

Science and Technology Studies: Its Relevance to Medical Education and the Practice of Medicine

Lundy Braun, PhD, and Anne Fausto-Sterling, PhD

Combine a quick glance at the front page of the *New York Times* or the *Boston Globe* with two minutes of advertising on the nightly news. It becomes clear that medicine is simultaneously big business, a cultural practice, and a healing profession. Headlines, such as “Big Study Finds No Clear Benefit of Calcium Pills,”¹ “Women’s Health: State of Confusion,”² “Drug Industry Braces for New Suits Over Even More of Its Products,”³ seemingly report on straightforward analyses of scientific studies. Behind these headlines, however, are central questions of values and knowing. What social and cultural values inform the scientific questions we ask? Why are certain questions asked and not others? How do scientists, physicians and their patients mediate the fraught, often contradictory terrain of their own political perspectives and socio-cultural values to provide the best possible health care?

Scholars in Science and Technology Studies, an interdisciplinary endeavor that brings together anthropologists, philosophers, historians, art historians, literary theorists, sociologists, scientists, and physicians, concern themselves with how scientific knowledge is produced, accepted by scientists, transmitted in popular culture, and incorporated into scientific and medical practice. There are many medical controversies for which a science studies analysis is relevant. Two case studies, one on hormone replacement therapy in menopausal women and the other on race and genomics, illustrate our claim that the scientific and the social are inextricably linked. Viewed in this way, many of the apparent contradictions that characterize the daily experience of clinical practitioners can be clarified. We conclude by offering some ideas on the importance of integrating a science and technology studies approach into the medical curriculum.

HORMONE REPLACEMENT THERAPY

In 2002, the use of hormone replacement therapy (HRT) involving

combined estrogen and progesterone administration ended abruptly when the Women’s Health Initiative reported that HRT increased the risk of breast cancer and, perhaps, cardiovascular disease.⁴ Furthermore, rather than reducing the carcinogenic effects of unopposed estrogen, the addition of progesterone increased the risk of breast cancer over that of estrogen alone. Before the Women’s Health Initiative report, most gynecologists routinely prescribed HRT for perimenopausal and menopausal women, basing the decision on a reasonable understanding of the evidence or at least the way in which the scientific literature presented the evidence. For months afterward, the press featured stories of anguished women and their physicians confronted with wrenching choices: increase the risk of breast cancer, deal with the unpleasant effects of menopause without HRT, or fall victim to one or more of a growing list of diseases and conditions—osteoporosis, cardiovascular disease, Alzheimer’s disease, depression, other mental deficits, and aging skin—presumably associated with the menopause and against which HRT was believed to be protective, if not curative.

To many scholars and activists, however, the key issue was not simply a question of evidence, since a fundamental tenet of science studies is that evidence is always interpreted in different ways in different historical periods. In this case, the science was not mysterious. The biological effects of both estrogen and progesterone on breast tissue were well-studied, and a role for estrogen signaling in the biology of breast cancer had long been recognized. Moreover, a strong association between estrogen replacement therapy and endometrial cancer was demonstrated conclusively in 1975. Among the questions that science studies scholars and many others began to ask in the 1980s and 1990s were: Why was HRT so widely and unquestioning accepted? What underlying cultural assumptions shaped prescription patterns and

women’s expectations of HRT as a “treatment” for menopause in Western societies? Was the relationship between menopause and disorders such as osteoporosis and cardiovascular disease sufficient to explain the acceptance of HRT?

The characterization of menopause as a hormone deficiency state and the underlying characterization of menopause as a condition requiring treatment has long been controversial. Life-long therapy with estrogen for post-menopausal women was vigorously promoted in the mid-1960s. As a result, Premarin became one of the most commonly prescribed drugs in the US.^{5,6} The first round of sales to “estrogen-starved” women was short-lived, however. With the 1975 publication of the article linking estrogen to endometrial cancer, women and their physicians retreated from the routine administration of estrogen. By the 1990s, despite considerable debate in previous decades about whether menopause was a “disease,”^{7,8} HRT, now combined with progesterone, again became a market phenomenon as the first wave of baby boom women entered menopause.

Was there enough new science to warrant the reintroduction of HRT as a safe drug? What was the role of the pharmaceutical industry in the relevant clinical research? Was women’s desire for eternal youth a significant factor in the resurgence in HRT? Which factors led to a change in practice, and how did these factors convince medical practitioners that HRT was a good idea? These are the questions that science and technology studies scholars address. We suggest that this approach to the analysis of scientific and clinical data ought to become an integral part of medical training.

In the aftermath of the Women’s Health Initiative study and the resultant confusion among women and physicians about the management of menopausal symptoms, a panel of epidemiologists, basic scientists, physicians, activists, and historians of medicine assembled in Bos-

ton in June 2004 to consider what types of interdisciplinary approaches might help to avoid such disappointment in the future. Understanding “its [HRT] societal context, including the impact of the pharmaceutical industry, the biomedical emphasis on individualized risk and preventive medicine, and the gendering of hormones,” participants at this conference concluded, was essential to the practice of “socially responsible science.”⁹

RACE, GENOMICS, AND HEALTH DISPARITIES

The genetics of race is another socially contentious issue in contemporary medical practice for which a science studies analysis is relevant. The debate has been triggered by the recent focus of commonsense notions of “race,” population and molecular genetic research, and social activism on the goal of rectifying racial and ethnic health disparities in the US and globally. Beginning in 2000, after the announcement of the sequencing of a draft of the human genome, editors at *Nature*, *Nature Genetics*, *New England Journal of Medicine*, *International Journal of Epidemiology*, and *American Psychologist* published editorials or devoted whole issues to the debate.^{10,11} With the approval and enthusiastic reception of BiDiI, the first “race-based” medicine marketed by Nitromed, Inc. to African Americans, the discussion has taken on an urgency that few in medicine can afford to ignore. Central questions include: What is race? Will biological investigations, based on the notion that races are homogeneous genetic categories, provide a pathway for alleviating health disparities? Or, should we think in a more complex way about how the social environment produces biological effects through the modulation of gene expression. Do the negative health effects of race reflect the social context of people’s lives rather than their DNA sequences? Why, finally, are genetic explanations so commonly invoked?^{12,13} For practitioners, this is not an abstract theoretical problem but is key to providing the highest standards of care to diverse populations.

While a full discussion of racial classification is beyond the scope of this article, the history of race in the West is linked to the development of modern science, beginning with the great classi-

fier Carl Linnaeus and followed by other Enlightenment thinkers, such as Johann Friedrich Blumenbach and Immanuel Kant. Until the end of the 19th century, the notion of race was fluid, though hierarchical, drawing on ideas both of biological and of cultural difference.¹⁴ Although the civil rights movement represented a moment when environmental explanations for the health experience of racial and ethnic minorities gained prominence, it was during the 20th century that biology assumed greater importance as a marker of racial difference and health status. Thus, it should not be surprising that at the beginning of the 21st century, many claim that differential health outcomes are rooted in genes.

What social and cultural values inform the scientific questions we ask?

In the case of hypertension, we can see quite clearly that the meaning we ascribe to race matters in terms of research priorities and clinical care. Hypertension has long been known to be more prevalent in African Americans as compared to white Americans. This point is not in dispute. At issue are the underlying causes. The major explanations fall into three groups: genetic difference, environmental differences, and biological manifestation of life, including environmental, experience. Each point of view implies a different approach to prevention and care. The predisposition of African Americans to hypertension has often been ascribed to primary genetic factors. Alternative theories for high hypertension rates among African Americans proposed by Nancy Krieger and others state that the life experience of racism can affect physiology through stress-mediated modulation of gene expression.¹⁵

A recent study by Richard Cooper and colleagues underscores the problem in viewing health exclusively through a racialized lens¹⁶ (one that, in fact, may be particular to the US, where race has long been defined differently than in Europe). Taking a comparative approach, these investigators examined hypertension rates in: Nigerians, US whites, Canadians, Ja-

maicans, Swedes, Italians, English, US blacks, Spanish, Finish, and Germans. Contrary to prevalent views, they showed that Germans, Finns, and the Spanish have higher hypertension rates than US blacks. The lowest hypertension rates were observed in Nigerians. The study is limited in that there is no racial breakdown in European countries studied and Nigerians are the only African population included. Nonetheless, this work is important in refuting the notion that “black genes” account for high hypertension rates. Thus, while it is still of great importance to deepen our understanding of racial disparities in hypertension in the US context, a more complex analysis of the assumptions about racial difference that drive research takes us in directions other than genetic explanations for health inequalities. According to sociologist and president of the American Sociological Association Troy Duster, such an approach would begin with the recognition of a “complex feedback loop and interaction effect between phenotype and social practices related to that phenotype.”¹⁷ Reading the literature on race and hypertension in a critical manner is difficult. One has to figure out the meaning of race as deployed in each paper; one has to examine the perspective of the authors. Are they oriented toward developing drug treatments or finding ways to reduce chronic stress that leads to hypertension? Again, those with a science studies training (such as sociologist Duster) can offer an alternative framework in which to view such complexities.

CONCLUSION

In this changing and uncertain landscape, how can we best equip medical students to understand and adapt to social change throughout their career? If medicine is simultaneously a scientific and social practice, then it follows that medical education should incorporate such a perspective. As well as learning the latest scientific advances, students need to learn how to examine the social context of medicine and acquire tools for understanding how science informs and is informed by societal deliberations. Studying the history of social medicine and of therapeutic reform in the US should inform many contemporary controversies in medicine.^{18,19}

To be sure, physicians routinely theorize about the social nature of medicine without the benefit of formal training. But formal training offers the opportunity for deeper knowledge and the ability to apply analytical skills to new situations that arise five, ten and twenty years after completion of medical school. While medical curricula have long sought to address the myriad of scientific and biological factors that challenge the effective implementation of evidence-based medicine, Brown Medical School seeks to build on its longstanding tradition of viewing medicine in its social context. The insights of science studies research will contribute to the development of a curriculum that offers an opportunity for more rigorous examination of the full complexity of the issues that physicians face.

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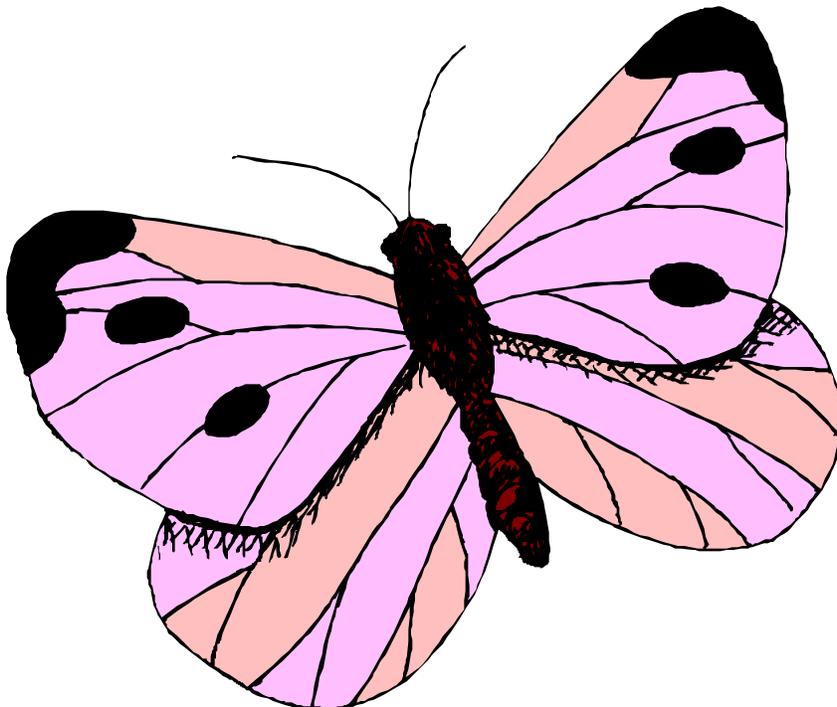
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Medicine Health RHODE ISLAND

VOLUME 89 No. 9 September 2006

PUBLICATION OF THE RHODE ISLAND MEDICAL SOCIETY

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