DEVELOPMENT

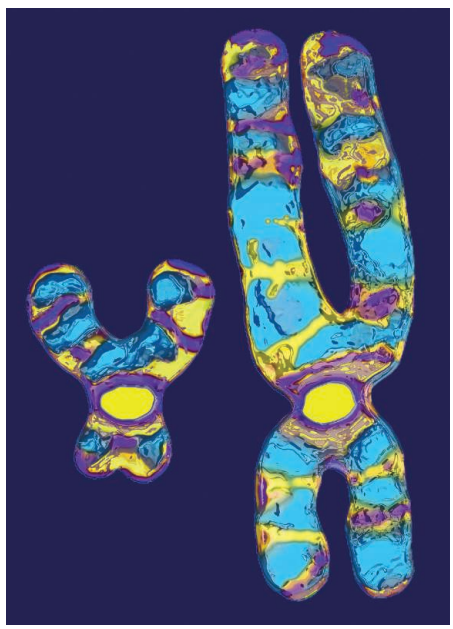
YseX Is a Matter of Concern Rather Than a Matter of Fact

Amade M'charek

The self-evidence and power of the X and Y chromosomes in science and society cannot be overestimated. As a binary couple they line up with other familiar biological categories such as eggs and sperm or estrogen and androgen, and increasingly they've come to stand for females and males. However, what if one did not take them as a matter of fact and instead asked how X and Y came to stand for female and male. What does it take to sex these chromosomes? Such questions refer not so much to the bodies in which these chromosomes are found but to the scientific practices that study them. Making the work of science visible, demonstrating how morals and values are part and parcel of the epistemology of science, means understanding the objects of science as "matters of concern" (*1*)—objects that require care and deserve density.

Historian of science Sarah S. Richardson (Harvard University) has taken this demonstration as her very task. In her erudite and well-balanced *Sex Itself*, she "examines the interaction between cultural gender norms and genetic theories of sex from the beginning of the twentieth century to the present postgenomic age." Richardson takes issue with the perpetual reductionist view on sex differences. Perplexed by the suggestion made in 2005 that genetic differences between men and women are larger than those between humans and chimpanzees, she meticulously demonstrates how the genetics of sex has been modeled on alleged and often rehearsed gender distinctions between men and women. But she does more. Richardson skillfully demonstrates how instrumental sex differences have been in the development of genetics. For example, she shows how the sex chromosomes were a key aspect in developing the chromosomal theory of inheritance and paving the way for experimental studies of gene mutations and genomic organization. The book includes several case studies that help us to understand the history of genetics in general.

Sex Itself consists of four parts. In three early chapters, Richardson examines the recognition of sex chromosomes in the early 20th century and their emergence in the context of chromosome mapping and the Mendelian theory of inheritance. She surveys the terminology (such as heterochromosomes, accessory chromosome, and sex chromosome) and makes visible the guardedness of geneticists to reducing sex determination to these chromosomes. Thomas Hunt Morgan, from whom she derives her title, preferred to say "sex factors on the chromosomes." She then discusses how the arrival of sex hormones provided sex chromosomes with a strong ally. They allowed for "a simple two-tiered model of sexual development, with genes as the initiators and sex hormones as the dominant agent of sexual differentiation." Richardson argues that hormone science thus "helped to constitute and solidify the 'sex chromosome.'"



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Sex Itself
The Search for Male and Female in the Human Genome

by Sarah S. Richardson
University of Chicago Press, Chicago, 2013. 319 pp. $45, £31.50. ISBN 9780226084688.

Richardson opens her second line of argument by analyzing the gender stereotypes that contributed to the sexing of the chromosomes and the identification of the Y with males and the X with females. While intelligent men such as Brian Sykes and Craig Venter ascribe much power to their Y chromosomes, "the vessel of manhood" (*2*), by contrast Richardson locates that power in a deeply gendered history of genetics. To that end, she examines a classic case of scientific error, the so-called "XYY supermale syndrome" of the 1960s and 1970s. Based on the speculation that the Y chromosome might contain some male traits, XYY males were viewed as having a double dose of maleness. Flawed research characterized these men as more sexual and aggressive than men who carried a single Y. Thus while XX and XY stood for the phenotypic difference between females and males, XYY hinted at the behavior of males. This case mirrors X-mosaicism theories of female biology and behavior, which Richardson takes up next.

X-mosaicism has been cast as revealing huge differences between males and females and as explaining ascribed behavioral traits of women (e.g., complicated, inconsistent, and unpredictable). Whereas mosaic X inactivation is constantly presented as a necessary essential female trait (for example, in studies of the incidence of autoimmunity), Richardson argues that these studies fail to take the biological context into account. Doing so reveals that X inactivation does not make females more female, but more like males. It "serves to equalize X dosage between males and females, so that the cells of *both* sexes are functionally monosomic for X-linked genes."

In her third argumentative strand, Richardson raises important questions of whether and how feminist scholarship has contributed to the science of sex. The case of sex determination proves to be an excellent example. Richardson reports on the race to locate the male sex-determining gene on the Y chromosome and the subsequent growing dismay that the *SRY* gene may not be in control. Rejecting the assumption that females were the result of a passive sex-determining pathway, feminist scientists began in the 1990s to critique the notion of the "master gene" as well as Y chromosome–centered research in sex determination. Jennifer Graves and other leading researchers argued that a gendered view such as the "dominant Y" with masculine qualities had geneticists believing that *SRY* is an activator and ignoring the fact that it could be an inhibitor or "a spoiler that turns off genes" (*3*). By the early 2000s, the notion of the master gene faded away to make room for the complexity of sex determination and the view that both male and female pathways played active roles therein. As Richardson argues, these shifts cannot be fully explained by feminist interventions, but gender criti-

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cism did actively interact with the research on sex determination.

In a contrasting case of the "vanishing Y" and the debate over whether the Y chromosome is gene-rich or almost dying out, Richardson zooms in on the ways gendered notions do not merely play a role in media debate. They are part and parcel of the research questions, design, and knowledge that comes out of laboratories. As there is no way of being gender neutral, we had better acknowledge and critically reflect on gender in genetics.

In the concluding chapters, Richardson attends to the genomic era and its effect on sex science. She offers reflections on the previous cases and prognoses focused on potential risks involved in the genomization of sex research. Like many scholars studying the social aspects of genomics, she voices concerns about the ways genomic science is reifying differences among people. She quite correctly notes that these concerns have been especially attended to in studies of the implications of genomics on race and racism, whereas little ink has been spilled on the reification of sex differences. Thus the urgent need for *Sex Itself*. Not simply an account of the effect of gender on genetics, it provides us with tools to think of the possibility of a gender-critical genetics.

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ENVIRONMENTAL LAW

The Case for a Public "Trust"

Rena Steinzor

Heaven only knows it is way past time for us to stop talking about whether climate change is the gravest threat that has ever confronted humankind while the shrill voices of a tiny minority insist nothing is wrong. Instead, the governments of all countries should be engaged in the most serious possible debate over how to mitigate and adapt to the effects humans have had on climate. The reasons that we have not reached this crucial phase are complicated. At the very least, they involve the myopic entitlement of developed nations and developing nations' desperate efforts to catch up. Our paralysis arises from the limits of our psychology and the constraints of our political systems; both seem entrenched in their commitment to preserving stability by maintaining the status quo. To the extent, though, that the United States legal system in and of itself frustrates an effective response, Mary Christina Wood's *Nature's Trust* makes a discrete contribution to the search for climate change solutions by rejecting dominant paradigms out of hand. Instead Wood (University of Oregon School of Law) urges the courts to pick up the isolated, tenuous threads of the "public trust" doctrine and use them to compel the executive and legislative branches to embrace the idea that all natural resources (including Earth's atmosphere) cannot be used in any way that exacerbates climate change.

The public trust, envisioned as the pooled ownership over natural resources possessed by all the country's citizens regardless of previous concepts of private property, would reject any land use that does not preserve the ability of nature to replenish itself. The doctrine would drive private rights into the background, supplanting them on the rationale that cutting back human production of greenhouse gases is of overriding importance and that nature does not have the capacity to safely absorb the quantities we have already emitted.

The nature's trust is the antithesis of what the author dubs "predatory capitalism." If, as Wood argues, Congress, the Executive Branch, polluting industries, and national environmental groups are hopelessly corrupt, the advancement of the doctrine would depend on a widespread grassroots rebellion and the independent thinking of the courts. The author is optimistic about the development of a mass movement because "assertions of commonwealth thinking now appear across the United States" in the form of "community gardens, inner-city farms, and urban homesteads." She acknowledges that it will take "enormous numbers of citizens to grow these seeds of change into a land revolution so strong that it displaces the market-driven system of land exploitation." But, she assures us, "those who truly cherish private property rights will find their calling in this land-as-commonwealth frame, as they will come to learn that their liberty and quiet enjoyment of land depends, first and foremost, on Earth's life-sustaining ecological endowment."

I must confess to wondering about the people who are unlikely to renounce private property: those grown wealthy and comfortable on the basis of land exploitation. Presumably, they will be overwhelmed and then reformed by everyone else, including those who have never felt secure enough to own anything. But because Wood is a zealot in the best sense of the word—possessing enormous energy, passion, and conviction that she has discovered the one true path forward—she does not dwell for long on the efforts the former will make to resist her. Nor does she acknowledge in any realistic way the privations we would endure to make the radical transition she envisions. Of course, she might respond to these critiques by asking whether the specter of unmitigated climate change is acceptable—and, of course, it is not. Yet the polarization of these alternatives undermines the book's credibility. How a mass movement would be sustainable if fed only by Wood's idealism, without preparing for the sacrifices that are inevitable, is far from clear.

Nature's Trust: Environmental Law for a New Ecological Age

by Mary Christina Wood

Cambridge University Press, New York, 2013. 460 pp. $115, £65. ISBN 9780521195133. Paper, $45, £27.99. ISBN 9780521144117.

Nature's Trust is hefty, running over 450 pages, and its primary value will be to lawyers who need a compendium of legal precedents to help them formulate test cases. A second audience might be composed of people who are not quite convinced about the vagaries of government regarding this issue. Wood effectively stokes rage against those in power—a white-hot phenomenon akin to road rage, at least with respect to Congress and the expansive Executive Branch. Oddly, she seems to have more confidence in the courts to adopt the nature's trust position, even though federal judges are not elected by anyone, including the enormous numbers of citizens she hopes will see the light.

Nonetheless, as jacket blurbs by Bill McKibben, James Hansen, and Ross Gelbspan express quite well, *Nature's Trust* is both ambitious and original. For anyone interested in using the legal system to prod action, Wood has made a major contribution.

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