1 • *Anne Fausto-Sterling*

DUELING DUALISMS

DISCUSSION QUESTIONS

1. Why does Fausto-Sterling argue that imposing categories of sex and gender are socially, not scientifically, driven?
2. How do contemporary categories of sexual identity complicate our understanding of historical findings of same-sex sexual behavior?
3. Why does the sex/gender dualism limit feminist analysis, according to Fausto-Sterling?
4. What limitations are there in using developmental systems theory?

MALE OR FEMALE?

In the rush and excitement of leaving for the 1988 Olympics, Maria Patiño, Spain's top woman hurdler, forgot the requisite doctor's certificate stating, for the benefit of Olympic officials, what seemed patently obvious to anyone who looked at her: she was female. But the International Olympic Committee (IOC) had anticipated the possibility that some competitors would forget their certificates of femininity. Patiño had only to report to the "femininity control head office," scrape some cells off the side of her cheek, and all would be in order—or so she thought.

A few hours after the cheek scraping she got a call. Something was wrong. She went for a second examination, but the doctors were mum. Then, as she rode to the Olympic stadium to start her first race, track officials broke the news: she had failed the sex test. She may have looked like a woman, had a woman's strength, and never had reason to suspect that she wasn't a woman, but the examinations revealed that Patiño's cells sported a Y chromosome, and that her labia hid testes within. Furthermore, she had neither ovaries nor a uterus. According to the IOC's definition, Patiño was not a woman. She was barred from competing on Spain's Olympic team.

Spanish athletic officials told Patiño to fake an injury and withdraw without publicizing the embarrassing facts. When she refused, the European press heard about it and the secret was out. Within months after returning to Spain, Patiño's life fell apart. Spanish officials stripped her of past titles and barred her from further competition. Her boyfriend deserted her. She was evicted from the national athletic residence, her scholarship was revoked, and suddenly she had to struggle to make a living. The national press had a field day at her expense. As she later said, "I was erased from the map, as if I had never existed. I gave twelve years to sports."

Down but not out, Patiño spent thousands of dollars consulting doctors about her situation. They explained that she had been born with a condition called *androgen insensitivity.* This meant that, although she had a Y chromosome and her testes made plenty

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of testosterone, her cells couldn't detect this masculinizing hormone. As a result, her body had never developed male characteristics. But at puberty her testes produced estrogen (as do the testes of all men), which, because of her body's inability to respond to its testosterone, caused her breasts to grow, her waist to narrow, and her hips to widen. Despite a Y chromosome and testes, she had grown up as a female and developed a female form.

Patiño resolved to fight the IOC ruling. "I knew I was a woman," she insisted to one reporter, "in the eyes of medicine, God and most of all, in my own eyes." She enlisted the help of Alison Carlson, a former Stanford University tennis player and biologist opposed to sex testing, and together they began to build a case. Patiño underwent examinations in which doctors "checked out her pelvic structures and shoulders to decide if she was feminine enough to compete." After two and a half years the International Amateur Athletic Federation (IAAF) reinstated her, and by 1992 Patiño had rejoined the Spanish Olympic squad, going down in history as the first woman ever to challenge sex testing for female athletes. Despite the IAAF's flexibility, however, the IOC has remained adamant: even if looking for a Y chromosome wasn't the most scientific approach to sex testing, testing *must* be done.

The members of the International Olympic Committee remain convinced that a more scientifically advanced method of testing will be able to reveal the true sex of each athlete. But why is the IOC so worried about sex testing? In part, IOC rules reflect cold war political anxieties: during the 1968 Olympics, for instance, the IOC instituted "scientific" sex testing in response to rumors that some Eastern European competitors were trying to win glory for the Communist cause by cheating—having men masquerade as women to gain unfair advantage. The only known case of a man infiltrating women's competition occurred back in 1936 when Hermann Ratjen, a member of the Nazi Youth, entered the women's high-jump competition as "Dora." His maleness didn't translate into much of an advantage: he made it to the finals, but came in fourth, behind three women.

Although the IOC didn't require modern chromosome screening in the interest of international politics until 1968, it had long policed the sex of Olympic competitors in an effort to mollify those who feared that women's participation in sports threatened to turn them into manly creatures. In 1912, Pierre de Coubertin, founder of the modern Olympics (from which women were originally banned), argued that "women's sports are all against the law of nature." If women were *by nature* not athletic competitors, then what was one to make of the sportswomen who pushed their way onto the Olympic scene? Olympic officials rushed to certify the femininity of the women they let through the door, because the very act of competing seemed to imply that they could not be true women. In the context of gender politics, employing sex police made a great deal of sense.

SEX OR GENDER?

Until 1968 female Olympic competitors were often asked to parade naked in front of a board of examiners. Breasts and a vagina were all one needed to certify one's femininity. But many women complained that this procedure was degrading. Partly because such complaints mounted, the IOC decided to make use of the modern "scientific" chromosome test. The problem, though, is that this test, and the more sophisticated polymerase chain reaction to detect small regions of DNA associated with testes development that the IOC uses today, cannot do the work the IOC wants it to do. A body's sex is simply too complex. There is no either/or. Rather, there are shades of difference.... One of the major claims I make in this book is that labeling someone a man or a woman is a social decision. We may use scientific knowledge to help us make the decision, but only our beliefs about gender—not science—can define our sex. Furthermore, our beliefs about gender affect what kinds of knowledge scientists produce about sex in the first place.

Over the last few decades, the relation between *social expression* of masculinity and femininity and their *physical underpinnings* has been hotly debated in scientific and social arenas. In 1972 the sexologists John Money and Anke Ehrhardt popularized the idea that sex and gender are separate categories.

Sex, they argued, refers to physical attributes and is anatomically and physiologically determined. *Gender* they saw as a psychological transformation of the self—the internal conviction that one is either male or female (gender identity) and the behavioral expressions of that conviction.

Meanwhile, the second-wave feminists of the 1970s also argued that sex is distinct from gender—that social institutions, themselves designed to perpetuate gender inequality, produce most of the differences between men and women. Feminists argued that although men's and women's bodies serve different reproductive functions, few other sex differences come with the territory, unchangeable by life's vicissitudes. If girls couldn't learn math as easily as boys, the problem wasn't built into their brains. The difficulty resulted from gender norms—different expectations and opportunities for boys and girls. Having a penis rather than a vagina is a sex difference. Boys performing better than girls on math exams is a gender difference. Presumably, the latter could be changed even if the former could not.

Money, Ehrhardt, and feminists set the terms so that *sex* represented the body's anatomy and physiological workings and *gender* represented social forces that molded behavior. Feminists did not question the realm of physical sex; it was the psychological and cultural meanings of these differences—gender—that was at issue. But feminist definitions of sex and gender left open the possibility that male/female differences in cognitive function and behavior could *result* from sex differences, and thus, in some circles, the matter of sex versus gender became a debate about how "hardwired" intelligence and a variety of behaviors are in the brain, while in others there seemed no choice but to ignore many of the findings of contemporary neurobiology.

In ceding the territory of physical sex, feminists left themselves open to renewed attack on the grounds of biological difference. Indeed, feminism has encountered massive resistance from the domains of biology, medicine, and significant components of social science. Despite many positive social changes, the 1970s optimism that women would achieve full economic and social equality once gender inequity was addressed in the social sphere has faded in the face of a seemingly recalcitrant inequality. All of which has prompted feminist scholars, on the one hand, to question the notion of sex itself, while on the other to deepen their inquiry into what we might mean by words such as *gender, culture,* and *experience.* The anthropologist Henrietta A. Moore, for example, argues against reducing accounts of gender, culture, and experience to their "linguistic and cognitive elements." In this book . . . I argue, as does Moore, that "what is at issue is the embodied nature of identities and experience. Experience . . . is not individual and fixed, but irredeemably social and processual."

Our bodies are too complex to provide clear-cut answers about sexual difference. The more we look for a simple physical basis for "sex," the more it becomes clear that "sex" is not a pure physical category. What bodily signals and functions we define as male or female come already entangled in our ideas about gender. Consider the problem facing the International Olympic Committee. Committee members want to decide definitively who is male and who is female. But how? If Pierre de Coubertin were still around, the answer would be simple: anybody who desired to compete could not, by definition, be a female. But those days are past. Could the IOC use muscle strength as some measure of sex? In some cases. But the strengths of men and women, especially highly trained athletes, overlap. (Remember that three women beat Hermann Ratjen's high jump.) And although Maria Patiño fit a commonsense definition of femininity in terms of looks and strength, she also had testes and a Y chromosome. But why should these be the deciding factors?

The IOC may use chromosome or DNA tests or inspection of the breasts and genitals to ascertain the sex of a competitor, but doctors faced with uncertainty about a child's sex use different criteria. They focus primarily on reproductive abilities (in the case of a potential girl) or penis size (in the case of a prospective boy). If a child is born with two X chromosomes, oviducts, ovaries, and a uterus on the inside, but a penis and scrotum on the outside, for instance, is the child a boy or a girl? Most doctors declare the child a girl, despite the penis, because of her potential to give birth, and intervene using surgery and hormones to carry out the decision. Choosing which criteria to use in determining sex, and choosing to make the determination at all, are social decisions for which scientists can offer no absolute guidelines.

REAL OR CONSTRUCTED?

I enter the debates about sex and gender as a biologist and a social activist. Daily, my life weaves in and out of a web of conflict over the politics of sexuality and the making and using of knowledge about the biology of human behavior. The central tenet of this book is that truths about human sexuality created by scholars in general and by biologists in particular are one component of political, social, and moral struggles about our cultures and economies. At the same time, components of our political, social, and moral struggles become, quite literally, embodied, incorporated into our very physiological being. My intent is to show how these mutually dependent claims work, in part by addressing such issues as how—through their daily lives, experiments, and medical practices—scientists create truths about sexuality; how our bodies incorporate and confirm these truths; and how these truths, sculpted by the social milieu in which biologists practice their trade, in turn refashion our cultural environment.

My take on the problem is idiosyncratic, and for good reason. Intellectually, I inhabit three seemingly incompatible worlds. In my home department I interact with molecular biologists, scientists who examine living beings from the perspective of the molecules from which they are built. They describe a microscopic world in which cause and effect remain mostly inside a single cell. Molecular biologists rarely think about interacting organs within an individual body, and even less often about how a body bounded by skin interacts with the world on the other side of the skin. Their vision of what makes an organism tick is decidedly bottom up, small to large, inside to outside.

I also interact with a virtual community—a group of scholars drawn together by a common interest in sexuality—and connected by something called a listserve. On a listserve, one can pose questions, think out loud, comment on relevant news items, argue about theories of human sexuality, and report the latest research findings. The comments are read by a group of people hooked together via electronic mail. My listserve (which I call "Loveweb") consists of a diverse group of scholars—psychologists, animal behaviorists, hormone biologists, sociologists, anthropologists, and philosophers. Although many points of view coexist in this group, the vocal majority favor body-based, biological explanations of human sexual behavior. Loveweb members have technical names for preferences they believe to be immutable. In addition to homosexual, heterosexual, and bisexual, for example, they speak of *hebephilia* (attracted primarily to pubescent girls), *ephebephilia* (aroused by young males in their late teens or early twenties), *pedophilia* (aroused by children), *gynephilia* (aroused by adult women), and *androphilia* (attracted to adult men). Many Loveweb members believe that we acquire our sexual essence before birth and that it unfolds as we grow and develop.

Unlike molecular biologists and Loveweb members, feminist theorists view the body not as essence, but as a bare scaffolding on which discourse and performance build a completely acculturated being. Feminist theorists write persuasively and often imaginatively about the processes by which culture molds and effectively creates the body. Furthermore, they have an eye on politics (writ large), which neither molecular biologists nor Loveweb participants have. Most feminist scholars concern themselves with real-world power relationships. They have often come to their theoretical work because they want to understand (and change) social, political, and economic inequality. Unlike the inhabitants of my other two worlds, feminist theorists reject what Donna Haraway, a leading feminist theoretician, calls "the God-trick"—producing knowledge from above, from a place that denies the individual scholar's location in a real and troubled world. Instead, they understand that all scholarship adds threads to a web that positions racialized bodies, sexes, genders, and preferences in relationship to one another. New or differently spun threads change our relationships, change how we are in the world.

Traveling among these varied intellectual worlds produces more than a little discomfort. When I lurk on Loveweb, I put up with gratuitous feminist-bashing aimed at some mythic feminist who derides biology and seems to have a patently stupid view of how the world works. When I attend feminist conferences, people howl in disbelief at the ideas debated on Loveweb. And the molecular biologists don't think much of either of the other worlds. The questions asked by feminists and Loveweb participants seem too complicated; studying sex in bacteria or yeast is the only way to go.

To my molecular biology, Loveweb, and feminist colleagues, then, I say the following: as a biologist, I believe in the material world. As a scientist, I believe in building specific knowledge by conducting experiments. But as a feminist Witness (in the Quaker sense of the word) and in recent years as a historian, I also believe that what we call "facts" about the living world are not universal truths. Rather, as Haraway writes, they "are rooted in specific histories, practices, languages and peoples." Ever since the field of biology emerged in the United States and Europe at the start of the nineteenth century, it has been bound up in debates over sexual, racial, and national politics. And as our social viewpoints have shifted, so has the science of the body.

Many historians mark the seventeenth and eighteenth centuries as periods of great change in our concepts of sex and sexuality. During this period a notion of legal equality replaced the feudal exercise of arbitrary and violent power given by divine right. As the historian Michel Foucault saw it, society still required some form of discipline. A growing capitalism needed new methods to control the "insertion of bodies into the machinery of production and the adjustment of the phenomena of population to economic processes." Foucault divided this power over living bodies (*bio-power*) into two forms. The first centered on the individual body. The role of many science professionals (including the so-called human sciences—psychology, sociology, and economics) became to optimize and standardize the body's function. In Europe and North America, Foucault's standardized body has, traditionally, been male and Caucasian. And although this book focuses on gender, I regularly discuss the ways in which the ideas of both race and gender emerge from underlying assumptions about the body's physical nature. Understanding how race and gender work—together and independently—helps us learn more about how the social becomes embodied.

Foucault's second form of bio-power—"*a biopolitics of the population*"—emerged during the early nineteenth century as pioneer social scientists began to develop the survey and statistical methods needed to supervise and manage "births and mortality, the level of health, life expectancy and longevity." For Foucault, "discipline" had a double meaning. On the one hand, it implied a form of control or punishment; on the other, it referred to an academic body of knowledge—the discipline of history or biology. The disciplinary knowledge developed in the fields of embryology, endocrinology, surgery, psychology, and biochemistry have encouraged physicians to attempt to control the very gender of the body—including "its capacities, gestures, movements, location and behaviors."

By helping the normal take precedence over the natural, physicians have also contributed to populational biopolitics. We have become, Foucault writes, "a society of normalization." One important mid-twentieth-century sexologist went so far as to name the male and female models in his anatomy text Norma and Normman [*sic*]. Today we see the notion of pathology applied in many settings—from the sick, diseased, or different body, to the single-parent family in the urban ghetto. But imposing a gender norm is socially, not scientifically, driven. The lack of research into the normal distributions of genital anatomy, as well as many surgeons' lack of interest in using such data when they do exist..., clearly illustrate this claim. From the viewpoint of medical practitioners, progress in the handling of intersexuality involves maintaining the normal. Accordingly, there *ought* to be only two boxes: male and female. The knowledge developed by the medical disciplines empowers doctors to maintain a mythology of the normal by changing the intersexual body to fit, as nearly as possible, into one or the other cubbyhole.

One person's medical progress, however, can be another's discipline and control. Intersexuals such as Maria Patiño have unruly—even heretical—bodies. They do not fall naturally into a binary classification; only a surgical shoehorn can put them there. But why should we care if a "woman" (defined as having breasts, a vagina, uterus, ovaries, and menstruation) has a "clitoris" large enough to penetrate the vagina of another woman? Why should we care if there are individuals whose "natural biological equipment" enables them to have sex "naturally" with both men and women? Why must we amputate or surgically hide that "offending shaft" found on an especially large clitoris? The answer: to maintain gender divisions, we must control those bodies that are so unruly as to blur the borders. Since intersexuals quite literally embody both sexes, they weaken claims about sexual difference.

This book reflects a shifting politics of science and of the body. I am deeply committed to the ideas of the modern movements of gay and women's liberation, which argue that the way we traditionally conceptualize gender and sexual identity narrows life's possibilities while perpetuating gender inequality. In order to shift the politics of the body, one must change the politics of science itself. Feminists (and others) who study how scientists create empirical knowledge have begun to reconceptualize the very nature of the scientific process. As with other social arenas, such scholars understand practical, empirical knowledge to be imbued with the social and political issues of its time. I stand at the intersection of these several traditions. On the one hand, scientific and popular debates about intersexuals and homosexuals—bodies that defy the norms of our two-sex system—are deeply intertwined. On the other, beneath the debates about what these bodies mean and how to treat them lie struggles over the meaning of objectivity and the timeless nature of scientific knowledge.

Perhaps nowhere are these struggles more visible than in the biological accounts of what we would today call sexual orientation or sexual preference. Consider, for instance, a television newsmagazine segment about married women who "discovered," often in their forties, that they were lesbian. The show framed the discussion around the idea that a woman who has sex with men must be heterosexual, while a woman who falls in love with another woman must be lesbian. On this show there seemed to be only these two possibilities. Even though the women interviewed had had active and satisfying sex lives with their husbands and produced and raised families, they knew that they must "be" lesbian the minute they found themselves attracted to a woman. Furthermore, they felt it likely that they must always have been lesbian without knowing it.

The show portrayed sexual identity as a fundamental reality: a woman is either inherently heterosexual or inherently lesbian. And the act of coming out as a lesbian can negate an entire lifetime of heterosexual activity! Put this way, the show's depiction of sexuality sounds absurdly oversimplified. And yet, it reflects some of our most deeply held beliefs—so deeply held, in fact, that a great deal of scientific research (on animals as well as humans) is designed around this dichotomous formulation....

Many scholars mark the start of modern scientific studies of human homosexuality with the work of Alfred C. Kinsey and colleagues, first published in 1948. Their surveys of sexual behavior in men and women provided modern sex researchers with a set of categories useful for measuring and analyzing sexual behaviors. For both men and women, they used a rating scale of 0 to 6, with 0 being 100 percent heterosexual, 6 being 100 percent homosexual. (An eighth category—"X"—was for individuals who experienced no erotic attractions or activities.) Although they designed a scale with discrete categories, Kinsey and co-workers stressed that "the reality includes individuals of every intermediate type, lying in a continuum between the two extremes and between each and every category on the scale."

The Kinsey studies offered new categories defined in terms of sexual arousal—especially orgasm—rather than allowing terms such as *affection, marriage,* or *relationship* to contribute to definitions of human sexuality. Sexuality remained an individual characteristic, not something produced within relationships in particular social settings. Exemplifying my claim that with the very act of measuring, scientists can change the social reality they set out to quantify, I note that today Kinsey's categories have taken on a life of their own. Not only do sophisticated gays and lesbians occasionally refer to themselves by a Kinsey number (such as in a personal ad that might begin "tall, muscular Kinsey 6 seeks..."), but many scientific studies use the Kinsey scale to define their study population.

Although many social scientists understand the inadequacy of using the single word *homosexual* to describe same-sex desire, identity, and practice, the linear Kinsey scale still reigns supreme in scholarly work. In studies that search for genetic links to homosexuality, for example, the middle of the Kinsey scale disappears; researchers seek to compare the extreme ends of the spectrum in hopes of maximizing the chance that they will find something of interest. Multidimensional models of homosexuality exist. Fritz Klein, for example, created a grid with seven variables (sexual attraction, sexual behavior, sexual fantasies, emotional preference, social preference, self-identification, hetero/homo lifestyle) superimposed on a time scale (past, present, future). Nevertheless, one research team, reporting on 144 studies of sexual orientation published in the *Journal of Homosexuality* from 1974 to 1993, found that only 10 percent of these studies used a multidimensional scale to assess homosexuality. About 13 percent used a single scale, usually some version of the Kinsey numbers, while the rest used self-identification (33 percent), sexual preference (4 percent), behavior (9 percent), or, most shockingly for an academic publication, never clearly described their methods (31 percent).

Just as these examples from contemporary sociology show that the categories used to define, measure, and analyze human sexual behavior change with time, so too has a recent explosion of scholarship on the social history of human sexuality shown that the social organization and expression of human sexuality are neither timeless nor universal. Historians are just beginning to pry loose information from the historical record, and any new overviews written are sure to differ. . . .

As historians gather information, they also argue about the nature of history itself. The historian David Halperin writes: "The real issue confronting any cultural historian of antiquity, and any critic of contemporary culture, is...how to recover the terms in which the experiences of individuals belonging to past societies were actually constituted." The feminist historian Joan Scott makes a similar argument, suggesting that historians must not assume that the term *experience* contains a self-evident meaning. Instead, they must try to understand the workings of the complex and changing processes "by which identities are ascribed, resisted, or embraced and 'to note' which processes themselves are unremarked and indeed achieve their effect because they are not noticed."

For example, in her book *The Woman Beneath the Skin,* the historian of science Barbara Duden describes coming upon an eight-volume medical text. Written in the eighteenth century by a practicing physician, the books describe over 1,800 cases involving diseases of women. Duden found herself unable to use twentieth-century medical terms to reconstruct what illnesses these women had. Instead she noticed "bits and pieces of medical theories that would have been circulating, combined with elements from popular culture; self-evident bodily perceptions appear alongside things that struck [her] as utterly improbable." Duden describes her intellectual anguish as she became more and more determined to understand these eighteenth-century German female bodies on their own terms:

> To gain access to the inner, invisible bodily existence of these ailing women, I had to venture across the boundary that separates...the inner body beneath the skin, from the world around it...the body and its environment have been consigned to opposing realms: on the one side are the body, nature, and biology, stable and unchanging phenomena; on the other side are the social environment and history, realms of constant change. With the drawing of this boundary the body was expelled from history.

In contrast to Duden's anguish, many historians of sexuality have leaped enthusiastically into their new field, debating with one another as they dug into their freshly discovered resources. They delighted in shocking the reader with sentences such as: "The year 1992 marked the 100th anniversary of heterosexuality in America" and "From 1700–1900 the citizens of London made a transition from three sexes to four genders." What do historians mean by such statements? Their essential point is that for as far back as one can gather historical evidence (from primitive artwork to the written word), humans have engaged in a variety of sexual practices, but that this sexual activity is bound to historical contexts. That is, sexual practices and societal understandings of them vary not only across cultures but over time as well.

The social scientist Mary McIntosh's 1968 article, "The Homosexual Role," provided the touchstone that pushed scholars to consider sexuality as a historical phenomenon. Most Westerners, she pointed out, assumed that people's sexuality could be classified two or three ways: homosexual, heterosexual, and bisexual. McIntosh argued that this perspective wasn't very informative. A static view of homosexuality as a timeless, physical trait, for instance, didn't tell us much about why different cultures defined homosexuality differently, or why homosexuality seemed more acceptable in certain times and places than in others. An important corollary to McIntosh's insistence on a history of homosexuality is that heterosexuality, and indeed all forms of human sexuality, have a history.

Many scholars embraced McIntosh's challenge to give human sexual expression a past. But disagreement about the implications of this past abounds. The authors of books such as *Gay American History* and *Surpassing the Love of Men* eagerly searched the past for role models that could offer psychological affirmation to members of the nascent gay liberation movement. Just as with the initial impulses of the women's movement to find heroines worthy of emulation, early "gay" histories looked to the past in order to make a case for social change in the present. Homosexuality, they argued, has always been with us; we should finally bring it into the cultural mainstream.

The initial euphoria induced by these scholars' discovery of a gay past was soon complicated by heated debates about the meanings and functions of history. Were our contemporary categories of sexuality inappropriate for analyzing different times and places? If gay people, in the present-day sense, had always existed, did that mean that the condition is inherited in some portion of the population? Could the fact that historians found evidence of homosexuality in whatever era they studied be seen as evidence that homosexuality is a biologically determined trait? Or could history only show us how cultures organize sexual expression differently in particular times and places? Some found the latter possibility liberating. They maintained that behaviors that might seem to be constant actually had totally different meanings in different times and places. Could the apparent fact that in ancient Greece, love between older and younger men was an expected component of the development of free male citizens mean that biology had nothing to do with human sexual expression? If history helped prove that sexuality was a social construction, it could also show how we had arrived at our present arrangements and, most important, offer insights into how to achieve the social and political change for which the gay liberation movement was battling.

Many historians believe that our modern concepts of sex and desire first made their appearance in the nineteenth century. Some point symbolically to the year 1869, when a German legal reformer seeking to change antisodomy laws first publicly used the word *homosexuality.* Merely coining a new term did not magically create twentieth-century categories of sexuality, but the moment does seem to mark the beginning of their gradual emergence. It was during those years that physicians began to publish case reports of homosexuality—the first in 1869 in a German publication specializing in psychiatric and nervous illness. As the scientific literature grew, specialists emerged to collect and systematize the narratives. The now-classic works of Krafft-Ebing and Havelock Ellis completed the transfer of homosexual behaviors from publicly accessible activities to ones managed at least in part by medicine.

The emerging definitions of homo- and heterosexuality were built on a two-sex model of masculinity and femininity. The Victorians, for example, contrasted the sexually aggressive male with the sexually indifferent female. But this created a mystery. If only men felt active desire, how could two women develop a mutual sexual interest? The answer: one of the women had to be an *invert,* someone with markedly masculine attributes. This same logic applied to male homosexuals, who were seen as more effeminate than heterosexual men. [T]hese concepts linger in late-twentieth-century studies of homosexual behaviors in rodents. A lesbian rat is she who mounts; a gay male rat is he who responds to being mounted.

In ancient Greece, males who engaged in same-sex acts changed, as they aged, from feminine to masculine roles. In contrast, by the early part of the twentieth century, someone engaging in homosexual acts *was,* like the married lesbians on the TV news show, a homosexual, a person constitutionally disposed to homosexuality. Historians attribute the emergence of this new homosexual body to widespread social, demographic, and economic changes occurring in the nineteenth century. In America, many men and eventually some women who had in previous generations remained on the family farm found urban spaces in which to gather. Away from the family's eyes, they were freer to pursue their sexual interests. Men seeking same-sex interactions gathered in bars or in particular outdoor spots; as their presence became more obvious, so too did attempts to control their behavior. In response to police and moral reformers, self-consciousness about their sexual behaviors emerged—a budding sense of identity.

This forming identity contributed to its own medical rendering. Men (and later women) who identified themselves as homosexual now sought medical help and understanding. And as medical reports proliferated, homosexuals used them to paint their own self-descriptions. "By helping to give large numbers of people an identity and a name, medicine also helped to shape these people's experience and change their behavior, creating not just a new disease, but a new species of person, 'the modern homosexual.'"

Homosexuality may have been born in 1869, but the modern heterosexual required another decade of gestation. In Germany in 1880 the word *heterosexual* made its public debut in a work defending homosexuality. In 1892, heterosexuality crossed the ocean to America, where, after some period of debate, a consensus developed among medical men that "heterosexual referred to a normal 'other-sex' Eros. [The doctors] proclaimed a new heterosexual separatism—an erotic apartheid that forcefully segregated the sex normals from the sex perverts."

Through the 1930s the concept of heterosexuality fought its way into the public consciousness, and by World War II, heterosexuality seemed a permanent feature of the sexual landscape. Now, the concept has come under heavy fire. Feminists daily challenge the two-sex model, while a strongly self-identified gay and lesbian community demands the right to be thoroughly normal. Transsexuals, transgendered people, and a blossoming organization of intersexuals all have formed social movements to include diverse sexual beings under the umbrella of normality.

The historians whose work I've just recounted emphasize discontinuity. They believe that looking "for general laws about sexuality and its historical evolution will be defeated by the sheer variety of past thought and behavior." But some disagree. The historian John Boswell, for instance, applies Kinsey's classification scheme to ancient Greece. How the Greeks interpreted the *molle* (feminine man) or the *tribade* (masculine woman), in Boswell's view, did not necessarily matter. The existence of these two categories, which Boswell might consider to be Kinsey 6s, shows that homosexual bodies or essences have existed across the centuries. Boswell acknowledges that humans organized and interpreted sexual behaviors differently in different historical eras. But he suggests that a similar range of bodies predisposed to particular sexual activities existed then and now. "Constructions and context shape the articulation of sexuality," he insists, "but they do not efface recognition of erotic preference as a potential category." Boswell regards sexuality as "real" rather than "socially constructed." While Halperin sees desire as a product of cultural norms, Boswell implies we are quite possibly born with particular sexual inclinations wired into our bodies. Growth, development, and the acquisition of culture show us how to express our inborn desires, he argues, but do not wholly create them.

Scholars have yet to resolve the debate about the implications of a history of sexuality. The historian Robert Nye compares historians to anthropologists. Both groups catalogue "curious habits and beliefs" and try, Nye writes, "to find in them some common pattern of resemblance." But what we conclude about people's past experiences depends to a large extent on how much we believe that our categories of analysis transcend time and place. Suppose for a minute that we had a few time-traveling clones—genetically identical humans living in ancient Greece, in seventeenth-century Europe, and in the contemporary United States. Boswell would say that if a particular clone was homosexual in ancient Greece, he would also be homosexual in the seventeenth century or today. The fact that gender structures differ in different times and places might shape the invert's defiance, but would not create it. Halperin, however, would argue that there is no guarantee that the modern clone of an ancient Greek heterosexual would also be heterosexual.... The identical body might express different forms of desire in different eras.

There is no way to decide whose interpretation is right. Despite surface similarities, we cannot know whether yesterday's *tribade* is today's butch or whether the middle-aged Greek male lover is today's pedophile.

NATURE OR NURTURE?

While historians have looked to the past for evidence of whether human sexuality is inborn or socially constructed, anthropologists have pursued the same questions in their studies of sexual behaviors, roles, and expressions found in contemporary cultures around the globe. Those examining data from a wide variety of non-Western cultures have discerned two general patterns. Some cultures, like our own, define a permanent role for those who engage in same-sex coupling—"institutionalized homosexuality," in Mary McIntosh's terminology.

In contrast are those societies in which all adolescent boys, as part of an expected growth process, engage in genital acts with older men. These associations may be brief and highly ritualized or may last for several years. Here oral-genital contact between two males does not signify a permanent condition or special category of being. What defines sexual expression in such cultures is not so much the sex of one's partner as the age and status of the person with whom one couples.

Anthropologists study vastly differing peoples and cultures with two goals in mind. First, they want to understand human variation—the diverse ways in which human beings organize society in order to eat and reproduce. Second, many anthropologists look for human universals. Like historians, anthropologists are divided about what information drawn from any one culture can tell them about another, or whether underlying differences in the expression of sexuality matter more or less than apparent commonalities. In the midst of such disagreements, anthropological data are, nevertheless, often deployed in arguments about the nature of human sexual behavior.

The anthropologist Carol Vance writes that the field of anthropology today reflects two contradictory strains of thought. The first she refers to as the "cultural influences model of sexuality," which, even as it emphasizes the importance of culture and learning in the molding of sexual behavior, nevertheless assumes "the bedrock of sexuality... to be universal and biologically determined; in the literature it appears as the 'sex drive' or 'impulse.'" The second approach, Vance says, is to interpret sexuality entirely in terms of social construction. A moderate social constructionist might argue that the same physical act can carry different social meanings in different cultures, while a more radical constructionist might argue that "sexual desire is itself constructed by culture and history from the energies and capacities of the body."

Some social constructionists are interested in uncovering cross-cultural similarities. For instance, the anthropologist Gil Herdt, a moderate constructionist, catalogs four primary cultural approaches to the organization of human sexuality. *Age-structured homosexuality,* such as that found in ancient Greece, also appears in some modern cultures in which adolescent boys go through a developmental period in which they are isolated with older males and perform fellatio on a regular basis. Such acts are understood to be part of the normal process of becoming an adult heterosexual. In *gender-reversed homosexuality,* "same-sex activity involves a reversal of normative sex-role comportment: males dress and act as females, and females dress and behave as males." Herdt used the concept of *role-specialized homosexuality* for cultures that sanction same-sex activity only for people who play a particular social role, such as a shaman. Role-specialized homosexuality contrasts sharply with our own cultural creation: *the modern gay movement.* To declare oneself "gay" in the United States is to adopt an identity and to join a social and sometimes political movement.

Many scholars embraced Herdt's work for providing new ways to think about the status of homosexuality in Europe and America. But although he has provided useful new typologies for the cross-cultural study of sexuality, others argue that Herdt carries with him assumptions that reflect his own culture. The anthropologist Deborah Elliston, for instance, believes that using the term *homosexuality* to describe practices of semen exchange in Melanesian societies "imputes a Western model of sexuality... that relies on Western ideas about gender, erotics and personhood, and that ultimately obscures the meanings that hold for these practices in Melanesia." Elliston complains that Herdt's concept of age-structured sexuality obscures the composition of the category "sexual," and that it is precisely this category that requires clarification to begin with.

When they turn their attention more generally to the relationships between gender and systems of social power, anthropologists face the same sorts of intellectual difficulties when studying "third" genders in other cultures. During the 1970s European and North American feminist activists hoped that anthropologists could provide empirical data to support their political arguments for gender equality. If, somewhere in the world, egalitarian societies existed, wouldn't that imply that our own social structures were not inevitable? Alternatively, what if women in every culture known to humankind had a subordinate status? Didn't such cross-cultural similarity mean, as more than one writer suggested, that women's secondary standing must be biologically ordained?

When feminist anthropologists traveled around the world in search of cultures sporting the banner of equity, they did not return with happy tidings. Most thought, as the feminist anthropologist Sherry Ortner writes, "that men were in some way or other 'the first sex.'" But critiques of these early cross-cultural analyses mounted, and in the 1990s some prominent feminist anthropologists reassessed the issue. The same problem encountered with collecting information by survey emerges in cross-cultural comparisons of social structures. Simply put, anthropologists must invent categories into which they can sort collected information. Inevitably, some of the invented categories involve the anthropologists' own unquestioned axioms of life, what some scholars call "incorrigible propositions." The idea that there are only two sexes is an incorrigible proposition, and so too is the idea that anthropologists would know sexual equality when they saw it.

Ortner thinks that argument about the universality of sexual inequality has continued for more than two decades because anthropologists assumed that each society would be internally consistent, an expectation she now believes to be unreasonable: "no society or culture is totally consistent. Every society/culture has some axes of male prestige and some of female, some of gender equality, and some (sometimes many) axes of prestige that have nothing to do with gender. The problem in the past has been that all of us... were trying to pigeonhole each case." Now she argues instead that "the most interesting thing about any given case is precisely the multiplicity of logics operating, of discourses being spoken, of practices of prestige and power in play." If one attends to the dynamics, the contradictions, and minor themes, Ortner believes, it becomes possible to see both the currently dominant system *and* the potential for minor themes to become major ones.

But feminists, too, have incorrigible propositions, and a central one has been that all cultures, as the Nigerian anthropologist Oyeronke Oyewumi writes, "organize their social world through a perception of human bodies" as male or female. In taking European and North American feminists to task over this proposition, Oyewumi shows how the imposition of a system of gender—in this case, through colonialism followed by scholarly imperialism—can alter our understandings of ethnic and racial difference. In her own detailed analysis of Yoruba culture, Oyewumi finds that relative age is a far more significant social organizer. Yoruba pronouns, for example, do not indicate sex, but rather who is older or younger than the speaker. What they think about how the world works shapes the knowledge that scholars produce about the world. That knowledge, in turn, affects the world at work.

If Yoruba intellectuals had constructed the original scholarship on Yoruba-land, Oyewumi thinks that "seniority would have been privileged over gender." Seeing Yoruba society through the lens of seniority rather than that of gender would have two important effects. First, if Euro-American scholars learned about Nigeria from Yoruba anthropologists, our own belief systems about the universality of gender might change. Eventually, such knowledge might alter our own gender constructs. Second, the articulation of a seniority-based vision of social organization among the Yoruba would, presumably, reinforce such social structures. Oyewumi finds, however, that African scholarship often imports European gender categories. And "by writing about any society through a gendered perspective, scholars necessarily write gender into that society.... Thus scholarship is implicated in the process of gender-formation."

Thus historians and anthropologists disagree about how to interpret human sexuality across cultures and history. Philosophers even dispute the validity of the words *homosexual* and *heterosexual*—the very terms of the argument. But wherever they fall along the social constructionist spectrum, most argue from the assumption that there is a fundamental split between nature and culture, between "real bodies" and their cultural interpretations. I take seriously the ideas of Foucault, Haraway, Scott, and others that our bodily experiences are brought into being by our development in particular cultures and historical periods. But especially as a biologist, I want to make the argument more specific. As we grow and develop, we literally, not just "discursively" (that is, through language and cultural practices), construct our bodies, incorporating experience into our very flesh. To understand this claim, we must erode the distinctions between the physical and the social body.

DUALISMS DENIED

"A devil, a born devil, on whose nature nurture can never stick." So Shakespeare's Prospero denounces Caliban in *The Tempest.* Clearly, questions of nature and nurture have troubled European culture for some time. Euro-American ways of understanding how the world works depend heavily on the use of dualisms—pairs of opposing concepts, objects, or belief systems. This book focuses especially on three of these: sex/gender, nature/nurture, and real/constructed. We usually employ dualisms in some form of hierarchical argument. Prospero complains that nature controls Caliban's behavior and that his, Prospero's, "pains humanely taken" (to civilize Caliban) are to no avail. Human nurture cannot conquer the devil's nature. In the chapters that follow we will encounter relentless intellectual struggle over which element in any particular pair of dualisms should (or is believed to) dominate. But in virtually all cases, I argue that intellectual questions cannot be resolved nor social progress made by reverting to Prospero's complaint. Instead, as I consider discrete moments in the creation of biological knowledge about human sexuality, I look to cut through the Gordian knot of dualistic thought. I propose to modify Halperin's *bon mot* that "sexuality is not a somatic fact, it is a cultural effect," arguing instead that sexuality *is* a somatic fact *created by* a cultural effect.

Why worry about using dualisms to parse the world? I agree with the philosopher Val Plumwood, who argues that their use makes invisible the interdependencies of each pair. This relationship enables sets of pairs to map onto each other. Consider an extract of Plumwood's list:

Reason	Nature
Male	Female
Mind	Body
Master	Slave
Freedom	Necessity (nature)
Human	Nature (nonhuman)
Civilized	Primitive
Production	Reproduction
Self	Other

In everyday use, the sets of associations on each side of the list often run together. "Culture," Plumwood writes, accumulates these dualisms as a store of weapons "which can be mined, refined and redeployed. Old oppressions stored as dualisms facilitate and break the path for new ones." For this reason, even though my focus is on gender, I do not hesitate to point out occasions in which the constructs and ideology of race intersect with those of gender.

Ultimately, the sex/gender dualism limits feminist analysis. The term *gender,* placed in a dichotomy, necessarily excludes biology. As the feminist theorist Elizabeth Wilson writes: "Feminist critiques of the stomach or hormonal structure . . . have been rendered unthinkable." . . . Such critiques remain unthinkable because of the real/constructed divide (sometimes formulated as a division between nature and culture), in which many map the knowledge of the real onto the domain of science (equating the constructed with the cultural). Dichotomous formulations from feminists and nonfeminists alike conspire to make a sociocultural analysis of the body seem impossible.

Some feminist theorists, especially during the last decade, have tried—with varying degrees of success—to create a nondualistic account of the body. Judith Butler, for example, tries to reclaim the material body for feminist thought. Why, she wonders, has the idea of materiality come to signify that which is irreducible, that which can support construction but cannot itself be constructed? We have, Butler says (and I agree), to talk about the material body. There *are* hormones, genes, prostates, uteri, and other body parts and physiologies that we use to differentiate male from female, that become part of the ground from which varieties of sexual experience and desire emerge. Furthermore, variations in each of these aspects of physiology profoundly affect an individual's experience of gender and sexuality. But every time we try to return to the body as something that exists prior to socialization, prior to discourse about male and female, Butler writes, "we discover that matter is fully sedimented with discourses on sex and sexuality that prefigure and constrain the uses to which that term can be put."

Western notions of matter and bodily materiality, Butler argues, have been constructed through a "gendered matrix." That classical philosophers associated femininity with materiality can be seen in the origins of the word itself. "Matter" derived from *mater* and *matrix,* referring to the womb and problems of reproduction. In both Greek and Latin, according to Butler, matter was not understood to be a blank slate awaiting the application of external meaning. "The matrix is a . . . formative principle which inaugurates and informs a development of some organism or object . . . for Aristotle, 'matter is potentiality, form actuality.' . . . In reproduction women are said to contribute the matter, men the form." As Butler notes, the title of her book, *Bodies That Matter,* is a well-thought-out pun. To be material is to speak about the process of materialization. And if viewpoints about sex and sexuality are already embedded in our philosophical concepts of how matter forms into bodies, the matter of bodies cannot form a neutral, pre-existing ground from which to understand the origins of sexual difference.

Since matter already contains notions of gender and sexuality, it cannot be a neutral recourse on which to build "scientific" or "objective" theories of sexual development and differentiation. At the same time, we have to acknowledge and use aspects of materiality "that pertain to the body." "The domains of biology, anatomy, physiology, hormonal and chemical composition, illness, age, weight, metabolism, life and death" cannot "be denied." The critical theorist Bernice Hausman concretizes this point in her discussion of surgical technologies available for creating male-to-female versus female-to-male transsexual bodies. "The differences," she writes, "between vagina and penis are not merely ideological. Any attempt to engage and decode the semiotics of sex... must acknowledge that these physiological signifiers have functions in the real that will escape... their function in the symbolic system."

To talk about human sexuality requires a notion of the material. Yet the idea of the material comes to us already tainted, containing within it pre-existing ideas about sexual difference. Butler suggests that we look at the body as a system that simultaneously produces and is produced by social meanings, just as any biological organism always results from the combined and simultaneous actions of nature and nurture.

Unlike Butler, the feminist philosopher Elizabeth Grosz allows some biological processes a status that pre-exists their meaning. She believes that biological instincts or drives provide a kind of raw material for the development of sexuality. But raw materials are never enough. They must be provided with a set of meanings, "a network of desires" that organize the meanings and consciousness of the child's bodily functions. This claim becomes clear if one follows the stories of so-called wild children raised without human constraints or the inculcation of meaning. Such children acquire neither language nor sexual drive. While their bodies provided the raw materials, without a human social setting the clay could not be molded into recognizable psychic form. Without human sociality, human sexuality cannot develop. Grosz tries to understand how human sociality and meaning that clearly originate outside the body end up incorporated into its physiological demeanor and both unconscious and conscious behaviors.

Some concrete examples will help illustrate. A tiny gray-haired woman, well into her ninth decade, peers into the mirror at her wrinkled face. "Who *is* that woman?" she wonders. Her mind's image of her body does not synchronize with the mirror's reflection. Her daughter, now in her mid-fifties, tries to remember that unless she thinks about using her leg muscles instead of her knee joint, going up and down the stairs will be painful. (Eventually she will acquire a new kinesic habit and dispense with conscious thought about the matter.) Both women are readjusting the visual and kinesic components of their body image, formed on the basis of past information, but always a bit out of date with the current physical body. How do such readjustments occur, and how do our earliest body images form in the first place? Here we need the concept of the psyche, a place where two-way translations between the mind and the body take place—a United Nations, as it were, of bodies and experiences.

In *Volatile Bodies,* Elizabeth Grosz considers how the body and the mind come into being together. To facilitate her project, she invokes the image of a Möbius strip as a metaphor for the psyche. The Möbius strip is a topological puzzle..., a flat ribbon twisted once and then attached end to end to form a circular twisted surface. One can trace the surface, for example, by imagining an ant walking along it. At the beginning of the circular journey, the ant is clearly on the outside. But as it traverses the twisted ribbon, without ever lifting its legs from the plane, it ends up on the inside surface. Grosz proposes that we think of the body—the brain, muscles, sex organs, hormones, and more—as composing the inside of the Möbius strip. Culture and experience would constitute the outside surface. But, as the image suggests, the inside and outside are continuous and one can move from one to the other without ever lifting one's feet off the ground.

As Grosz recounts, psychoanalysts and phenomenologists describe the body in terms of feelings. The mind translates physiology into an interior sense of self. Oral sexuality, for example, is a physical feeling that a child and later an adult translates into psychosexual meaning. This translation takes place on the inside of the Möbius surface. But as one traces the surface toward the outside, one begins to speak in terms of connections to other bodies and objects—things that are clearly not-self. Grosz writes, "Instead of describing the oral drive in terms of what it feels like... orality can be understood in terms of what it does: creating linkages. The child's lips, for example, form connections... with the breast or bottle, possibly accompanied by the hand in conjunction with an ear, each system in perpetual motion and in mutual interrelation."

Continuing with the Möbius analogy, Grosz envisions that bodies create psyches by using the libido as a marker pen to trace a path from biological processes to an interior structure of desire. It falls to a different arena of scholarship to study the "outside" of the strip, a more obviously social surface marked by "pedagogical, juridical, medical, and economic texts, laws, and practices" in order to "carve out a social subject... capable of labor, or production and manipulation, a subject capable of acting as a subject." Thus Grosz also rejects a nature versus nurture model of human development. While acknowledging that we do not understand the range and limits of the body's pliability, she insists that we cannot merely "subtract the environment, culture, history" and end up with "nature or biology."

BEYOND DUALISMS

Grosz postulates innate drives that become organized by physical experience into somatic feelings, which translate into what we call emotions. Taking the innate at face value, however, still leaves us with an unexplained residue of nature. Humans are biological and thus in some sense natural beings *and* social and in some sense artificial—or, if you will, constructed entities. Can we devise a way of seeing ourselves, as we develop from fertilization to old age, as simultaneously natural and unnatural? During the past decade an exciting vision has emerged that I have loosely grouped under the rubric of developmental systems theory, or DST. What do we gain by choosing DST as an analytic framework?

Developmental systems theorists deny that there are fundamentally two kinds of processes: one guided by genes, hormones, and brain cells (that is, nature), the other by the environment, experience, learning, or inchoate social forces (that is, nurture). The pioneer systems theorist, philosopher Susan Oyama promises that DST: "gives more clarity, more coherence, more consistency and a different way to interpret data; in addition it offers the means for synthesizing the concepts and methods... of groups that have been working at cross-purposes, or at least talking past each other for decades." Nevertheless, developmental systems theory is no magic bullet. Many will resist its insights because, as Oyama explains, "it gives less... guidance on fundamental truth" and "fewer conclusions about what is inherently desirable, healthy, natural or inevitable."

How, specifically, can DST help us break away from dualistic thought processes? Consider an example described by systems theorist Peter Taylor, a goat born with no front legs. During its lifetime it managed to hop around on its hind limbs. An anatomist who studied the goat after it died found that it had an S-shaped spine (as do humans), "thickened bones, modified muscle insertions, and other correlates of moving on two legs." This (and every goat's) skeletal system developed as part of its manner of walking. Neither its genes nor its environment determined its anatomy. Only the ensemble had such power. Many developmental physiologists recognize this principle. As one biologist writes, "enstructuring occurs during the enactment of individual life histories."

A few years ago, when the neuroscientist Simon LeVay reported that the brain structures of gay and heterosexual men differed (and that this mirrored a more general sex difference between straight men and women), he became the center of a firestorm. Although an instant hero among many gay males, he was at odds with a rather mixed group. On the one hand, feminists such as myself disliked his unquestioning use of gender dichotomies, which have in the past never worked to further equality for women. On the other, members of the Christian right hated his work because they believe that homosexuality is a sin that individuals can choose to reject. LeVay's, and later geneticist Dean Hamer's, work suggested to them that homosexuality was inborn or innate. The language of the public debate soon became polarized. Each side contrasted words such as *genetic, biological, inborn, innate,* and *unchanging* with *environmental, acquired, constructed,* and *choice.*

The ease with which such debates evoke the nature/nurture divide is a consequence of the poverty of a nonsystems approach. Politically, the nature/nurture framework holds enormous dangers. Although some hope that a belief in the nature side of things will lead to greater tolerance, past history suggests that the opposite is also possible. Even the scientific architects of the nature argument recognize the dangers. In an extraordinary passage in the pages of *Science,* Dean Hamer and his collaborators indicated their concern: "It would be fundamentally unethical to use such information to try to assess or alter a person's current or future sexual orientation. Rather, scientists, educators, policy-makers and the public should work together to ensure that such research is used to benefit all members of society."

The feminist psychologist and critical theorist Elisabeth Wilson uses the hubbub over LeVay's work to make some important points about systems theory. Many feminist, queer, and critical theorists work by deliberately displacing biology, hence opening the body to social and cultural shaping. This, however, is the wrong move to make. Wilson writes: "What may be politically and critically contentious in LeVay's hypothesis is not the conjunction neurology-sexuality per se, but the particular manner in which such a conjunction is enacted." An effective political response, she continues, doesn't have to separate the study of sexuality from the neurosciences. Instead, Wilson, who wants us to develop a theory of mind and body—an account of psyche that joins libido to body—suggests that feminists incorporate into their worldview an account of how the brain works that is, broadly speaking, called connectionism.

The old-fashioned approach to understanding the brain was anatomical. Function could be located in particular parts of the brain. Ultimately function and anatomy were one. This idea underlies the corpus callosum debate,... for example, as well as the uproar over LeVay's work. Many scientists believe that a structural difference represents the brain location for measured behavioral differences. In contrast, connectionist models argue that function emerges from the complexity and strength of many neural connections acting at once. The system has some important characteristics: the responses are often nonlinear, the networks can be "trained" to respond in particular ways, the nature of the response is not easily predictable, and information is not located anywhere—rather, it is the net result of the many different connections and their differing strengths.

The tenets of some connectionist theory provide interesting starting points for understanding human sexual development. Because connectionist networks, for example, are usually nonlinear, small changes can produce large effects. One implication for studying sexuality: we could easily be looking in the wrong places and on the wrong scale for aspects of the environment that shape human development. Furthermore, a single behavior may have many underlying causes, events that happen at different times in development. I suspect that our labels of homosexual, heterosexual, bisexual, and transgender are really not good categories at all, and are best understood only in terms of unique developmental events affecting particular individuals. Thus, I agree with those connectionists who argue that "the developmental process itself lies at the heart of knowledge acquisition. Development is a process of emergence."

In most public and most scientific discussions, sex and nature are thought to be real, while gender and culture are seen as constructed. But these are false dichotomies. I start... with the most visible, exterior markers of gender—the genitalia—to illustrate how sex is, literally, constructed. Surgeons remove parts and use plastic to create "appropriate" genitalia for people born with body parts that are not easily identifiable as male or female. Physicians believe that their expertise enables them to "hear" nature telling them the truth about what sex such patients ought to be. Alas, their truths come from the social arena and are reinforced, in part, by the medical tradition of rendering intersexual births invisible.

Our bodies, as well as the world we live in, are certainly made of materials. And we often use scientific investigation to understand the nature of those materials. But such scientific investigation involves a process of knowledge construction. I illustrate this in some detail in chapter 5, which moves us into the body's interior—the less visible anatomy of the brain. Here I focus on a single scientific controversy: Do men and women have differently shaped corpus callosums (a specific region of the brain)? In this chapter, I show how scientists construct arguments by choosing particular experimental approaches and tools. The entire shape of the debate is socially constrained, and the particular tools chosen to conduct the controversy (for example, a particular form of statistical analysis or using brains from cadavers rather than Magnetic Resonance Image brain scans) have their own historical and technical limitations.

Under appropriate circumstances, however, even the corpus callosum is visible to the naked eye. What happens, then, when we delve even more deeply—into the body's invisible chemistry? In chapters 6 and 7, I show how in the period from 1900 to 1940 scientists carved up nature in a particular fashion, creating the category of sex hormones. The hormones themselves became markers of sexual difference. Now, the finding of a sex hormone or its receptor in any part of the body (for example, on bone cells) renders that previously gender-neutral body part sexual. But if one looks, as I do, historically, one can see that steroid hormones need not have been divided into sex and nonsex categories. They could, for example, have been considered to be growth hormones affecting a wide swath of tissues, including reproductive organs.

Scientists now agree about the chemical structure of the steroid molecules they labeled as sex hormones, even though they are not visible to the naked eye. In chapter 8, I focus in part on how scientists used the newly minted concept of the sex hormone to deepen understanding of genital development in rodents, and in part on their application of knowledge about sex hormones to something even less tangible than body chemistry: sex-related behavior. But, to paraphrase the Bard, the course of true science never did run smooth. Experiments and models depicting the role of hormones in the development of sexual behaviors on rodents formed an eerie parallel with cultural debates about the roles and abilities of men and women. It seems hard to avoid the view that our very real, scientific understandings of hormones, brain development, and sexual behavior are, nevertheless, constructed in and bear the marks of specific historical and social contexts.

This book, then, examines the construction of sexuality, starting with structures visible on the body's exterior surface and ending with behaviors and motivations—that is, with activities and forces that are patently invisible—inferred only from their outcome, but presumed to be located deep within the body's interior. But behaviors are generally social activities, expressed in interaction with distinctly separate objects and beings. Thus, as we move from genitalia on the outside to the invisible psyche, we find ourselves suddenly walking along the surface of a Möbius strip back toward, and beyond, the body's exterior. In the book's final chapter, I outline research approaches that can potentially show us how we move from outside to inside and back out again, without ever lifting our feet from the strip's surface.