for correlations between certain genetic profiles and disease (Roden et al. 2008). Biobanking—the establishment of repositories of human biological material—is also changing medical practice, providing new forms of bio-data for clinical research and practice (Gottweis and Petersen 2008). Research on attitudes toward DNA biobanking found widespread support among a sample of patients (Pulley et al. 2008).

Such examples of technoscientific developments — from MRI (Joyce 2008) to personalized medicine (Hedgecoe 2004) — can be seen across health care delivery and research infrastructures. Of course, as with women’s health care described above, these “advances” are stratified in their application: Elites everywhere receive “too much” boutique care, while impoverished people in both the global North and South lack even the most basic levels of nutrition and hygiene.

Reconfigurations of Human Bodies

Medicine in the early- to mid-twentieth century could be characterized by a mechanical notion of widespread application of technologies to human bodies and use of technical objects on bodies. Such technologies, many innovated in military contexts, unquestionably affected bodies, as they were designed to do, with the aim of improving human health. Serlin (2004), for example, nimbly traces the origins and impacts of an “engineering” model in postwar America that resulted in new cultural meanings of the prosthetic and collective recognition of

our “replaceable” body parts. Yet a key shift in medical technology has been the introduction of novel pills, devices, and other objects, both small and large, which remake bodies, often from the inside out. Clarke (1995) described this move from technologies of control to technologies of transformation, marking an epochal shift from the “modern” to the “postmodern” period. These technical practices have produced variations in bodies across time and space, alongside new epistemological frameworks.

In 1989, Nelkin and Tancredi (1989) documented, in vaguely alarmist prose, the rise of “dangerous diagnostics”—a set of technologies, such as genetic testing for possible future maladies and IQ tests, that increasingly pervaded the social sphere and threatened individual bodies and rights. They analyzed genetic technologies and biological information in social context, but they did not delve into the historical and cultural configurations of the technologies themselves, or their impacts, on bodies. One such “dangerous diagnostic” is amniocentesis. As Rothman (1993) argued, use of this prenatal test spurred a new ontological embodied category, the “tentative pregnancy.” She found that until a negative test result proved optimal health of a fetus, pregnant women could not fully accept their pregnancies. On the other hand, a positive diagnosis of genetic aberration created moral and bodily dilemmas; in the absence of prenatal treatment options and/or counseling, women with “defective” fetuses were confronted with the hollow “choice” of abortion. Rapp (2000) later explored these dynamics among a more ethnically and economically diverse group of women, finding a more intricate set of embodied politics.

Duster ([1990] 2003) presented a nuanced analysis of genetic technologies and risks posed to civil liberties and bodies by recycled explanations of science, heredity, and race. He suggested that genetic information reproduces structural inequalities, thus diluting any potential impact toward alleviation of human suffering. In Duster’s story, the technologies have both histories and politics, as do the humans. In 2004, Hedgecoe offered an ethnographic account of genetics in practice, documenting the ascendance of personalized medicine and its impact on patients and practices. Wailoo and Pemberton (2006) then placed race, ethnicity, and racialized bodies front and center in their historical analysis of Tay-Sachs, cystic fibrosis, and sickle cell disease.

One of the most startling and instructive examples of old and very new technologies reshaping human bodies and lives is that of pharmaceuticals.

A special issue of *Sociology of Health and Illness* (Williams, Gabe, and Davis 2008) explored multifaceted issues including direct-to-consumer advertising, sleep drugs, the human papillomavirus (HPV) vaccine, antiretroviral therapy, and stem cells. For example, Casper and Carpenter (2008) showed, with respect to the innovative and controversial HPV vaccine, that new technologies transform clinical practices: “the vaccine reveals gendered aspects of the doctor-patient relationship while creating new categories of patients and new pathways to medicalization of girls’ bodies. . . . New drugs may reorder or forge new health-care practices and markets” (p. 890). These transnational dynamics are increasingly played out on the bodies of women in developing nations, often those women most desperately in need of new preventive and healing technologies (Carpenter and Casper 2009).

Similarly, in their landmark volume, anthropologists Petryna, Lakoff, and Kleinman (2006) describe the state of affairs:

Major pharmaceutical breakthroughs occurred during and after World War II . . . After the war, the industry used sophisticated marketing methods to transform from a commodity chemicals business . . . to one heavily concentrated in several large firms and dependent on large investments in research and marketing. Global pharmaceutical spending reached almost \$500 billion in 2003; approximately half of that was attributed to the United States and Canada.” (p. 2)

As they also note, however, “behind these figures lies a morass of economic and moral paradoxes” (p. 2).

Biehl (2006) highlights such paradoxes in his investigation of the AIDS Program in Brazil, where state-supported production of antiretroviral medication has become a key strategy for controlling the epidemic. Drawing on ethnography geared toward making visible the “people missing in official data,” he writes that “Brazil’s policy of biotechnology for the people has dramatically reduced AIDS mortality and improved the quality of life for the patients covered” (p. 236).

Abundantly clear in the literature on pharmaceuticals is their profound impact on human bodies and experiences. Lakoff’s (2005) compelling ethnography of mental illness showcases the transformative role of the multinational pharmaceutical industry in forging connections across psychiatric diagnostic categories in the United States and Argentina. In

order for future pharmaceutical treatments to apply worldwide, the classification of bipolar disorder had to be standardized. The patients who populate the Buenos Aires clinic in Lakoff's study must negotiate the complex intersections of embodied personhood with "expert" medical knowledge, and of local experience with global formations. Lakoff's (2008) more recent work follows "pharmaceutical circuits" of regulation, technical standards, and struggles over inclusion and exclusion in finding the "right patients" for pharmaceutical clinical trials. Greene (2007) similarly argues that increasing reliance on measures such as blood pressure or cholesterol levels turns people without illnesses into those with "pre-disease" that doctors may feel obligated to treat.

One result of this over-reliance on tests is that drugs for the management of not-yet-illnesses are continuously used in human bodies, requiring ongoing monitoring and adjustment. Lovell (2006) states, "The history of buprenorphine, like that of psychotropics more generally, is a narrative of effects in search of an application" (p. 138). To state this more baldly, the pharmaceuticals often come first via the operations of global capitalism ("Big Pharma"), and diagnoses and patients follow as drug-makers seek new markets (and bodies) for their goods. Biehl (2006) notes, regarding the Brazilian program, "as the AIDS policy unfolded, Brazil attracted new investments, and novel public-private cooperation over access to medical technologies ensued" (p. 237). These arrangements resulted in expanded markets for pharmaceutical manufacturers and a marketing support infrastructure for the supply of "pharmaceutical intelligence" and forecasting (e.g., Piribo Limited 2010). New arrangements have also led to intensification of clinical research targeting human bodies conceptualized in terms of disease or pre-disease categories.

Use of cochlear implants provides a fascinating example of technical transformations of bodies and ensuing social consequences (Blume 2009). Advocates for Deaf culture have vigorously opposed the technological "solution" of cochlear implants on the grounds that deafness is not a difference in need of intervention, particularly in children (Hyde and Power 2006; Sparrow 2005). For these advocates, Deafness is a source of pride, an identity with a culture unified by its own unique language. Like medical sociologists, disability studies scholars have contested the biomedical model, arguing that "disability" is a socially constructed category (Shakespeare 1998). The biomedical model

focuses on individual-level therapy and treatment, neglecting social conditions that lead to loss of mobility and social interaction that turns "impairment" into a disability. A constructionist stance toward disability has reframed bodily differences, such as deafness, to highlight abilities rather than deficits. Siebers (2006) has called for an embodied ontology as a theoretical ground for disability studies, echoing medical sociologists' call for attention to human bodies and embodiment.

In short, while we have learned much about how technologies remake human bodies, we need empirical and theoretical works on new bio-subjectivities - work that can track formation of technoscientific identities alongside reconfigurations of bodies (Clarke et al. 2003, 2010; Sulik 2009). The questions then become bigger: In what ways, with what consequences, and by whom are these technoscientific identities constructed? In what ways and with what meanings and consequences do people take up such embodied identities? Sulik (2009), for example, found that women with breast cancer diagnoses formed one such identity as a result of their immersion in professional knowledge, placing themselves discursively within this technoscientific framework, receiving support in this identity from the medical system, and prioritizing official classification over their own suffering. Future work might investigate, for example, relations between humans and their brain implants (Morrison 2009), emergent pharmaceutical relations, new "biosocial" collective identities (Gibbon and Novas 2008; Rabinow 1992), and social movements associated with technologies (Kenny 2009).

Technologies and Embodied Health Movements

Since pioneering work by Epstein (1996), sociologists of medicine have theorized and examined connections among health, illness, and social movements—what Brown et al. (2004) call embodied health movements (EHMs). These are social movements organized around health-related issues such as disease categories, access to care, illness experiences, and inequities. Regarding HIV/AIDS activism (Epstein 1996), diethylstilbestrol (DES) daughters (Bell 2009), environmental contaminants (Brown 2007), and other product- and practice-oriented movements (Hess 2005), scholars have analyzed connections between health statuses and movement formation, development, and activism.

Communities have emerged on the basis of biosocial categories, deploying technoscientific identities and knowledge (Bell 2009; Epstein 2008). Scholars have analyzed novel group formations and strategies using terms such as “biosociality,” “biological citizenship,” and others that are Foucauldian in their understandings of power and dominance (Petryna 2002; Rabinow and Rose 2006; Rose and Novas 2005).

Klawiter’s (2008) work on breast cancer, for example, shows how the breast cancer movement transformed fundamental terms of debate about the condition: coalitions of women, researchers, and funding agencies reshaped the landscape of scientific inquiry and lived experiences. Breast cancer has been transformed from an embodied experience of passive patienthood to active identification and solidarity with others, from victim to survivor. This solidarity, in turn, helps individuals take control of their health care decisions, while it also attempts to direct research funding at the federal level. Yet contestation surrounds the prioritizing of research on breast cancer treatment (including pharmaceuticals) at the expense of prevention (Ehrenreich 2001; Ley 2009). Screening mammographies had long been recommended for even very young women, enlarging the population of women considered “at risk” but who had not yet been diagnosed with cancer. New guidelines issued in 2009 by the U.S. Preventive Services Task Force recommended limiting routine mammography to women over 50 (Mandelblatt et al. 2009), sparking a firestorm of controversy (Rabin 2009).

Central to Klawiter’s analysis, and to other work on breast cancer (e.g., Fosket 2004), is the figure of the “risky subject”—the woman who may carry a genetic marker predisposing her to breast cancer. Kenny’s (2009) work on the “previvor” movement is one example of breast cancer activism that emerged from groups of women with the BRCA1 and BRCA2 gene mutations seeking support based on the knowledge that they are at greater risk for breast cancer. Previvors are women with the BRCA 1 and 2 genes but without the disease; marked with the “pre-disease,” these women may ultimately make significant treatment decisions in the absence of actual symptoms (Koenig et al. 1998). This group of women is one of many who are advocating for research on young girls, seeking environmental causes for genetic variations even before birth (Ley 2009; Thomson 2009).

POLICY IMPLICATIONS

What implications derive from this retrospective of a half-century of research on technology? Although policy has not been an explicit focus of the analyses discussed here, many of the works implicitly urge policy at local, national, and transnational levels. We want to stress that medical sociologists should continue to engage in critical analysis of medical practices and health policy (Harrington and Estes 2007; Mechanic 2007). Often this work takes the form of health disparities or health services research (e.g., Barr 2008); yet other fields in the discipline have much to offer. Medical sociologists interested in the effects of medical technology might, for example, examine the ways in which technologies such as electronic medical records, disease classification systems, and other artifacts and processes create and obscure certain forms of professional and lay work.

While medical sociologists will, of course, continue to produce intellectually rigorous, critical, and creative accounts of historical and contemporary medical practices, we also envision more sophisticated interdisciplinary work in the future. In forging links with bioethics and neuroethics, for example, medical sociologists may highlight inequities in resource allocation, informed consent, and institutional structures that obscure or make invisible the ethical practices of those who engage in medical work. Some sociologists practice “empirical bioethics” (De Vries and Kim 2008; Fisher 2009) while wearing the hat of faculty members in interdisciplinary academic centers for bioethics. These connections will become more important as new technologies enter the biomedical landscape, forging shifts in practice, innovative embodied identities, and as-yet-unknown social movements. As technologies become ever tinier—for example, nanotechnologies—scholars will need to attend to a host of issues concerning bodily integrity and autonomy, civil liberties, and the inner and outer reaches of medicine.

Medical sociologists play a substantial role in analyzing power relations within medicine, including the scope of medical authority, biopolitics, and health policy. Experts on medical technology should engage here as well. Despite passage of the federal Patient Protection and Affordable Care Act in March 2010, vociferous debates over health care reform in the United States continue at the time of this writing. Medical sociologists are poised to

make key contributions to these debates, with the expertise to highlight connections between health economics and finance and inequalities in provision of services. Yet health disparities are not merely economic, in terms of too much or too little care; they also embody questions of social justice in distributing social resources. In an era when Americans spend too much money for care that is not equitably distributed, sociologists may highlight moral and ethical dimensions of this unequal distribution. Fears of rationing contribute to both public panic and political posturing instead of meaningful comparative analysis. Sociologists can contribute through studies of public and political discourse around policy change, as well as through empirical studies comparing health care systems locally, regionally, and nationally.

Additional research should be conducted transnationally and in dialogue with human rights theory and praxis (Gruskin 2006; Turner 2006). In the context of global flows of capital, bodies, and other resources, how do medical technologies, and the expertise it takes to use them, become distributed throughout the world? Who does what kinds of work, for whom, and with what consequences? What kinds of inequalities are created when MRI scans, x-rays, and other tests and techniques are performed in one location and analyzed in another? Some researchers have already documented the "outsourcing" of clinical trials research to the "Third World" (Cooper 2008; Sunder Rajan 2006). What kind of medicine do we get when drugs are created in the United States, tested abroad, and then marketed, sold, and consumed in wealthy nations? What kinds of technology do we get? Who benefits? Such questions of technology will continue to be at the core of medical sociology.

ACKNOWLEDGMENTS

We gratefully acknowledge Lisa Jean Moore and two anonymous reviewers for their insightful comments on this manuscript. We dedicate this article to the memory of Susan Leigh Star, whose innovative work has influenced us in myriad ways.

REFERENCES

- Anspach, Renée R. 1993. *Deciding Who Lives: Fateful Choices in the Intensive-Care Nursery*. Berkeley: University of California Press.
- Armstrong, David. 1995. "The Rise of Surveillance Medicine." *Sociology of Health and Illness* 17:393-404.
- Barr, Michael S. 2008. "The Need to Test the Patient-Centered Medical Home." *Journal of the American Medical Association* 300:834-35.
- Bell, Susan E. 1995. "Gendered Medical Science: Producing a Drug for Women." *Feminist Studies* 21:469-500.
- . 2009. *DES Daughters: Embodied Knowledge and the Transformation of Women's Health Politics*. Philadelphia, PA: Temple University Press.
- Biehl, João. 2006. "Pharmaceutical Governance." Pp. 206-39 in *Global Pharmaceuticals: Ethics, Markets, Practices*, edited by A. Petryna, A. Lakoff, and A. Kleinman. Durham, NC: Duke University Press.
- Blizzard, Deborah. 2007. *Looking Within: A Sociocultural Examination of Fetoscopy*. Cambridge, MA: MIT Press.
- Blume, Stuart. 2009. *The Artificial Ear: Cochlear Implants and the Culture of Deafness*. New Brunswick, NJ: Rutgers University Press.
- Bowker, Geoffrey C. and Susan Leigh Star. 2000. *Sorting Things Out: Classification and its Consequences*. Cambridge, MA: MIT Press.
- Briggs, Laura. 2002. *Reproducing Empire: Race, Sex, Science, and U.S. Imperialism in Puerto Rico*. Berkeley: University of California Press.
- Brown, Phil. 2007. *Toxic Exposures: Contested Illness and the Environmental Health Movement*. New York: Columbia University Press.
- Brown, Phil, Stephen Zavestoski, Sabrina McCormick, Brian Mayer, Rachel Morello-Frosch, and Rebecca Gasior Altman. 2004. "Embodied Health Movements: New Approaches to Social Movements in Health." *Sociology of Health and Illness* 26:1-31.
- Burri, Regula Valerie and Joseph Dumit. 2008. "Social Studies of Scientific Imaging and Visualization." Pp. 297-318 in *The Handbook of Science and Technology Studies*, edited by E. Hackett, O. Amsterdamska, M. Lynch, and J. Wajcman. Cambridge, MA: MIT Press.
- Canguilhem, Georges. 1991. *The Normal and the Pathological*. New York: Zone Books.
- Carpenter, Laura M. and Monica J. Casper. 2009. "Global Intimacies: Innovating the HPV Vaccine for Women's Health." *Women's Studies Quarterly* 37:80-100.
- Casper, Monica J. 1998. *The Making of the Unborn Patient: A Social Anatomy of Fetal Surgery*. New Brunswick, NJ: Rutgers University Press.
- Casper, Monica J. and Laura M. Carpenter. 2008. "Sex, Drugs, and Politics: The HPV Vaccine for Cervical Cancer." *Sociology of Health and Illness* 30:886-99.
- Casper, Monica J. and Adele E. Clarke. 1998. "Making the Pap Smear into the Right Tool for the Job: Cervical Cancer Screening in the U.S., c1940-1995." *Social Studies of Science* 28:255-90.

- Casper, Monica J. and Lisa Jean Moore. 2009. *Missing Bodies: The Politics of Visibility*. New York: New York University Press.
- Caufield, Catherine. 1989. *Multiple Exposures: Chronicles of the Radiation Age*. Chicago, IL: University of Chicago Press.
- Charmaz, Kathy C. 1991. *Good Days, Bad Days: The Self and Chronic Illness*. Piscataway, NJ: Rutgers University Press.
- Clarke, Adele E. 1995. "Modernity, Postmodernity, and Reproductive Processes, ca 1890-1990: or, 'Mommy, Where do Cyborgs Come from Anyway?'" Pp. 139-56 in *The Cyborg Handbook*, edited by C. H. Gray, S. Mentor, and H. Figueroa-Sarriera. New York: Routledge.
- Clarke, Adele E. and Monica Casper. 1996. "From Simple Technique to Complex System: Classification of Pap Smears, 1917-1990." *Medical Anthropology Quarterly* 10:601-23.
- Clarke, Adele E. and Joan H. Fujimura. 1992. "What Tools? Which Jobs? Why Right?" Pp. 3-44 in *The Right Tools for the Job: At Work in Twentieth Century Life Sciences*, edited by A. E. Clarke and J. H. Fujimura. Princeton, NJ: Princeton University Press.
- Clarke, Adele E. and Virginia L. Olesen. 1999. *Revisioning Women, Health, and Healing: Feminist, Cultural, and Technoscience Perspectives*. New York: Routledge.
- Clarke, Adele E., Janet K. Shim, Laura Mamo, Jennifer Ruth Fosket, and Jennifer R. Fishman. 2003. "Biomedicalization: Technoscientific Transformations of Health, Illness, and U.S. Biomedicine" *American Sociological Review* 68:161-94.
- — —. 2010. *Biomedicalization: Technoscience and Transformations of Health and Illness in the U.S.* Durham, NC: Duke University Press.
- Clarke, Adele E. and Susan Leigh Star. 2007. "The Social Worlds/Arenas Framework: A Theory-Methods Package." Pp. 113-37 in *The Handbook of Science and Technology Studies*, edited by E. Hackett, O. Amsterdamska, M. Lynch, and J. Wajcman. Cambridge, MA: MIT Press.
- Conrad, Peter. 2005. "The Shifting Engines of Medicalization." *Journal of Health and Social Behavior* 46:3-14.
- — —. 2007. *The Medicalization of Society: On the Transformation of Human Conditions into Treatable Disorders*. Baltimore, MD: Johns Hopkins University Press.
- Conrad, Peter and Jonathan Gabe. 1999. *Sociological Perspectives on the New Genetics*. Oxford, England: Blackwell.
- Cooper, Melinda. 2008. *Life as Surplus: Biotechnology and Capitalism in the Neoliberal Era*. Seattle: University of Washington Press.
- De Vries, Raymond and Scott Kim. 2008. "Bioethics and the Sociology of Trust: Introduction to the Theme." *Medicine, Health Care and Philosophy* 11: 377-79.
- Dumit, Joseph. 2003. *Picturing Personhood: Brain Scans and Biomedical Identity*. Princeton, NJ: Princeton University Press.
- Duster, Troy. [1990] 2003. *Backdoor to Eugenics*. 2nd ed. New York: Routledge.
- Ehrenreich, Barbara. 2001. "Welcome to Cancerland: A Mammogram Leads to a Cult of Pink Kitsch." *Harp-er's Magazine*, November 2001, pp. 43-53.
- Epstein, Steven. 1996. *Impure Science: AIDS, Activism, and the Politics of Knowledge*. Berkeley: University of California Press.
- — —. 2008. "Patient Groups and Health Movements." Pp. 499-540 in *The Handbook of Science and Technology Studies*, edited by E. Hackett, O. Amsterdamska, M. Lynch, and J. Wajcman. Cambridge, MA: MIT Press.
- Fisher, Jill A. 2009. *Medical Research for Hire: The Political Economy of Pharmaceutical Clinical Trials*. New Brunswick, NJ: Rutgers University Press.
- Fosket, Jennifer R. 2004. "Constructing 'High Risk Women': The Development and Standardization of a Breast Cancer Risk Assessment Tool." *Science, Technology and Human Values* 29:291-313.
- Foucault, Michel. 1994. *The Birth of the Clinic*. New York: Pantheon.
- — —. 1995. *Discipline and Punish: The Birth of the Prison*. New York: Vintage.
- — —. 2008. *The Birth of Biopolitics: Lectures at the Collège de France, 1978-1979*. New York: Palgrave Macmillan.
- Franklin, Sarah. 2000. "Life Itself." Pp. 188-98 and 215-27 in *Global Nature/Global Culture*, edited by S. Franklin, C. Lurie, and J. Stacey. London, England: Sage.
- — —. 2007. *Dolly Mixtures: The Remaking of Genealogy*. Durham, NC: Duke University Press.
- Fujimura, Joan H. 1988. "The Molecular Biological Bandwagon in Cancer Research: Where Social Worlds Meet." *Social Problems* 35:261-83.
- — —. 1996. *Crafting Science: A Sociohistory of the Quest for the Genetics of Cancer*. Cambridge, MA: Harvard University Press.
- Gibbon, Sahra and Carlos Novas. 2008. *Biosocialities, Genetics, and the Social Sciences: Making Biologies and Identities*. London: Routledge.
- Ginsburg, Faye D. and Rayna Rapp. 1995. *Conceiving the New World Order: The Global Politics of Reproduction*. Berkeley: University of California Press.
- Glaser, Barney G. and Anselm Strauss. 1965. *Awareness of Dying*. Chicago, IL: Aldine.

- Gottweis, Herbert and Alan Petersen. 2008. *Biobanks: Governance in Comparative Perspective*. New York: Routledge.
- Greene, Jeremy A. 2007. *Prescribing by Numbers: Drugs and the Definition of Disease*. Baltimore, MD: Johns Hopkins University Press.
- Grinker, Roy Richard. 2010. "Disorder out of Chaos." *New York Times*, February 9, P. A23. Retrieved March 2, 2010 (<http://www.nytimes.com/2010/02/10/opinion/10grinker.html>).
- Gruskin, Sofia. 2006. "Rights-Based Approaches to Health: Something for Everyone." *Health and Human Rights* 9:5-9.
- Harrington, Charlene and Carroll L. Estes. 2007. *Health Policy: Crisis and Reform in the U.S. Health Care Delivery System*, 5th ed. Sudbury, MA: Jones and Bartlett.
- Hatch, Anthony R. 2009. "The Politics of Metabolism: The Metabolic Syndrome and the Reproduction of Race and Racism." PhD dissertation, Department of Sociology, University of Maryland, College Park, MD.
- Hedgecoe, Adam. 2004. *The Politics of Personalised Medicine: Pharmacogenetics in the Clinic*. Cambridge, England: Cambridge University Press.
- Hess, David J. 2005. "Technology- and Product-Oriented Movements: Approximating Social Movement Studies and Science and Technology Studies." *Science, Technology, and Human Values* 30:515-35.
- Horwitz, Allan V. 2002. *Creating Mental Illness*. Chicago, IL: The University of Chicago Press.
- Hyde, Merv and Des Power. 2006. "Some Ethical Dimensions of Cochlear Implantation for Deaf Children and Their Families." *Journal of Deaf Studies and Deaf Education* 11:102-11.
- Illich, Ivan. 1975. *Medical Nemesis: The Expropriation of Health*. London, England: Calder & Boyars.
- Joyce, Kelly A. 2008. *Magnetic Appeal: MRI and the Myth of Transparency*. Ithaca, NY: Cornell University Press.
- Keating, Peter and Alberto Cambrosio. 2002. "From Screening to Clinical Research: The Cure of Leukemia and the Early Development of the Cooperative Oncology Groups, 1955-1966." *Bulletin of the History of Medicine* 76:299-334.
- . 2003. *Biomedical Platforms: Realigning the Normal and the Pathological in Late-Twentieth Century Medicine*. Cambridge, MA: MIT Press.
- Kenny, Katherine E. 2009. "Breast Cancer Activism and the 'Previvor' Movement: Embodiment, Citizenship, and the Genetically 'at Risk.'" Presented at the meeting of the Society for the Social Studies of Science, Washington, DC, October 31.
- Klawiter, Maren. 2004. "Breast Cancer in Two Regimes: The Impact of Social Movements on Illness Experience." *Sociology of Health and Illness* 26: 845-74.
- . 2008. *The Biopolitics of Breast Cancer: Changing Cultures of Disease and Activism*. Minneapolis: University of Minnesota Press.
- Koenig, Barbara A., Henry T. Greely, Laura M. McConnell, Heather L. Silverberg, Thomas A. Raffin, and the Members of the Breast Cancer Working Group of the Stanford Program in Genomics, Ethics, and Society. 1998. "Genetic Testing for BRCA1 and BRCA2: Recommendations of the Stanford Program in Genomics, Ethics, and Society." *Journal of Women's Health* 7:531-45.
- Lakoff, Andrew. 2005. *Pharmaceutical Reason: Knowledge and Value in Global Psychiatry*. Cambridge, England: Cambridge University Press.
- . 2008. "The Right Patient for the Drug: Pharmaceutical Circuits and the Codification of Illness." Pp. 741-60 in *The Social Construction of Technological Systems*, edited by W. E. Bijker, T. P. Hughes, and T. Pinch. Cambridge, MA: MIT Press.
- Ley, Barbara L. 2009. *From Pink to Green: Disease Prevention and the Environmental Breast Cancer Movement*. New Brunswick, NJ: Rutgers University Press.
- Lorber, Judith and Lisa Jean Moore. 2002. *Gender and the Social Construction of Illness*, 2nd ed. Walnut Creek, CA: Rowman Altamira.
- Lovell, Anne M. 2006. "Addiction Markets: The Case of High-Dose Buprenorphine in France." Pp. 136-70 in *Global Pharmaceuticals: Ethics, Markets, Practices*, edited by A. Petryna, A. Lakoff, and A. Kleinman. Durham, NC: Duke University Press.
- Mandelblatt, Jeanne, Kathleen A. Cronin, Stephanie Bailey, Donald A. Berry, Harry J. de Koning, Gerrit Draisma, Hui Huang, Sandra J. Lee, Mark Munsell, Sylvia K. Pleveritis, Peter Ravdin, Clyde B. Schechter, Bronislava Sigal, Michael A. Stoto, Satasha K. Stout, Nicolien T. van Ravesteyn, John Venier, Marvin Zelen, Eric J. Feuer, and for the Breast Cancer Working Group of the Cancer Intervention and Surveillance Modeling Network (CISNET). 2009. "Effects of Mammography Screening Under Different Screening Schedules: Model Estimates of Potential Benefits and Harms." *Annals of Internal Medicine* 151:738-47.
- McKinlay, John B. 1984. *Issues in the Political Economy of Health Care*. New York: Tavistock.
- Mechanic, David. 2007. "Population Health: Challenges for Science and Society." *The Milbank Quarterly* 85:533-59.
- Morrison, Daniel R. 2009. "Brain and Machine: Deep Brain Stimulation and the Self." Presented at the meeting of the Society for the Social Studies of Science, Washington, DC, October 31.
- Murray, John E. 2007. *Origins of American Health Insurance: A History of Industrial Sickness Funds*. New Haven, CT: Yale University Press.

- Navarro, Vicente. 1986. *Crisis, Health, and Medicine: A Social Critique*. New York: Tavistock.
- Nelkin, Dorothy and Laurence Tancredi. 1989. *Dangerous Diagnostics: The Social Power of Biological Information*. New York: Basic Books.
- Nye, David E. 2006. *Technology Matters: Questions to Live With*. Cambridge, MA: MIT Press.
- Oakley, Ann. 1984. *The Captured Womb: A History of the Medical Care of Pregnant Women*. Oxford, England: Blackwell.
- Oshinsky, David M. 2005. *Polio: An American Story*. New York: Oxford University Press.
- Petryna, Adriana. 2002. *Life Exposed: Biological Citizens after Chernobyl*. Princeton, NJ: Princeton University Press.
- Petryna, Adriana, Andrew Lakoff, and Arthur Kleinman. 2006. *Global Pharmaceuticals: Ethics, Markets, Practices*. Durham, NC: Duke University Press.
- Pickering, Andrew. 1992. *Science as Practice and Culture*. Chicago, IL: The University of Chicago Press.
- Piribo Limited. 2010. "About Piribo." Retrieved March 6, 2010 (http://www.piribo.com/about_us/index.html).
- Pulley, Jill M., Margaret M. Brace, Gordon R. Bernard, and Dan R. Masys. 2008. "Attitudes and Perceptions of Patients towards Methods of Establishing a DNA Biobank." *Cell and Tissue Banking* 9:55-65.
- Quadagno, Jill. 2006. *One Nation, Uninsured: Why the U.S. Has No National Health Insurance*. New York: Oxford University Press.
- Rabin, Roni Caryn. 2009. "New Guidelines on Breast Cancer Draw Opposition." *New York Times*, November 16. Retrieved March 6, 2010 (<http://www.nytimes.com/2009/11/17/health/17sere.html>).
- Rabinow, Paul. 1992. "Artificiality and Enlightenment: From Sociobiology to Biosociality." Pp. 234-52 in *Incorporations*, edited by J. Crary and S. Kwinter. New York: Zone.
- Rabinow, Paul and Nikolas Rose. 2006. "Biopower Today." *Biosocieties* 1:195-217.
- Rapp, Rayna. 2000. *Testing Women, Testing the Fetus: The Social Impact of Amniocentesis in America*. New York: Routledge.
- Reiser, Stanley Joel and Michael Anbar. 1984. *The Machine at the Bedside: Strategies for Using Technology in Patient Care*. New York: Cambridge University Press.
- Riessman, Catherine Kohler. 1983. "Women and Medicalization: A New Perspective." *Social Policy* 14:3-18.
- Robert Wood Johnson Foundation. 2009. "Health Care Spending as Percentage of GDP." Talking About Quality Part 1: Health Care Today. Retrieved March 5, 2010 (<http://www.rwjf.org/pr/product.jsp?id=45110>).
- Roden, Dan M., Jill Pulley, Melissa Basford, Gordon Bernard, Ellen Wright Clayton, Jeffrey Balsler, and Dan Masys. 2008. "Development of a Large-Scale De-Identified DNA Biobank to Enable Personalized Medicine." *Clinical Pharmacology and Therapeutics* 84:362-69.
- Rose, Nikolas S. 2007. *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century*. Princeton, NJ: Princeton University Press.
- Rose, Nikolas S. and Carlos Novas. 2005. "Biological Citizenship." Pp. 439-64 in *Global Assemblages: Technology, Politics, and Ethics as Anthropological Problems*, edited by A. Ong and S. J. Collier. Malden, MA: Blackwell.
- Rothman, Barbara Katz. 1993. *The Tentative Pregnancy: How Amniocentesis Changes the Experience of Motherhood*. New York: W.W. Norton & Co.
- Ruzek, Sheryl Burt, Virginia L. Olesen, and Adele E. Clarke. 1997. *Women's Health: Complexities and Differences*. Columbus: The Ohio State University Press.
- Serlin, David H. 2004. *Replacable You: Engineering the Body in Postwar America*. Chicago, IL: University of Chicago Press.
- Shakespeare, Tom (ed.). 1998. *The Disability Reader: Social Science Perspectives*. London, England: Continuum.
- Siebers, Tobin. 2006. "Disability in Theory: From Social Construction to the New Realism of the Body." Pp. 173-84 in *The Disability Studies Reader*, 2nd ed., edited by L. J. Davis. New York: Routledge.
- Sparrow, Robert. 2005. "Defending Deaf Culture: The Case of Cochlear Implants." *The Journal of Political Philosophy* 13:135-52.
- Star, Susan Leigh and James R. Griesemer. 1989. "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39." *Social Studies of Science* 19:387-420.
- Star, Susan Leigh and Anselm Strauss. 1999. "Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work." *Computer Supported Cooperative Work* 8:9-30.
- Starr, Paul. 1982. *The Social Transformation of American Medicine: The Rise of a Sovereign Profession and the Making of a Vast Industry*. New York: Basic Books.
- Strauss, Anselm. 1988. "The Articulation of Project Work." *The Sociological Quarterly* 29:163-78.
- Strauss, Anselm L., Shizuko Fagerhaugh, Barbara Suezek, and Carolyn Wiener. 1985. *Social Organization of Medical Work*. Chicago, IL: University of Chicago Press.
- Sulik, Gayle A. 2009. "Managing Biomedical Uncertainty: The Technoscientific Illness Identity." *Sociology of Health and Illness* 31:1059-76.

- Sunder Rajan, Kaushik. 2006. *Biocapital: The Constitution of Postgenomic Life*. Durham, NC: Duke University Press.
- Talley, Heather Lane. 2008. "Face Work: Cultural, Technical, and Surgical Interventions for Facial 'Disfigurement.'" PhD dissertation, Department of Sociology, Vanderbilt University, Nashville, TN.
- Tanner, Lindsey. 2010. "Proposed Autism Diagnosis Changes Anger 'Aspies.'" Associated Press, February 10, 2010. Retrieved March 5, 2010 (http://www.apa.org/news/psycport/psycPORTArticle.aspx?id=ap_2010_02_11_aponline:all_D9DQ25C80_news_ap_org.apa.xml).
- Taylor, Janelle S. 2000. "Of Sonograms and Baby Prams: Prenatal Diagnosis, Pregnancy, and Consumption." *Feminist Studies* 26:391-418.
- . 2008. *The Public Life of the Fetal Sonogram: Technology, Consumption, and the Politics of Reproduction*. New Brunswick, NJ: Rutgers University Press.
- Thompson, Charis. 2005. *Making Parents: The Ontological Choreography of Reproductive Technologies*. Cambridge, MA: MIT Press.
- Thomson, L. Katherine. 2009. "Transdisciplinary Knowledge Production of Endocrine Disruptors: 'Windows of Vulnerability' in Breast Cancer Risk." PhD dissertation, Department of Social and Behavioral Sciences, University of California, San Francisco, CA.
- Timmermans, Stefan. 1999. *Sudden Death and the Myth of CPR*. Philadelphia, PA: Temple University Press.
- Timmermans, Stefan and Marc Berg. 2003. *The Gold Standard: The Challenge of Evidence-Based Medicine and Standardization in Health Care*. Philadelphia, PA: Temple University Press.
- Turner, Bryan S. 2006. *Vulnerability and Human Rights: Essays on Human Rights*. University Park, PA: The Pennsylvania State University Press.
- Wailoo, Keith and Stephen Pemberton. 2006. *The Troubled Dream of Genetic Medicine: Ethnicity and Innovation in Tay-Sachs, Cystic Fibrosis, and Sickle Cell Disease*. Baltimore, MD: Johns Hopkins University Press.
- Wainwright, Steven P., Clare Williams, Mike Michael, Bonnie Farsides, and Alan Cribb. 2006. "From Bench to Bedside? Biomedical Scientists' Expectations of Stem Cell Science as a Future Therapy for Diabetes." *Social Science and Medicine* 63:2052-64.
- Waldby, Catherine. 1996. *AIDS and the Body Politic: Biomedicine and Sexual Difference*. New York: Routledge.
- . 2000. *The Visible Human Project: Informatic Bodies and Posthuman Medicine*. New York: Routledge.
- Waldby, Catherine and Robert Mitchell. 2006. *Tissue Economies: Blood, Organs, and Cell Lines in Late Capitalism*. Durham, NC: Duke University Press.
- Wiener, Carolyn, Anselm Strauss, Shizuko Fagerhaugh, and Barbara Sueczek. 1997. "Trajectories, Biographies, and the Evolving Medical Technology Scene." Pp. 229-50 in *Grounded Theory in Practice*, edited by A. Strauss and J. Corbin. Thousand Oaks, CA: Sage.
- Williams, Clare, Steven P. Wainwright, Kathryn Ehrlich, and Mike Michael. 2008. "Human Embryos as Boundary Objects: Some Reflections on the Biomedical Worlds of Embryonic Stem Cells and Pre-Implantation Genetic Diagnosis." *New Genetics and Society* 27:7-18.
- Williams, Simon J., Jonathan Gabe, and Peter Davis. 2008. "The Sociology of Pharmaceuticals: Progress and Prospects." *Sociology of Health and Illness* 30:813-24.
- Yoxen, Edward. 1987. "Seeing with Sound: A Study of the Development of Medical Images." Pp. 281-303 in *The Social Construction of Technological Systems*, edited by W. E. Bijker, T. P. Hughes, and T. Pinch. Cambridge, MA: MIT Press.
- Zetka, James R. 2003. *Surgeons and the Scope*. Ithaca, NY: ILR Press/Cornell University Press.
- Zola, Irving Kenneth. 1972. "Medicine as an Institution of Social Control." *Sociological Review* 20:487-504.

Bios

Monica J. Casper is professor of social and behavioral sciences and women and gender studies, and director of Humanities, Arts, and Cultural Studies, at Arizona State University's New College. Her research and teaching interests include bodies, feminist technoscience studies, medical sociology, gender and sexuality, women's health, environmental justice, human reproduction, security and war, disability studies, trauma studies, and biopolitics. She is author of *The Making of the Unborn Patient: A Social Anatomy of Fetal Surgery* (Rutgers University Press, 1998), co-author of *Missing Bodies: The Politics of Visibility* (New York University Press, 2009), and editor of *Synthetic Planet: Chemical Politics and the Hazards of Modern Life* (Routledge, 2003). She has published widely on women's health. Her current research investigates the biopolitics of infant mortality and maternal-child health in the United States. With Lisa Jean Moore, she co-edits the New York University Press book series *Biopolitics: Medicine, Technoscience, and Health in the 21st Century*.

Daniel R. Morrison is a doctoral candidate in the Department of Sociology at Vanderbilt University. His research interests include medicine, science and technology studies, feminist technoscience studies, culture, and biomedical ethics. His dissertation is a qualitative study of the development and use of brain implant technologies. He received a Vanderbilt Social Science Dissertation Fellowship for 2010-2011.