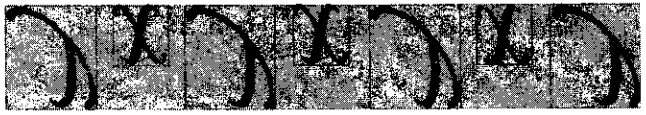
SEXING THE BODY

GENDER POLITICS *and the* CONSTRUCTION *of* SEXUALITY

ANNE FAUSTO-STERLING



BASIC BOOKS

A MEMBER OF THE PERSEUS BOOKS GROUP

Published by Basic Books,
A Member of the Perseus Books Group

Book design by Victoria Kuskowski

All uncredited illustrations are from the author's collection and are used with her permission.

First Edition

A CIP catalog record for this title is available from the Library of Congress.
00 01 02 / 10 9 8 7 6 5 4 3 2 1
ISBN 0-465-07714-5 (paper)

For the ever delightful and always stimulating Paula.

You excite my heart and my mind.

'wiring' for these behaviors persists. . . . In this sense Beach was correct in questioning the idea that perinatal steroids change the essential structure of the nervous system."[178]

The notion of permanence faces other troubles as well. Activating effects were originally thought to be transitory, lasting from a few hours to a few days. In contrast, permanent organization events are supposed to last a lifetime. In practice, this has meant several months to about a year. But how does one classify hormonal effects on the brain that last for weeks rather than days or months? A variety of such cases exists for both songbirds and mammals. In these examples, particular brain structures respond to hormone increases, even in adulthood, by growth and to hormone reduction by shrinkage.[179] If the brain can respond to hormonal stimuli with anatomical changes that can endure for weeks or even months, then the door opens wide for theories in which experience can play a significant role. Even rodents engage in extensive periods of social play, activities that influence the development of the nervous system and future behaviors. It is at least plausible that play activities alter hormone levels and that the developing brain can respond to such changes.[180] Hormonal systems, after all, respond exquisitely to experience, be it in the form of nutrition, stress, or sexual activity (to name but a few possibilities). Thus, not only does the distinction between organizational and activational effects blur, so too does the dividing line between so-called biologically and socially shaped behaviors.

Humans are learners, and proudly so. We are, arguably, the most mentally complex of all animals (no offense meant to the great apes, who might argue with us if they could speak). It seems ironic, therefore, that our most prominent and influential accounts of the development of sexual behaviors in advanced mammals omit learning and experience. Because the control of hormone synthesis differs between primates and other species,[181] a case can be made that studies on the hormonal basis of sexual behaviors in nonprimates tell us little, if anything, about primates, including humans.[182] As I turn in the final chapter to theories of human sexuality, I make a broader claim: that the theories we have derived from rodent experimentation are inadequate even for rodents.

9

GENDER SYSTEMS:

TOWARD A THEORY OF HUMAN SEXUALITY

Portrait of the Scientist as a Young Girl

CONSIDER A CHILD BORN IN THE SUMMER OF 1944. LATER SHE BECAME a scientist. Does a portrait of her at age two (figure 9.1)—one hand holding a water-filled test tube up to the light, the other grasping a measuring cup—give evidence of the early expression of an inborn inclination to measure and analyze, of her genes leading her down the road to the research laboratory? Or is it testimony to her feminist mother's determination to find nontraditional toys for her young daughter? As the child grew, her mother began to write children's books about nature, and the young girl and her brother (who also became a scientist) learned on their walks through the woods to spot mosses, ferns, mushrooms, and insect homes.[1] When she was in graduate school, her father wrote a biography of Rachel Carson.[2] Science genes or environment? A logical argument can be made for each interpretation, and there is no way to prove whether either answer is right.[3]

For many who would think about this girl's life path, gender is not far from the surface. Her early interest in frogs and snakes marked her as a tomboy, a label some social scientists today interpret as an early sign of untoward masculinity.[4] When she was eleven, her friends at summer camp wrote her epitaph—"In memory of Anne, who liked bugs better than boys" —perhaps foreshadowing a future homosexuality. But that summer she developed a painful crush on one of the young male camp counselors, and by the time she was twenty-two she would marry for love and lust. Only years later would that epitaph for an eleven-year-old seem prophetic.

This young girl didn't like dolls, kept pet snakes and frogs, and grew up first with heterosexual interests and later developed homosexual ones. How are we to interpret her life, or any life? Speculating about genes for analytical personalities or homosexuality may make for good party chitchat or provide

FIGURE 9.1: A budding scientist? (Source: Philip Sterling)

solace for those eager to explain why someone turned out "that way." But partitioning genes from environment, nature from nurture, is a scientific dead end, a bad way of thinking about human development. Instead, I suggest we heed the words of the philosophers John Dewey and Arthur Bentley, who half a century ago "asserted the right to see together . . . much that is talked about conventionally as if it were composed of irreconcilable spheres."[5]

In this book I have shown how medical and scientific knowledge about anatomy and physiology acquires gender. I started at the outside, with genital gender, and moved inward, from the brain to body chemistry and ultimately to something quite intangible: behavior (in rodents). It turns out, however, that we cannot understand the underlying physiology of behavior without considering an animal's social history and contemporary environment. True to the image of the Möbius strip, when we reached a level of analysis that involved chemistry (and, by implication, genes)—that is, when we were at the most interior moment in our journey—we had, suddenly, to consider the most exterior of factors: What was the animal's social history? What was the architecture of the test apparatus? Why did specific genetic strains respond to hormone stimuli only under certain conditions? And while the driving question on the exterior surface of the Möbius strip is, "How does knowledge about the body acquire gender?" the active question on the inside surface is, "How do gender and sexuality become somatic facts?" How, in other words, does the social become material? Answering this inside question would require a book-length essay, so in this concluding chapter I offer but a framework for future research.

Successful investigations of the process of gender embodiment must use three basic principles. First, nature/nurture is indivisible. Second, organisms—human and otherwise—are active processes, moving targets, from fertilization until death.[6] Third, no single academic or clinical discipline provides us with the true or best way to understand human sexuality. The insights of many, from feminist critical theorists to molecular biologists, are essential to the understanding of the social nature of physiological function.

"R" Genes Us?

We live in a genocentric world.[7] The "genes 'r' us" habit is so deeply imbued in our thought processes that it seems impossible to think otherwise. We think of our genes as a blueprint for development, linear information that need only be read out of the book of life. We go to movies in which the major premise is that a DNA sequence isolated from a fossilized mosquito is all we need to create *Tyrannosaurus rex*. (The nicety, clearly found in *Jurassic Park*, that the

DNA needed an egg to become a *T. rex* is lost in the shuffle).[8] And we hear almost daily on the news that the project to sequence human DNA molecules has led us from the genes for breast cancer and diabetes to Parkinson's and more. Present-day students of human genetics can do the rest, "discovering" genes for alcoholism, shyness, and- -yes—homosexuality.[9]

Even when scientists are themselves cautious about imbuing all power to the gene, popular renditions of new scientific findings dispense with linguistic subtlety. When Dean Hamer and his colleagues published evidence that some male homosexuals possessed the same region of DNA located on the X chromosome, for instance, they used fairly cautious language. Phrases such as "the role of genetics in male homosexual orientation," "genetically influenced," or "a locus related to sexual orientation" abound in the paper.[10] Such caution did not, however, extend to other pages in the same issue of *Science*, the journal in which the Hamer group's report appeared. In the Research News section of the same issue, the headline ran: "Evidence for Homosexuality Gene: A genetic analysis . . . has uncovered a region on the X chromosome that appears to contain a gene or genes for homosexuality."[11] Two years later, coverage in a more popular venue, *The Providence Journal,* had, on the same page, headlines referring to "gay gene" research and "schizophrenia gene search."[12]

But what does it mean to speak of gay genes or genes for some other complex behavior? Do such phrases, or Hamer and colleagues' more circumspect language advance our understanding of human sexuality? I think that the language not only fails to illuminate the issues at hand; it gives us intellectual cataracts.[13]

A brief review of basic genetic physiology demonstrates why: genetic function can be understood only in the context of that developmental system we call the cell. Most protein sequence information in a cell can be found in DNA located in the cell's nucleus. The DNA itself is a large molecule composed of linked chemicals called bases.[14] Genetic information is not continuous in the DNA molecule. A stretch that codes for part of a protein (called an *exon*) may be linked to a noncoding region (called an *intron*). Before a gene's information can be used in protein construction, the cell must make an RNA cast for both the coding and noncoding regions of the DNA. Then enzymes snip out the introns and stitch the exons together into a linear sequence containing the template for a specific protein. Making the protein requires the coordinated activity of additional special types of RNA molecules and many different proteins.

In shorthand, we sometimes say that genes make proteins; but it is precisely such shorthand that gets us into trouble. Naked DNA cannot make a

protein. It needs many other molecules—special RNAs to carry the amino acid to the ribosome and secure it, like a vise, so that other proteins can link it to its next neighbor. Proteins also help transport the DNA's message out of the nucleus and into the cytoplasm, help the DNA unwind so that other molecules can interpret its message in the first place and cut and splice the RNA template. In short, DNA or genes don't make gene products. Complex cells do. Put pure DNA in a test tube and it will sit there, inert, pretty much forever. Put DNA in a cell and it may do any number of things, depending in large part on the present and recent past histories of the cell in question.[15] In other words, a gene's actions, or lack thereof, depend on the microcosm in which it finds itself.[16] New work, suggesting that as many as 8,000 genes can be expressed in a developmentally stimulated cell, shows just how complex that microcosm can be.[17]

Development, to paraphrase the philosopher Alfred North Whitehead, is a moving target. As an organism emerges from a single fertilized egg cell, it builds on what has gone before. By analogy, consider how a forest grows back in an empty, unmowed field. At first annuals, grasses, and woody shrubs appear, then a few years later scattered cedars, willows, hawthornes, and locusts. These trees need full sun to grow, so as they get larger, they create so much shade that their own seedlings cannot survive. But the white poplar does well under the conditions created by the cedar and its companions. Eventually, the poplar and other trees create a cool, leaf-covered forest floor on which the seedlings of hemlock, spruce, red maple, and oak thrive. Finally these create conditions for hemlock, beech, and sugar maple to grow. These new trees, in turn, create a microclimate under which their own seedlings thrive, and a stable constellation of trees, called a climax forest, finally develops. The regularity of such a succession of growth does not result from some ecological program found in the genes of cedar, hawthorne, and willow trees, "rather it arises via a historical cascade of complex stochastic [random processes that can be studied statistically] interactions between various" living organisms.[18]

The work of M. C. Escher offers a helpful analogy. In the early 1940s he produced a series of woodcuts designed to divide a plane into interlocking figures. Two features of these images help us see how developmental systems theory applies to cells and development (see figure 9.2). First, as one stares at the image, the birds jump into view, then the fish swim up. Both are always there, but how one focuses at a particular moment makes one animal more visible than the other. Second, each line simultaneously delineates the outline of both a fish and a bird. If Escher were to change the shape of the bird, the

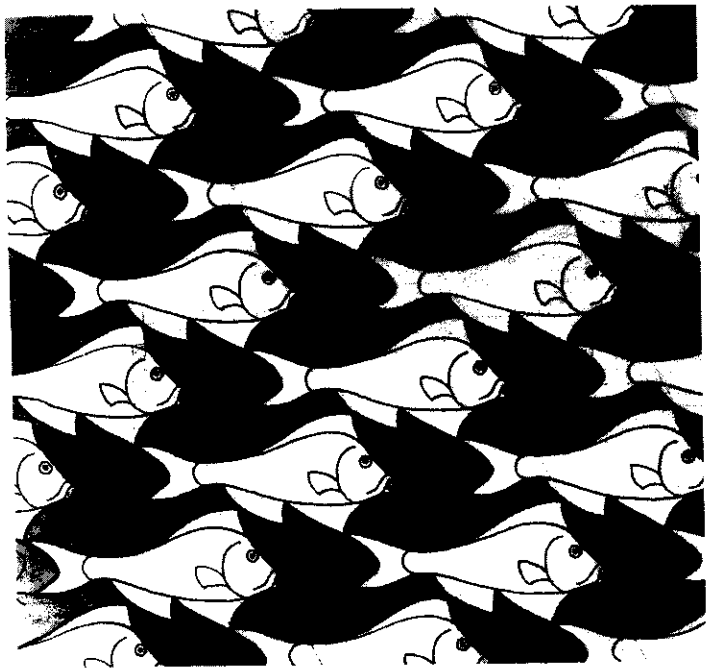


FIGURE 9.2: Symmetry drawing E34B, by M. C. Escher. (© Cordon Art, reprinted with permission)

fish would change shape as well. Thus it is with a systems account of cellular physiology. Genes (or cells or organisms) and environment are like the fish and the bird. Change one change all. See one see all.

Socializing the Cell

NERVE CELLS AND BRAINS

Genes, then, function as part of a complex cell with its own important history. Cells, in turn, operate as large, intimately connected groups that form coherent organs within a complex, functionally integrated body. It is at this level, when we look at cells and organs within the body, that we can begin to glimpse how events outside the body become incorporated into our very flesh.

Just after the turn of the twentieth century in the Bengal Province of India, the Reverend J. A. Singh "rescued" two children (whom he named Amala and

Kamala), girls succored since infancy by a pack of wolves.[19] The two girls could run faster on all four limbs than other humans could on two. They were profoundly nocturnal, craved raw meat and carrion, and could communicate so well with growling dogs at feeding time that the dogs allowed the girls to eat from the same bowls. Clearly these children's bodies—from their skeletal structure to their nervous systems—had been profoundly changed by growing up with nonhuman animals.

Observations of wild children dramatize what has become increasingly clear to neuroscientists, especially in the past twenty years: brains and nervous systems are plastic. Overall anatomy—as well as the less visible physical connections among nerve cells, target organs, and the brain—change not only just after birth but even into the adult years. Recently, even the dogma that no new cells appear in the adult brain has gone the way of the dodo.[20] Anatomical change often results when the body's nervous system responds to, and incorporates, external messages and experiences.

Examples abound in which a social interaction causes a physical change in the nervous system.[21] Two types of studies seem especially relevant to a framework for understanding human sexuality. One concerns the development and plasticity of nerve cells and their interconnections in the central and peripheral nervous systems.[22] The other addresses changes in nerve cell receptors that potentially can bind transmitters such as serotonin or steroid hormones such as estrogens and androgens, which can in turn activate the protein synthetic machinery of a particular set of cells.[23] These examples show how nervous systems and behaviors develop as part of social systems.

Scientists sometimes disrupt such systems by interfering with the genetic function of one or another component. Analytically, this is akin to removing a spark plug to see whether and how it interferes with the running of an internal combustion engine. For example, scientists have created mice that lack the gene for serotonin receptors and have observed their distorted behaviors.[24] But although such experiments provide important information about how cells function and communicate, they cannot explain how mice develop particular behaviors in particular social settings.[25]

How might social experience affect the neurophysiology of gender? The comparative neurobiologists G. Ehret and colleagues offer an example in their study of paternal behavior in male mice. Males that never have contact with young pups will not retrieve them in the spirit of good fathering (when they inch too far from the nest), but even a few hours or a day spent in the company of baby rats will evoke ongoing paternal pup retrieval. Ehret and colleagues found that early exposure to pups correlated with increased estrogen receptor binding in a number of areas of the brain and decreased binding in one area.[26]

In other words, parenting experience may have changed the hormonal physiology of the father's brain as well as the mouse's ability to care for his pups.

The fact that human brains are also plastic, a concept that recently has begun to make it into the mass media,[27] makes it possible to imagine mechanisms by which gendered experience could become gendered soma. Environmental signals stimulate the growth of new brain cells or cause old ones to make new connections.[28] At birth the human brain is quite incomplete. Many of the connections between nerve cells and other parts of the body are tentative, requiring at least a little external stimulation to become permanent. In some brain regions, unused neural connections disintegrate throughout the first twelve years of life.[29] Thus, early physical and cognitive experience shape the brain's structure.[30] Even muscular movements before birth play a role in brain development.

One way the brain "hardens" a neural connection is by producing a fatty sheath, called myelin, around the individual nerve fibers. At birth the human brain is incompletely myelinated. Although major myelination continues through the first decade of life, the brain is not completely fixed even then. There is an additional twofold increase in myelinization between the first and second decades of life, and an additional 60 percent between the fourth and sixth decades,[31] making plausible the idea that the body can incorporate gender-related experiences throughout life.

Finally (for this discussion at least),[32] large groups of cells can change their patterns of connectivity—or *architecture,* as brain scientists call it. For years neuroanatomists have performed experiments to find out what segment of the brain responds when they stimulate an exterior part of the body. Touching the face provokes certain cortical nerves to fire, touching the hand and individual fingers affects different nerves, the feet still other nerve cells. Textbooks often summarize such experiments with a cartoon of a misshapen body (called a *homunculus*) superimposed on the brain cortex. Scientists used to think that after early childhood, the shape of the homunculus did not change. But following a series of experiments with other primates, this viewpoint has changed dramatically.[33]

One recent study compared the representation on the cerebral cortex of the fingers of the left hand of stringed instrument players to age- and gender-matched controls who had no experience with stringed instruments. String players constantly move the second through fifth digits of the left hand. The left hand homunculus was visibly larger for digits two through five compared to both non-string players and to the musicians' own right hands.[34] Or consider people who, blind from a young age, have become accomplished Braille

readers.[35] Not surprisingly, they have enlarged the hand representation for their Braille-reading fingers. But their brains have made an even more amazing readjustment. They have recruited a region of the cortex that sighted people use to process visual information (the so-called visual cortex) and instead use it to process tactile sensations.[36]

For both musicians and those blind from birth, cortical reorganization probably takes place during childhood, a fact that confirms something we already know: children have enormous learning capacities. Such studies extend our ideas about learning, however, by showing that the material anatomic connections in the brain respond to external influences. Such knowledge wreaks havoc with both attempts to maintain a distinction between mind and body and attempts to offer up the body as a precursor to behavior. Instead they back up an insistence that the environment and the body co-produce behavior and that it is inappropriate to try to make one component prior to the other.[37]

The studies on Braille users and musicians show brain plasticity in the young, but can adult brain anatomy change as well? The answer comes from the study of a phenomenon that has long fascinated students of the human brain, from neurosurgeons to phenomenologists: the mystery of the phantom limb. Amputees often feel that the missing part is still present. At first the phantom seems to the patient to be shaped like the missing part. With time, however, the perceived shape changes; in contrast to a real limb, a phantom part feels lighter and hollow. Like a ghost, the phantom limb seems able to penetrate a solid object.[38]

Someone who has lost a hand may "feel" the missing hand following light stimulation of the lips; a light touch to the face may make someone who has lost an arm "feel" the missing limb, a phenomenon called *referred sensation.* A series of recent studies tries to explain such sensations with the finding that nerves in the region of the homunculus previously devoted to the now-missing limb are "taken over" by adjacent areas—in the example given, the cortical field connecting exterior stimuli to the face. The size of the homunculus for the intact hand also increases, presumably in response to increased use demanded by the loss of one hand.[39] Although remapping of the brain's cortex probably doesn't explain all phantom limb phenomena,[40] it does provide a dramatic instance of how adult brain anatomy responds to new circumstances.[41]

How might all this apply to the development of sexual difference and human sexual expression? Answers developed to date have been impossibly vague, in part because we have been thinking too much about individual com-

ponents and not enough about developmental systems. Paul Arnstein, a practicing nurse concerned with understanding physiological links between learning and chronic pain, writes that: "The true nature of the central nervous system has eluded investigators because of its fully integrated, constantly changing structure and a symphony of chemical mediators. Each sensation, thought, feeling, movement and social interaction changes the structure and function of the brain. The mere presence of another living organism can have profound effects on the mind and body."[42] We will begin to understand how gender and sexuality enter the body only when we learn how to study the symphony and its audience together.

SEXUAL ANATOMY AND REPRODUCTION

During our lives, the brain changes as part of a dynamic developmental system that includes everything from nerve cells to interpersonal interactions. In principle, we can apply similar concepts to gonads and genitals. The gonads and genitals developed during fetal development continue to grow and change shape during childhood, affected by such things as nutrition, health status, and random accidents. At puberty anatomic sex expands to include not only genital differentiation but also secondary sex characteristics, which in turn depend not only on nutrition and general health but also on levels of physical activity. For example, women who train for long-distance events lose body fat, and below a certain fat-to-protein ratio, the menstrual cycle shuts down. Thus, gonadal structure and function respond to exercise and nutrition levels, and of course they also change during the life cycle.

Not only does sexual physiology change with age—so, too, does sexual anatomy. I don't mean that a penis drops off or an ovary dissolves, but that one's physique, one's anatomical function, and how one experiences one's sexual body change over time. We take for granted that the bodies of a newborn, a twenty-year-old, and an eighty-year-old differ. Yet we persist in a static vision of anatomical sex. The changes that occur throughout the life cycle all happen as part of a biocultural system in which cells and culture mutually construct each other. For example, competitive athletics leads both athletes, and a larger public who emulate them, to reshape bodies through a process that is at once natural and artificial. Natural, because changing patterns of diet and exercise change our physiology and anatomy. Artificial, because cultural practices help us decide what look to aim for and how best to achieve it. Furthermore, disease, accident, or surgery—from the transformations undergone by surgical transsexuals, to the array of procedures (applied to secondary sexual characteristics) that include breast reduction or enlargement and penile enlargement—can modify our anatomic sex. We think of anatomy as

constant, but it isn't; neither, then, are those aspects of human sexuality that derive from our body's structure, function, and inward and outward image.

Reproduction also changes throughout the life cycle. As we grow, we move from a period of reproductive immaturity into one during which procreation is possible. We may or may not actually have children (or actually be fertile, for that matter), and when and how we choose to do so will profoundly affect the experience. Motherhood at twenty and at forty, in a heterosexual couple, as a single parent, or in a lesbian partnership is not a singular, biological experience. It will differ emotionally and physiologically according to one's age, social circumstance, general health, and financial resources. The body and the circumstances in which it reproduces are not separable entities. Here again something that we often think of as static changes across the life cycle and can be understood only in terms of a biocultural system.[43]

In their book *Rethinking Innateness*, the psychologist Jeffrey Elman and his colleagues ask why animals with complex social lives go through long periods of postnatal immaturity, which would seem to present big dangers: "vulnerability, dependence, consumption of parental and social resources." "Of all primates," they note, "humans take the longest to mature."[44] Their answer: long periods of development allow more time for the environment (historical, cultural, and physical) to shape the developing organism. Indeed, development within a social system is the sine qua non of human sexual complexity. Form and behavior emerge only via a dynamic system of development. Our psyches connect the outside to the inside (and vice versa) because our multiyear development occurs integrated within a social system.[45]

Thank Heaven for Little Girls—and Little Boys, Too

THE PROCESS OF GENDER

"All this cell, brain, and organ development stuff is fascinating," a frustrated parent might say to me. "But I still want to know why my little boy rushes around shooting imaginary laser guns, while my little girl prefers jump rope." Many Loveweb participants raise similar challenges, citing studies showing that gender differences appear at an early age—surely, they believe, an argument for inborn difference. How can I reconcile the observations of countless parents and the multitude of studies by sociologists and developmental psychologists with a systems approach to gender acquisition? Here I fit together already existing pieces of the puzzle.

"Gender," argue some sociologists, "is a situated accomplishment . . . not merely an individual attribute but something accomplished in interaction with others."[46] Both children and adults learn through direct feedback from

others to "do gender."[47] Classmates, parents, teachers, and even strangers on the street evaluate how a child dresses. A boy who wears pants conforms to social norms, while one who dons a skirt does not. And he hears about it right away! Gender, then, is never merely individual, but involves interactions between small groups of people. Gender involves institutional rules. If a gay man made up as a woman walks down the street, he soon learns that he has deviated from a gender norm. The same man in a gay bar will receive compliments as he partakes in a subculture that plays by a different set of guidelines. Furthermore, we "do gender" as part of "doing difference." We establish identities that include race and class as well as gender, and we do gender differently depending upon our location in racial and class hierarchies.[48]

In America and Europe, boys and girls begin to behave differently during the preschool years. By middle school each group thinks the other has "cooties," but during the years of hormonal hell, they return to each other for sex and socializing. As adults they live and work in overlapping but gender-divided institutions, and as old people they are separated once more, this time by the differential death rates for men and women. Developmental psychologists, sociologists, and systems theorists have some tantalizing findings about how children acquire gender, although obtaining similar information for the rest of the life cycle remains for future scholars.[49]

Traditionally, psychology has offered three approaches to understanding gender development: Freudian psychodynamics, social learning, and cognitive development. For Freud, the child's own awareness of his or her genitals produces erotic fantasies, which in turn lead to identification with a suitable adult figure and the development of an appropriate gender role.[50] Social learning proponents focus on adult awareness of an infant's genitals, which leads to differential reinforcement, the offer of gender-appropriate models, and thus the development of gender role and identity.[51] Cognitive theory also starts with others' awareness of a child's genitals. This leads to labeling and thence to gender identity and finally to the acquisition of an appropriate gender role.[52] Feminist social scientists have used each of these paradigms to produce information about the development of sexual difference. A primary goal in the past has been to produce better accounts of female development, since in their original forms all three theories primarily produced narratives about how boys became men. More recently, however, a number of feminist voices have begun to challenge the very structure of the field, calling for more complex accounts of difference *and* a return to the study of male-female similarities.[53] Here I depend especially on the work of cognitive and social learning researchers. Regardless of the particular approach, the goal remains that of understanding the development of the self: "behavior, experience, and identifications, including sexual desire and object choice, [that] are relatively stable or fixed or that, at least, . . . [are] a basic or primary 'core' of identity."[54]

Gender and sexuality often appear to us as universal features of human existence. Need such apparent universality mean that human sexuality and gender are inborn and only superficially shaped by social experience? We can see that this is the wrong way to ask the question by looking at the development of another apparently universal human behavior: smiling.[55] Newborns have a simple smile: the face relaxes while the sides of the mouth stretch outward and up. An identical "smile" has been seen in fetuses as young as twenty-six weeks of gestation. This suggests that, initially, a basic set of neural connections develops that enables a developing human to "smile" as a reflex, even in utero. In the newborn, smiling occurs spontaneously in rapid eye movement (REM) sleep states, but at first does not function as a mode of emotional expression.

By two weeks after birth, smiles begin to appear infrequently when the baby is awake, and more body parts are recruited into the event. The lips curl up farther, "cheek muscles contract, and the skin around the eyes wrinkles." Three-month-old babies smile much more frequently when awake, and they do so in nonrandom bursts, in response to stimuli in the environment. By the time an infant is from half a year to two years old, smiling blends with a wide variety of other facial expressions—surprise, anger, excitement. Furthermore, the facial expressions have become both more complex and individually varied. Accompanying the smile may be "nose wrinkles, jaw drops, blinks, blows, and brow raises that served to communicate affects from pleasure to mischief."[56] Thus, over two years, smiling changes in shape (and all that shape implies in terms of muscle and nerve recruitment), timing, and connection to other expressive actions. A smile is not a smile is not a smile (to butcher Gertrude Stein a bit).

At the same time that the muscles and nerves that govern smiling develop and become more complex, so too do the functions and social contexts that elicit smiling. While at birth, drowsiness and a decrease in sensory input elicits smiling, soon infants respond by smiling at familiar voices and sounds, and less regularly to touch. By six weeks, a baby smiles mostly while awake, in response to visual cues. By three to six months, a baby is more likely to smile at its mother than at inanimate objects, and by the end of the first year "smiling serves a variety of communicative functions, including the intent to flirt or do mischief."[57] At first blush, smiling seems to be a simple reflexive response, but over time it changes in complex ways—in terms of the nerves and muscles involved, but also in terms of what social situations elicit smiling and how the child uses smiling as part of a complex system of communication—

with other humans. Thus a physiological response becomes "socialized" not only in terms of intentional use but also in terms of the actual body parts (which nerves and muscles are used and what stimulates them) themselves.

Looking at the smile response as a developmental system enables us to exchange meaningless claims such as that "smiling is inborn and genetic" for carefully designed experimental studies "that systematically vary the conditions . . . which . . . may influence the form, timing and function of smiling" over different parts of the life cycle.[58] The psychologist Alan Fogel and his colleagues have used their studies of the smile response to develop what they call a dynamic systems perspective on emotion.[59] First they argue that emotions are relational rather than individual. Young infants, for example, smile in response to other people or objects. Second, they view emotions as self-organizing, stable systems. But stability does not imply permanence. Thus visual induction of the smiling response is stable in infants for three to four months, but is eventually replaced by a new stable system involving a variety of forms of physical interactions with its mother (or other caretaker).[60]

Little if any of the work on dynamic developmental systems has made its way into the study of human sexual development, but its applicability seems obvious. First, we need to stop looking for universal causes of sexual behavior and gender acquisition and instead learn more about (and from) individual difference. Second, we need to think harder about how to study sex and gender as part of a developmental system. Third, we need to become more imaginative and specific about what we mean by the word *environment*. At the moment I think we are pretty clueless about the environmental components of human sexual development, but the idea provided by Fogel and others—that behaviors go through periods of instability (when they are more easily changed) and stability (when they seem fixed)—is helpful.

We do have some starting points. Since the mid-1980s, several groups of developmental psychologists have asked a set of interrelated questions about gender: What do children know about sex (the body parts), and when do they know it? Does such knowledge correlate with or affect gender-related behaviors such as differing patterns of play? A story outline has begun to emerge.[61] Psychologists have introduced the concept of a schema or schematic processing, which enable children to use rudimentary knowledge to make choices about "appropriate" play, peers, and behaviors. According to this line of thought, children adopt particular sex roles as they integrate their own sense of self with their developing gender schema, a process—like the developing smile—that takes several years. It is a reasonable (and testable) guess that during this time certain forms of bodily gender expression (such as "throwing like a girl") develop stability. But—also like the developing

smile—stability need not suggest permanence, as observing top girl Little Leaguers would make quite clear.

Anybody who has observed a young child as he or she learns about the world has seen schema in operation. I remember, for example, when my toddler niece pointed at a clock with a schematic outline of an owl's face. "Owl," she proudly pronounced. I recall being amazed that she could recognize such a featureless representation when her storybooks all showed detailed drawings of these nocturnal birds. But she had internalized an owl schema, which enabled her to recognize this bird on the basis of minimal information. Beverly Fagot and her colleagues studied gender schema in children ranging in age from 1.75 to 3.25 years. They gave the kids a "gender task"—to correctly classify pictures of adults and children as "mommy," "daddy," "boy," or "girl." The younger children (those averaging about two years old) could not pass the test—that is, they apparently had no working concept of gender. The older children, however, (those averaging about 2.5 years), correctly classified both adults and children. Furthermore, those children who had developed boy-girl labels behaved differently from those who had not. The older kids, for example, preferred same-sex play groups, and girls who passed the labeling test were less aggressive.[62]

Fagot and Leinbach also observed 1.5-year-old kids at home. At this age they could neither pass gender-labeling tests nor engage in sex-typed play. By the time the children were 2.25 years old about half, called early labelers, could accurately label boys and girls. Two differences emerged between the early and late labelers. First, "parents of future early labelers gave more positive and negative responses to sex-typed toy play" and, by 2.25 years, "early labelers showed more traditional sex-typed behavior than late labelers."[63] By age 4, early and late labelers did not differ in preference for sex-stereotyped play. The early labelers maintained a greater awareness of sex stereotypes, however. Fagot and colleagues conclude that "the child's construction of a gender schema reflects back the behavioral, cognitive, and affective dimensions of the familial environment."[64]

I used to ride my bike to grade school, ruminating as I traveled the suburban New York landscape. For a time one problem in particular held my attention. I knew that boys had short hair, girls had long hair, and babies were born bald. How, I puzzled, did adults have the awesome power to declare immediately the sex of a newborn? I knew about genitalia, of course. I had an older brother, and we bathed together until I was four or five. Occasionally, also, I caught a glimpse of my father in the altogether. But I never connected such information to my puzzlement with birth announcements. Then, one day when I was about ten years old, biking home from school, the answer just

popped into my head. "So *that's* how they know," I thought. As I look back now, through feminist theory-fogged scrim, I realize that as a child, gender had been clear on my horizon many years before sex became visible.[65]

I was not alone in my confusion, just a bit slow to resolve it. In America, at least, small children seem to base their initial, rudimentary gender schema on cultural markers of gender, not knowledge of genital differences. In one study, the psychologist Sandra Bem showed 3-, 4- and 5-year-olds photographs of either a naked boy or a naked girl and then of the same child dressed either in girls' or boys' clothing. Children younger than three had a hard time labeling the naked children as a boy or a girl, but successfully used social clues—clothes and hairstyles—to classify the dressed ones.[66] About 40 percent of the 3-, 4- and 5-year-old children accurately identified sex in all the photos once they had knowledge of genitalia. The rest, however, had not yet acquired a notion of sex constancy—that is, they used gender signals such as hairstyle and clothing to decide who was a boy and who was a girl. This also meant that some of these children believed that they could become the opposite sex by dressing as one. Their own gender identity was not yet fixed.

Children's understanding of anatomical constancy didn't seem to affect sex role preferences. Instead, early gender schema proved critical. "First, children learned to label the sexes, and only later did they show strong sex-typed toy and peer preferences and knowledge about sex differences in toys and clothing." Even though children did not need a concept of sex stability to develop sex-stereotyped preferences, having such knowledge strengthened the level of such preferences. It may be that "children who can label the sexes but do not understand anatomical stability are not yet confident that they will always remain in one gender group."[67] In keeping with the above findings, older children (aged 6 to 10 years) make more extreme stereotypic gender judgments than do younger ones. Not surprisingly, they first learn to associate characteristics relevant to their own sex and only later stabilize their expectations of the other sex (see figure 9.3).[68]

FROM INDIVIDUALS TO INSTITUTIONS AND BACK AGAIN

By the time children become accomplished members of the grade and middle school social scenes, they know that they are either a boy or a girl, and they expect to remain so. How do gender-aware children "do gender"? In her important study, *Gender Play: Girls and Boys in School*, the sociologist Barrie Thorne builds an essential methodological framework for studying older children. She became increasingly unhappy, she writes, "with the frameworks of 'gender socialization' and 'gender development' " in use for work on gender in children's lives. Thorne complains that traditional ideas about gender so-

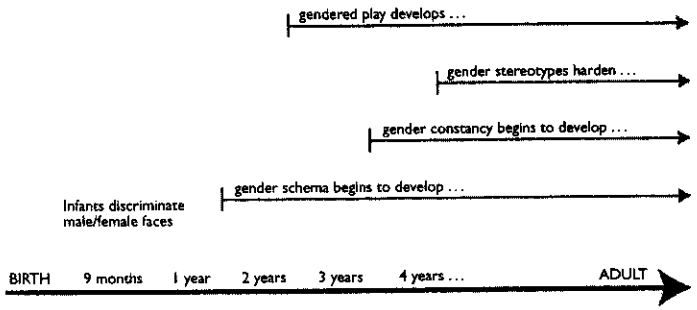


FIGURE 9.3: Stages in the development of gender specificity. (Source: Erica Warp, for the author)

cialization presume a one-way interaction from strong (the powerful adult) to weak (the passive, accepting child), and that even when granting some agency to children, social scientists have defined them as recipients, bodies acted upon by adults and the surrounding culture. Adults have "the status of full social actors," while children are "incomplete, adults-in-the-making." Thorne argues that social scientists would do better to see "children not as the next generation's adults, but as social actors in a range of institutions." Finally, and most important, traditional frameworks of gender socialization focus on the unfolding of individuals. In her work, Thorne chose to begin instead with "group life—with social relations, the organization and meanings of social situations, the collective practices through which children and adults create and recreate gender in their daily interactions"—that is, with a system and its process.[69]

By focusing on how social context and daily practice—of both children and adults—generate meaning, Thorne moves away from the question "Are girls and boys different?" and asks instead how children actively create and challenge gender structures and meanings.[70] She urges us to turn gender into a complex of concepts having to do with both individual and social structure. Furthermore, she finds it important to understand that "gender relations are not fixed . . . but vary by context" (including race, class, and ethnicity). As a feminist, Thorne's goal is to promote equity in education and beyond. Applying her approaches to the study of boys and girls, she feels, can help accomplish such ends. In a similar vein, the psychologist Cynthia García-Coll and her colleagues propose to integrate studies of gender in children with studies of race, ethnicity, and social class.[71]

Dynamic systems theorists such as Alan Fogel suggest, in principle, how

gender can move from outside to inside the body, while developmental psychologists and sociologists such as Thorne, Fagot, Bem, García-Coll, and others show how institutional gender, as well as attributes such as race and social class, might become part of individual systems of behavior. Indeed, gender is represented both within social institutions and within individuals. The sociologist Judith Lorber provides a European-American roadmap for such distinctions (see table 9.1). The institutional components of gender feed back on individual aspects; individuals interpret sexual physiology in the context of institutional and individual gender. The subjective sexual self always emerges in this complex system of gender. Lorber argues (and I agree), that "as a social institution, gender is a process of creating distinguishable social statuses for the assignment of rights and responsibilities. . . . As a *process*, gender creates the social differences that define 'woman' and 'man.' . . . Gendered patterns of interaction acquire additional layers of gendered sexuality, parenting, and work behaviors in childhood, adolescence and adulthood."[72] Thus Lorber, as well as other feminist sociologists and psychologists,[73] points out that concern with our subjective selves is not "merely" about human psychology and physiology. Rather, gendered individuals exist in social institutions strongly marked by a variety of power inequities.[74]

Although Lorber correlates institutional with individual gender, it was not her goal to show how the individual physically imbibes the institutional. But the work of sociologists and historians can provide helpful roadmaps for future work.[75] Consider the work of survey sociologists such as Kinsey and others who have followed in his footsteps. Surveying populations to learn more about human sexuality is a tricky business. On the one hand, population surveys provide us with information about gender and sexuality that can be very important in the formulation of policy issues ranging from poverty to public health.[76] On the other hand, when we create the categories that enable us to count, we bring into being new types of people.[77]

Consider the seemingly simple question: How many homosexual men and women are there in the United States? To answer it, we must first decide who is homosexual and who is heterosexual. Do we base our decision on identity? If so, we would count only those who will say, at least to themselves, "I am a homosexual" or "I am a heterosexual." Or should we count men who consider themselves fully heterosexual, but who once or twice a year get drunk, go to a gay bar, and have sex with several men— later indicating that since their urge to have such sex is so easily satisfied by such irregular encounters, they see no need to tell their wives or to apply the label "homosexual"?[78] Should we create a separate category for bisexuals, and how shall we define the true bisexual?[79] Is a man who in his early adolescence experimented once or twice

TABLE 9.1 *Lorber's Subdivision of Gender*

AS A *SOCIAL INSTITUTION*, GENDER IS COMPOSED OF:	FOR AN *INDIVIDUAL*, GENDER IS COMPOSED OF:
Gender statuses: socially recognized genders and expectations for their enactment behaviorally, gesturally, linguistically, emotionally, and physically	*Sex category:* individual assigned prenatally, at birth, or following reconstructive surgery
Gendered division of labor	*Gender identity:* the individual's sense of gendered self as a worker and family member
Gendered kinship: the family rights and responsibilities for each gender status	*Gendered marital and procreative status:* fulfillment or nonfulfillment of allowed or disallowed mating, impregnation, childbearing, and/or kinship roles
Gendered sexual scripts: the normative patterns of sexual desire and sexual behavior as prescribed for different gender statuses	*Gendered sexual orientation:* socially and individually patterned sexual desires, feelings, practices, and identifications
Gendered personalities: combinations of traits patterned by gendered behavioral norms for different gender statuses	*Gendered personality:* internalized patterns of socially normative emotions as organized by family structure and parenting
Gendered social control: the formal and informal approval and reward of conforming behavior and stigmatization and medicalization of nonconforming behavior	*Gendered processes:* "doing gender"—the social practices of learning and enacting gender-appropriate behaviors, i.e., of developing a gender identity
Gender ideology: the justification of gender statuses, often by invoking arguments about natural (biological) difference	*Gender beliefs:* incorporation of, or resistance to, gender ideology
Gender imagery: the cultural representations of gender in symbolic language and artistic productions	*Gender display:* presentation of self as a kind of gendered person through dress, cosmetics, adornments, and permanent and reversible body markers

Source: Adapted from Lorber 1994, pp. 30–31.

with another male but ever since has had sex only with women bisexual? Are people who are homosexual in prison but not on the street bisexual?[80]

By answering such questions, survey sociologists create the categories by which we organize sexual experience. As sociologists create "objective" information about human sexuality, they provide individually useful categories. The "Kinsey 6," for example, is now part of the national culture and contributes to the structuring of the psyche of some individuals, while the man who gets drunk and has homosexual sex once a year need not conceptualize himself as a homosexual because he does not have a "preference" or an "orientation" toward men.[81] None of this is to suggest that survey sociologists should close up shop. Indeed, the information they create is deeply important. But we should always hold in view the fact that surveys necessarily incorporate past ideas about gender and sexuality while at the same time creating new categories that are bound to carry both institutional and individual weight.

Historians as well as sociologists contribute to both the structure and understanding of institutional and individual gender. The psychologist George Elder, Jr., writes: "Human lives are socially embedded in specific historical times and places that shape their content, pattern, and direction. . . . Types of historical change are experienced differentially by people of different ages and roles."[82] The historian Jeffrey Weeks applies this idea to the study of human sexuality by suggesting that we study five aspects of the social production of systems of sexual expression.[83] *Kinship and family* systems and *economic and social changes* (such as urbanization, the increasing economic independence of women, and the growth of a consumer economy)[84] both organize and contribute to changing forms of human sexual expression. So, too, do new types of *social regulation*, which may be expressed through religion or the law. What Weeks calls *the political moment*, that is, "the political context in which decisions are made—to legislate or not, to prosecute or ignore—can be important in promoting shifts in the sexual regime," also profoundly contributes to individual sexual expression.[85] Finally, Weeks invokes what he calls *cultures of resistance*. Stonewall, for example, where the symbolic founding event of the gay rights movement took place, was, after all, a bar where gay men gathered for social rather than political purposes. Although, ultimately, self-identified homosexuals took to conventional political means—voting, lobbying, and political action committees—the prior existence of private spaces in which a gay subculture developed enabled such activities by making visible the potential allies with whom one might join to exact political change, while at the same time modifying individual embodiment of what came to be known as gay sexuality.[86]

Understanding the history of technology is also key to understanding the individual embodiment of contemporary gender systems. Think, for example, about the category of the transsexual. In the nineteenth century transsexuals did not exist. To be sure, men passed as women, and vice versa.[87] But the modern-day transsexual, a person who uses surgery and hormones to transform his or her birth genitals, could not have existed without the necessary medical technology.[88] The transsexual emerged as an identity or type of human, when, in exchange for medical recognition and access to hormones and surgery, transsexuals convinced their doctors that they had become the most stereotypical members of their sex-to-be.[89] Only then would physicians agree to create a medical category that transsexuals could apply in order to obtain surgical treatment.

Russian Dolls

Is there some easy way to envision the double-sided process that connects the production of gendered knowledge about the body on the one surface to the materialization of gender within the body on the other?[90] While no metaphor is perfect, Russian nesting dolls have always fascinated me. As I take apart each outer doll, I wait expectantly to see if there is yet a smaller one within. As the dolls get tinier and tinier, I marvel at the delicacy of the craft that produces successively smaller dolls. But displaying them is a dilemma. Should I leave each doll separate but visible, lined up in an ever-diminishing row? Such a display is pleasing, because it shows each component of the largest doll, but dissatisfying, because each individual doll, while visible, is empty. The complexity of the nesting is gone and, with it, the pleasure, craft, and beauty of the assembled structure. Understanding the system of nesting dolls comes not from seeing each separate doll, but from the process of assembly and disassembly.

I find the Russian nesting doll useful for envisioning the various layers of human sexuality, from the cellular to the social and historical (figure 9.4).[91] Academics can take the system apart for display or to study one of the dolls in more detail. But an individual doll is hollow. Only the complete assembly makes sense. Unlike its wooden counterpart, the human nesting doll changes shape with time. Change can happen in any of the layers, but since the entire assembly has to fit together, altering one of the component dolls requires the interlinked system—from the cellular to the institutional—to change.

While social and comparative historians write about the past to help us understand why we frame the present in particular ways (the outermost doll),

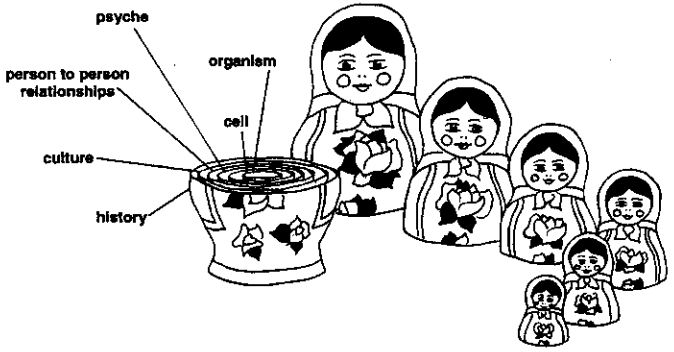


FIGURE 9.4: The organism as represented by a system of Russian stacking dolls. (Source: Erica Warp, for the author)

analysts of popular culture, literary critics, anthropologists, and some sociologists tell us about our current culture (the second largest doll). They analyze our aggregate behaviors, think about how individuals and institutions interact, and chronicle social change. Other sociologists and psychologists think about individual relationships and individual development (the third largest doll), while some psychologists write about the mind or psyche (the fourth doll in). As the location (or, as some would prefer, activity) that links events that occur outside the body to those that occur inside the organism (the second smallest doll),[92] the mind plays an important and peculiar function. The brain is a key organ in the transfer of information from outside the body in and back again, and neuroscientists of many stripes try not only to understand how the brain works as an integrated organ but also how its individual cells function. Indeed, cells make the final, tiny doll found within the organism.[93] In different organs, cells specialize for a variety of functions. They also work as systems, their history and immediate surroundings stimulating signals for particular genes—to contribute (or not) to cellular activities.

Using Russian nesting dolls as a framework suggests that history, culture, relationships, psyche, organism, and cell are each appropriate locations from which to study the formation and meanings of sexuality and gender. Developmental systems theory, whether applied to the assembled doll or to its subunits, provides the scaffolding for thought and experiment. Assembling the smaller dolls into a single large one requires the integration of knowledge derived from very different levels of biological and social organization. The

cell, the individual, groups of individuals organized in families, peer groups, cultures, and nations and their histories all provide sources of knowledge about human sexuality. We cannot understand it well unless we consider all of these components. To accomplish such a task, scholars would do well to work in interdisciplinary groups. And while it is not reasonable, for example, to ask all biologists to become proficient in feminist theory or all feminist theorists to be proficient in cell biology, it *is* reasonable to ask each group of scholars to understand the limitations of knowledge obtained from working within a single discipline. Only nonhierarchical, multidisciplinary teams can devise more complete (or what Sandra Harding calls "less false")[94] knowledge about human sexuality.

I do not naively believe that tomorrow everyone will rush out and join interdisciplinary research teams while revising their belief systems about the nature of scientific knowledge. But public controversies about sex differences and sexuality will continue to break out. Can homosexuals change? Were we born that way? Can girls do high-level mathematics and compete well in the physical sciences? Whenever these or related quandaries boil to the surface, I hope that readers can return to this book to find new and better ways to conceptualize the problems at hand.

The feminist theorist Donna Haraway has written that biology is politics by other means.[95] This book provides an extended argument for the truth of that claim. We will, I am sure, continue to fight our politics through arguments about biology. I want us never, in the process, to lose sight of the fact that our debates about the body's biology are always simultaneously moral, ethical, and political debates about social and political equality and the possibilities for change. Nothing less is at stake.

NOTES

Chapter 1: Dueling Dualisms

1. Hanley 1983.

2. My description of these events is based on the following reports: de la Chapelle 1986; Simpson 1986; Carlson 1991; Anderson 1992; Grady 1992; Le Fanu 1992; Vines 1992; Wavell and Alderson 1992.

3. Quoted in Carlson 1991 p. 27.

4. Ibid.

The technical name for Patiño's condition is Androgen Insensitivity Syndrome. It is one of a number of conditions that leads to bodies having mixtures of male and female parts. Today we call such bodies *intersexes.*

5. Quoted in Vines 1992, p. 41.

6. Ibid., p. 42.

7. The contradiction plagued women's athletics at all levels. See, for example, Verbrugge 1997.

8. The Olympics specifically, and women's sport in general, have built all sorts of gender difference into the heart of its practice. Barring women from certain events or having different rules for the men's and women's games provide obvious examples. For a detailed discussion of gender and sport, see Cahn 1994. For other examples of how gender itself contributes to the construction of different male and female bodies in sports, see Lorber 1993 and Zita 1992.

9. Money and Ehrhardt define "gender role" as "everything that a person says and does to indicate to others or to the self the degree that one is either male, or female, or ambivalent."

They define "gender identity" as "the sameness, unity, and persistence of one's individuality as male, female, or ambivalent. . . . Gender identity is the private experience of gender role, and gender role is the public experience of gender identity" (Money and Ehrhardt 1972, p. 4. For a discussion of Money's separation of "sex" from "gender," see Hausman 1995.

Money and Ehrhardt distinguish between chromosomal sex, fetal gonadal sex, fetal hormonal sex, genital dimorphism, brain dimorphism, the response of adults to the infant's gender, body image, juvenile gender identity, pubertal hormonal sex, pubertal eroticism, pubertal morphology, and adult gender

152. See, for example, Houtsmuller et al. 1994. There is a fairly large literature on the effects of location in the uterus on future behavior.

153. Gottlieb 1997.

154. Laviola and Alleva 1995.

155. Harris and Levine 1965.

156. De Jonge et al. 1988.

157. Harris and Levine 1965.

158. Feder 1981.

159. Gerall et al. 1967; Valenstein and Young 1955; Hard and Larsson 1968; Thor and Holloway 1984; and Birke 1989.

160. For example, when nonovulating female rats were housed with sexually experienced males, they would not mate. But after 3 months of continuous cohabitation, 18 out of 60 of these females responded to male mounting (Segal and Johnson, cited in Harris and Levine 1965).

161. Ward 1992.

162. Moore et al. 1992. Moore describes the effects of early testosterone treatment as either a web or a cascade. Her model has no linear connections. The number of affected organs grows as hormones influence the scent glands and the brain early in the process and subsequently alter liver physiology, genital anatomy, and muscle development. Finally maternal licking, overall body size, play, exploration, and self-grooming behaviors all interact with hormonal effects. Thus, behavior results from the intersection of links among physiology, anatomy, and behavior. For example, maternal licking causes and is caused by the interrelationships between pup odor, pup urine production and retention, pup leg-extension behavior, maternal water and salt balance related to lactation and attraction to pup odor. The relationships are complex and decentralized. Hormones become part of a web that includes—among other things—experience, the brain, peripheral muscles, and general physiology (Moore and Rogers 1984; Moore 1990).

163. Drickamer 1992.

164. Moore and Rogers 1984; Moore 1990.

165. Arnold and Breedlove 1985.

166. Breedlove 1997, p.801. There are other hormone effects as well. Prenatal or perinatal testosterone treatment lowers thyroid function, affects the liver, and causes a wide variety of reproductive system abnormalities (Moore and Rogers 1984; Moore 1990; Harris and Levine 1965; de Jonge et al. 1988; de Jonge 1986).

167. Södersten describes a strain of rats in which intact males exhibit significant levels of lordosis, often considered to be an exclusively female behavior, while van de Poll and colleagues report on one showing no hormonally induced alterations in aggressive behavior. Finally, Luttge and Hall and McGill and Haynes discuss strain differences in how mice respond to testosterone

treatment (van de Poll et al. 1981; Södersten 1976; McGill and Haynes 1973; Luttge and Hall 1973).

168. See, for example, Calhoun 1962; Berry and Bronson 1992; Smith, Hurst et al. 1994.

169. Gerall et al. 1973.

170. Södersten 1976.

171. Adkins-Regan et al. 1989.

172. De Jonge et al. 1988. This result is consistent with the report that an ovary present around puberty in either male or female rats facilitated the appearance of female behavior when the animals were examined as adults (Gerall et al. 1973).

173. Tobet and Fox 1992.

174. Toran-Allerand 1984, p. 63; emphasis added.

175. One correspondent who read this comment scoffed, suggesting it would be a waste of time to do long-term studies, since he was certain the outcome wouldn't change. Given the current explosion of information on neural plasticity, I believe that long-term studies that manipulate environmental variables are quite appropriate.

176. Brown-Grant 1974.

177. Beach 1971.

178. Feder 1981, p. 143.

179. Arnold and Breedlove 1985.

180. Thor and Holloway 1984 review work on social play in juvenile rats.

181. The pituitary of adult female rats, for example, controls the reproductive cycle with periodic or cyclical secretions. In contrast, the male rat pituitary controls reproduction with a constant flow of hormones. Perinatal testosterone seems to permanently suppresses cyclicity in treated females, while castration of newborn males results in adults with a cyclically functioning pituitary (Harris and Levine 1965). In primates, however, prenatal hormonal effects on pituitary function are not permanent. Thus the development of sex differences in pituitary physiology differs in rats and primates. In the latter group, functional modulation in adulthood is possible (Baum 1979).

182. Feder 1981; Adkins-Regan 1988.

Chapter 9: Gender Systems: Toward a Theory of Human Sexuality

1. Sterling 1954, 1955. A number of scholars took the time to read and critique an earlier draft of this chapter. They of course bear no responsibility for its final condition, but they do deserve my heartfelt thanks: Liz Grosz, John Modell, Cynthia García-Coll, Robert Perlman, Lundy Braun, Peter Taylor, Roger Smith, and Susan Oyama.

2. Sterling 1970.

3. For example, perhaps her genetic makeup synchronized with her environment, and thus both pushed in the same direction. Or, what if she had wanted to dress in pink and hated the woods? Could any amount of maternal pressure have parted her from her Betsy Wetsy? Then again, what if she had grown up in New York City, born of parents who had little curiosity about how the natural world works? Would her inner scientist have suffered the fate of Shakespeare's sister, described with such sadness by Virginia Woolf in *A Room of One's Own*? There is no way to sort out these possibilities, and thus the speculation about origins always remains, as with the corpus callosum debate, as much in the political realm as in the scientific.

4. See, for example, Money and Ehrhardt 1972; Zucker and Bradley 1995.

5. Dewey and Bentley 1949, p. 69.

6. The philosopher Alfred North Whitehead writes: "the notion of 'organism' has two meanings . . . the microscopic meaning and the macroscopic meaning. The microscopic meaning is concerned with . . . a process of realizing an individual unity of experience. The macroscopic meaning is concerned with the givenness of the actual world . . . the stubborn fact which at once limits and provides opportunity for the actual occasion. . . . In our experience we essentially arise out of our bodies which are the stubborn facts of the immediate relevant past" (Whitehead 1929, p.129). Like a number of biologists (Waddington 1975; Gottlieb 1997), I find Whitehead's process philosophy the most appropriate way to think about organisms. For more on Whitehead, see Kraus 1979.

7. Hubbard and Wald 1993; Lewontin et al. 1984; Lewontin 1992.

8. Crichton 1990.

9. Hubbard and Wald 1993.

10. Hamer et al. 1993, pp. 321, 326. Rice et al. (1999) have been unable to repeat the finding that places it among a large number of genetic claims about complex behavior that continue to be in dispute.

11. Pool 1993, p. 291.

12. Anonymous 1995a; Anonymous 1995b.

13. A workshop of behavioral scientists that focused on the question "How do genes set up behavior?" wrote that future work will lead to the conclusion that "gene products are but a minute fraction of the total number of behavioral determinants. A second, small fraction will be identifiable as relatively straightforward environmental factors. Most importantly, however, the vast majority of deterministic factors will reside in the multitude of as yet unpredictable interactions between genetic and environmental factors." While this group still uses the language of interactionism, their results and conclusions suggest strongly that dynamic systems will provide the better path to understanding relationships between genes and behavior (Greenspan and Tully 1993, p. 79).

14. There are four kinds of bases that, when grouped together three at a time, can signal the cell to bring a particular amino acid to a structure called a ribosome, which is itself made up of several proteins and a different kind of gene product called ribosomal RNA. On the ribosome other molecules, RNAs, and proteins cooperate to link different amino acids into linear arrays called proteins. Protein assembly takes place in the cell but outside the nucleus.

15. Cohen and Stewart 1994; Ingber 1998.

16. See Stent 1981.

17. Brent 1999. Developmentalists are only now thinking about how to handle and analyze such complexity. Some have even reached for connectionist models! See, for example, Reinitz et al. 1992. Furthermore, geneticists have become increasingly aware of the complexity of expression even of genes usually trotted out as examples of a "pure" 1:1 relationship between genetic structure and phenotype (Scriver and Waters 1999).

18. Stent 1981, p. 189.

19. The ethical question of whether these children were "captured" or "rescued" is discussed in Noske 1989. See also Singh 1942; Gesell and Singh 1941.

20. Recent results on humans include Eriksson et al. 1998; Kemperman and Gage 1999. Recent results on other mammals include Barinaga 1998; Johansson et al. 1999; Wade 1999; Gould et al. 1999; Kemperman et al. 1998; and Gould et al. 1997.

21. Barinaga 1996; Yeh et al. 1996; Vaias et al. 1993; Moore et al. 1995. Dramatic examples come from fish that change sex depending on their social setting. See Grober 1997; see also Kolb and Whishaw 1998.

22. Examples of plasticity from nonhuman vertebrates have been accumulating for years. See, for example, Crair et al. 1998; Kolb 1995; Kirkwood et al. 1996; Kaas 1995; Singer 1995; Sugita 1996; and Wang et al. 1995. It is imperative to incorporate this work into theories of sexual development. It no longer seems acceptable to me to conclude—even tentatively—from consistent patterns emerging from, for example, studies of cognition in adult heterosexual males and females compared to gay male and lesbian adults that "prenatal sex hormones are critical determinants of a wide range of sex-typical characteristics" (Halpern and Crothers 1997, p. 197).

23. See White and Fernald 1997.

24. But remember how hard this turns out to be—the same genetic strain of mouse behaves differently in different laboratories (Crabbe et al. 1999).

25. See also Juraska and Meyer 1985. Morphological changes in the shape of individual nerve cells can happen very rapidly (within 30 minutes) after a

period of intense activity (Maletic-Savatic et al. 1999; Engert and Bonhoeffer 1999. Longer-term behavioral changes may involve changes in the structure and relationships of so-called neural assemblies—groups of interconnected cells. See Hammer and Menzel 1994.

Consider the dwarf Siberian hamster. Like many animals living in the wild, males develop mature testes and mate during certain seasons, but their gonads shrink and no longer make sperm during their "down time." While short day length can induce the regression of mature gonads, it can do so only if there are no receptive females and young in the vicinity. Diet can also affect the pattern. Day length, social cues, and diet are all environmental signals that directly affect the hypothalamus, a part of the brain involved in regulating hormonal signals that can affect behavior (Matt 1993). Similar stories can be told for birds, see Ball 1993.

The frequency of sex can also affect the nervous system. The psychologist Marc Breedlove studied spinal cord nerves in rats, focusing on specific nerves involved with erection and ejaculation. Sexually active male rats had smaller nerve cells in certain spinal cord nerves than did celibate ones. This observation is important when trying to interpret information such as that provided by LeVay's finding that gay and straight men had slightly different cell groupings in their hypothalamus. We have no way of knowing if the difference caused a behavior or vice versa. Given the complexity of human sexual desire, I suspect the latter is a more likely interpretation (Breedlove 1997; LeVay 1991).

26. Specifically, there was binding in the bed nucleus of the stria terminalis, the hippocampus, subiculum, lateral septal nuclei, entorhinal and piriform cortex, and medial preoptic area and arcuate nucleus of the hypothalamus. There was a decreased presence of estrogen receptor binding cells in the periventricular gray area of the midbrain (Ehret et al. 1993).

27. Blakeslee 1995; Zuger 1997.

28. Kolata 1998b.

29. Huttenlocher and Dabholkar 1997.

30. Another recent animal example: The neurobiologist Eric Knudsen provided young barn owls with prism glasses, thus distorting their early visual experiences. This led, in turn, to permanent adult changes in the visual fields of the treated owls. He writes that "the act of learning abnormal associations early in life leaves an enduring trace . . . that enables unusual functional connections to be reestablished as needed, in adulthood, even when the associations represented by these connections have not been used for an extended period of time." (Knudsen 1998, p. 1,531).

31. Benes et al. 1993; see also Paus et al. 1999. There are two caveats to this claim. First, the study only goes through the seventh decade of life. I predict that the finding of continued new myelination will be extended as our lifespan increases. Second, Benes et al. studied only one particular region of

brain—a region of the hippocampus. Not all regions of the brain have the same developmental pattern, but I suspect that the general finding that brain development continues throughout life will become more and more supported by future studies on a variety of brain regions.

32. The study of neuroplasticity, especially in adult humans, is in its early days. I expect that additional mechanisms of neural plasticity will be found as studies continue. For a recent example, see Byrne 1997.

33. Kirkwood et al. 1996; Wang et al. 1995; Singer 1995; Sugita 1996.

34. This finding fits nicely with work showing a change in cortical representation of monkeys trained to repeatedly use the middle finger of one hand (Jenkins 1992; Elbert et al. 1995).

35. Cohen et al. 1997; Sterr et al. 1998.

36. Pons 1996; Sadato et al. 1996.

37. Baharloo et al. related the development of perfect pitch in musicians early musical training (Baharloo et al. 1998).

38. For a discussion of how earlier physiologists interpreted the phenomenon, see Grosz 1994.

39. Aglioti et al. 1994; Yang et al. 1994; Elbert et al. 1997.

40. Elbert et al. 1994; Kaas 1998. The explanations of phantom limb pain are complicated. See Flor et al. 1995; Knecht et al. 1996; Montoya et al. 1998.

41. Such knowledge has stimulated the development of training programs for those who have lost the use of limbs due to stroke. Some programs include mental as well as physical interventions, again suggesting that the world outside the body can help shape the body's interior (Taub et al. 1993; Taub et al. 1994).

42. Arnstein 1997, p. 179.

43. For analyses of embodiment during pregnancy and of the effects of technologies of fetal visualization on the embodiment of pregnancy, see Rothman 1990, chapter 9, and Rapp 1997.

44. Elman et al. 1996, pp. 354, 365.

45. Elman and colleagues acknowledge their intellectual debt to other connectionist theorists. Clearly, thought has converged from many intellectual locations toward the idea of dynamic systems development.

46. These days some psychologists and many neurobiologists have collapsed the distinction between body and mind. One contributor to Loveweb writes: "The only reason we use psychological language intentions, goals, motives, etc. at all is that we don't know how to talk about these states in neurophysiological terms . . . Environmentalists and interactionists who believe that social/cultural/contextual influences cannot, in principle, be reduced to biological influences are using discourse that is incommensurate with science." Many psychologists disagree with such bio-imperialism. One respondent to Slashdot writes: "The key point about 'psychological language' is that it for-

malizes the way in which conscious humans have evolved to carve up the firm realities of the world of inner personal awareness and its imperfect) social exchange. . . . What we call objective 'scientific' observation and thought are parasitic on the capacity to share subjective experiences. . . . And it's only because we can eventually and appreciably relate physical descriptions of brains, genes, etc. back to experiential accounts that the former can tell us anything with human usefulness." For a feminist analysis of mind, body, and cognitive psychology, see Wilson 1998. In this chapter I use the words *psyche* and *mind* interchangeably. Traditionally, according to the OED (online), *psyche* has meant "the animating principle in man and other living beings . . . in distinction from its material vehicle, the soma or body"; in psychology the word has meant "the conscious and unconscious mind and emotion, esp. as influencing the whole person."

46. West and Fenstermaker 1995, p. 21.

47. West and Zimmerman 1987.

48. West and Fenstermaker 1995; Alarcón et al. 1998; Akiba et al. 1999; Hammonds 1994.

49. The study of human development over the entire life cycle has come into its own in the past twenty or so years. For a thorough review, see Elder 1998.

50. For more on the psychoanalytic approach, see Fast 1993; Magee and Miller 1997.

51. Jacklin and Reynolds 1993. Lott and Maluso write: "What appears to be central to all social learning perspectives, and the unifying factor in otherwise differing approaches, is the use of general learning principles to explain human social behavior" (Lott and Maluso 1993, p. 100). For a theory combining learning and cognitive approaches as well as emphasizing gender as a lifelong accomplishment, see Bussey and Bandura 1998.

52. Kessler and McKenna 1978.

53. One exception is the visionary work of Kessler and McKenna (1978), who provided a mature theory of gender construction at a time when thinking about the social construction of gender was in its infancy. See also Beall and Sternberg 1993; Gergen and Davis 1997.

54. Magee and Miller 1997, p. xiv.

55. The several process or systems approaches to the study of human development differ in detail, but none address gender at much length. See Grotevant 1987; Wapner and Demick 1998; and Gottlieb et al. 1998.

56. Fogel and Thelen 1987, p. 756.

57. Ibid., p. 757.

58. Ibid.

59. The psychologist Esther Thelen and her colleagues have applied these ideas to the development of basic motor skills in infants. Traditionally, psychologists believe that infants develop through a series of stages, in which

neuromuscular development precedes the acquisition of new abilities such as crawling or walking. Traditionalists presume that neuromuscular development proceeds according to a gene-driven developmental plan. In contrast, Thelen offers evidence that neuromuscular connections needed for walking are present at birth, but that infants don't walk because other aspects of their support structure—bone and muscle strength, for example—are not developed enough to support the body's weight. Infant crawling, for example, is not "an inevitable human stage" but "an ad hoc solution to the problem of getting desired distant objects discovered by individual infants, given a particular level of strength and postural control" (Thelen 1995, p. 91). Thelen does not find the emphasis on individuality at odds with species similarities. She writes: "Because humans also share anatomy and common biomechanical . . . constraints, solutions to common motor problems also converge. We all discover walking rather than hopping (although our gait styles are individual and unique)" (p. 91). These latter particularities have developed as part of the child's prior movements in interaction with the environment.

Thelen and her colleagues see developmental change "as a series of states of stability, instability and phase shifts" (p. 84). Knowing when such phase shifts or periods of instability are under way can be important for both physical and mental therapy, since these are periods when behaviors have a greater possibility of change. The technical term for such stabilization is *canalization*, a word C. H. Waddington first applied to embryological development, but a number of developmental psychologists now apply it to the development of behavior. Thelen uses a Waddington-style diagram of canalization to illustrate her point. See also Gottlieb 1991, 1997; Gottlieb et al. 1998; and Waddington 1957. Change can occur throughout a lifetime and is always accompanied by the destabilization of a current system, followed by a period of instability—a phase of exploration—and ultimately the settling in of a new pattern.

The infant lives in a rich environment, absorbing information from sight, sound, touch, taste, and muscle, joint, and skin receptors that register the constant changes imbibed by an active body. Along with a growing number of developmental psychologists, Thelen rejects a dualism between structure and function. Instead, "repeated cycles of perception and action give rise to new forms of behavior without preexisting mental or genetic structures" (p. 93). Thelen lists six goals for a developmental theory: "1. To understand the origins of novelty. 2. To reconcile global regularities with local variability, complexity, and context-specificity. 3. To integrate developmental data at many levels of explanation. 4. To provide a biologically plausible yet nonreductionist account of the development of behavior. 5. To understand how local processes lead to global outcomes. 6. To establish a theoretical basis for generating and interpreting empirical research" (Thelen and Smith 1994, p. xviii).

60. For an in-depth treatment, see Fogel et al. 1997. Other studies fit

well into Fogel's theories, theories that attract me because emotion can be seen to develop as a system that is at the same time physiological and relational. See, for example, Dawson et al. 1992. Jerome Kagan and his colleagues correlated individual differences in temperament found in very young infants with the subsequent development of childhood and adult personality traits. In their view, temperament emerges as a component of nervous activity that, just as with smile development, the child and its environment transform into a recognizable pattern of behavior. For example, Kagan proposes the temperamental category *inhibited,* which develops from "very low motor activity and minimal crying in response to unfamiliar events at four months and sociable, fearless behavior in response to discrepant events at one and two years of age" (Kagan 1994, p. 49). He believes that the motor activity of newborns is the product of complex genetic and environmental interactions. The terminology used here can very confusing. Researchers, reporters, and laypeople often confuse terms such as *genetic, biological,* and *inborn.* Technically, a genetic cause would be one form of biological difference. Something inborn could be inherited in the DNA, or it could result from something that affected the fetus in utero. The term *environment* could also refer to events in utero. For example, infection with the German measles virus can cause permanent damage to a developing fetus. This damage is environmental rather than genetic, but it is also biological, because it interferes with embryonic development. The term *environment* can also refer to postbirth effects resulting from parental reinforcement or modeling, peer interactions, and the like. "Development," he suggests, "is a cooperative mission, and no behavior is a first-order, direct product of genes" (Kagan 1994, p. 37).

Kagan offers a systematic account to what every mother claims to know: Children have different temperaments from the moment of birth. Individual personality traits develop and refine over the life cycle. Herein lie two important contributions to the study of human sexuality. First, individual variability is at least as important as belonging to a particular category such as male or female; and second, behavioral profiles (personalities) develop over the entire life cycle. A particular early pattern does not necessarily become a specific later one. The vast majority of researchers in this field study group differences; those critical of such an approach argue that group difference studies erase variability within groups, variability that is often as great or greater than between-group difference. Furthermore, such an approach fixes the categories. For example, the idea of "the woman" emerges rather than more differentiated categories, such as "the white, middle class woman in her fifth decade." See discussions by Lewis 1975; Hare-Mustin and Marecek 1994; Kitzinger 1994; James 1997; and Chodorow 1995. Lott and Maluso note that gender is a complex category because it is always part of a complex that includes race, class, and individual experiences (family, sibling order, etc.). This makes gender a fairly unreliable predictor of behavior. They write: "our gen-

...prophecies based on stereotyped expressions often fail, particularly in ...tions/contexts where other social categories or personal attributes are ...e salient or relevant. Our social institutions continue, nevertheless, to ...gly support the stereotypes and to generalize behavior, thereby main...ng gender inequities in power and privilege" (Lott and Maluso 1993, p. ...). See also Valsiner 1987 for a detailed evaluation of theories in develop...tal psychology.

...Kagan does examine sex differences. He reported that about 15 percent of ...who were inhibited at nine and fourteen months became very fearful by ...ty-one months of age, while very few low-reactive boys became more ...d with time. He presumes (with some evidence) that minimal sex differ...es in personality became exaggerated over time because "parents uncon...sly treat sons and daughters in different ways and produce the larger ...ber of older fearful girls" (Kagan 1994, p. 263).

...61. Of the psychologists cited in the coming paragraphs, Sandra Bem and ...rie Thorne are outspoken feminists. I do not know the political outlook of ...other scholars whose work I use here.

...62. Fagot et al. 1986.

...63. Infants as young as nine months can perceive the difference between ...male and female faces, but their ability to label others or self does not ...lop until some time later (Fagot and Leinbach 1993). Fagot and Leinbach ...d behaviors according to types of toys chosen (e.g., dolls vs. transporta...toys), communication with adults, and levels of aggression. By the time ...child reached 2.25 years, the parents of early and late labelers no longer ...ed in the frequency of positive and negative responses to sex-stereotyped ... (Fagot and Leinbach 1989, p. 663). On sex-stereotyped parental re...ses to newborn children, see Karraker et al. 1995.

...64. Fagot and Leinbach 1989, p. 672. Levy (1989) found that certain ...s of parental interactions correlated with greater gender schematization ...ildren; girls with mothers who worked outside the home had greater ...er flexibility, as did children with fewer siblings. Boys who watched en...inment TV had a greater knowledge of sex roles, while girls who watched ...tional television had greater gender role flexibility. Thus many factors ...ibute to the strength and rigidity of gender role schemas in young chil...ged 2.8 to 5 years old.

...65. Developmental psychologists use the term *gender constancy* to describe ...d's ability to tell a person's sex regardless of clues such as dress or hair...There is dispute about when and how such gender constancy develops ... 1989).

...66. Bem (1989) used photos of children with short hair, but gave them ...er-appropriate wigs when she created the gender-typical photos. See also ...arneffe 1997.

...67. Martin and Little 1990, pp. 1,436, 1,437; Martin 1994.

68. Martin et al. 1990. For additional interactions between cognitive maturation and socialization experiences in middle childhood, see Serbin et al. 1993.

69. Thorne 1993, pp. 3–4. In 1998, Judith Rich Harris's book caused a big media flap because she argued the importance of peer socialization. She makes an extreme statement of what Thorne and many other psychologists have known for years. See Harris 1998. The September 7, 1998, issue of *Newsweek* devoted its cover story to the book. For recent research on intrafamilial effects of sibling order, gender, and parental attitudes, see McHale et al. 1999.

70. Thorne is far from alone in questioning the utility of continued research on difference. See, e.g., James 1997.

71. García-Coll et al. (1997) suggest seven new research approaches: 1) "Focus on the social and psychological processes that become packaged as 'race,' ethnicity, social class and/or gender;" 2) "Examine how contexts shape children's understandings of social categories;" 3) "Examine the intersection and boundaries of social categories in children's lives;" 4) "Examine how children participate in constructing, using, and resisting social categories;" 5) "Examine how social identities influence children's goals, values, self-concepts, and behavioral engagement;" 6) "Study 'race,' ethnicity, social class and gender as developmental phenomena;" 7) "Study the categories themselves."

72. Lorber 1994, p. 32; emphasis in original. Lorber is also careful to point out that gender is not the only socially produced dichotomy; she focuses additionally on race and class. Presumably, subjective identities are not acquired additively, but gender comes to mean different things within the added matrices of race and class. Psychologists and sociologists concentrate on gender for two positive reasons: The gender dichotomy becomes established very early on, and it is a major component of the way many, if not all, cultures produce social organization. There are, of course, also negative reasons—racism and classism—for the relative lack of study of the development of race and class dichotomy in a society in which these aspects of human existence also loom large. See also West and Fenstermaker 1995.

73. See, for example, Epstein 1997; Lott 1997.

74. Lorber 1994; Fiske 1991; Bem 1993; Halley 1994; Jacklin 1989.

75. In a debate among feminist theorists, the political scientist Mary Hawkesworth wrote that "discussions of gender in history, language, literature and the arts, education, the media, politics, psychology, religion, medicine and science, society, law and the workplace have become staples of contemporary feminist scholarship" (Hawkesworth 1997). I agree that all of these intellectual arenas have the potential to contribute to the project of understanding the body as a biosociocultural system. Here I draw examples from the fields of sociology and history.

76. From Katherine B. Davis's work on women in prison (see chapter 6), to present-day studies on the frequency of homosexual interactions in urban and rural settings, social scientists have wanted information with which to guide important social policy decisions. Are crime and sex related? Can we obtain realistic models of sexual activities and networks that can help us stop the spread of AIDS and other sexually transmitted diseases? Is teenage pregnancy really on the rise, and if so, why? Getting answers to these questions is not easy, and whatever conclusions we *can* reach are always qualified by the limits on information gained through mass survey methods (di Mauro 1995, Ericksen 1999).

77. Hacking 1986.

78. Delaney 1991. Or what about men who will not use the word *sex* to describe homosexual encounters? Instead they have sex with their wives and "fool around" with men (Cotton 1994).

79. Garber (1995) discusses bisexuality. Other discussions of problems with using oversimplified categories of sexual preference may be found in (Rothblatt 1995; Burke 1996).

80. Diamond 1993, p. 298. Such homosexuality is not necessarily "displacement activity." One need only read in the genre of prison biography to find men who genuinely fall in love in prison, but who have a heterosexual love life on the outside. For a moving account of falling in love with other men in prison, see Berkman 1912. Berkman, Emma Goldman's longtime lover, writes of his deep feelings developed on two occasions while in prison. It is hard to interpret these as merely a sexual outlet. For a more modern account, see Puig 1991.

81. The fear that naming categories and asking people whether they fit in them will actually *create* the behaviors in question lies at the root of the political difficulties that sexologists (here I speak primarily of sociologists and psychologists who study human sexual behavior) encounter in obtaining funding to do such studies (Fausto-Sterling 1992a; Laumann, Michael, et al. 1994). Mainstream scholars as well as politicians view the study of human sexual behavior with more than a little suspicion. In the 1960s no academic journal would publish Masters and Johnson's original work on the physiology of the human sexual response (Masters and Johnson 1966). More recently, Cynthia Jayne, a clinical psychologist in private practice, could not convince a major psychology journal to accept her study on female orgasm and sexual satisfaction although a sexology journal took it right away. Since their work is often attacked as scandalous, sex researchers have adopted a defensive posture. This fact has contributed significantly to the intellectual shape of the field. As Jayne writes: "There then exists a narrow path which sex researchers must navigate between responding to inappropriate criticism and generating the critiques that ensure the health and continued professional growth of the field" (Jayne 1986, p. 2). See also Irvine 1990a, 1990b.

82. Elder 1998, p. 969.

83. Weeks 1981b. Weeks does not claim these as the only categories, but thinks of them more as a set of guidelines.

84. Evans (1993) writes that "state penetration of civil society in consumer capitalism means that instead of capital domination being grounded in a civil society colonised to the ends of reproducing labour, now civil society is colonised by the state to the ends of reproducing consumers, 'men and women whose needs are permanently redirected to fit the needs of the market', in their obsessive pursuit of sexuality, 'the medium through which they seek to define their personalities and to be conscious of themselves" (p. 64).

85. Weeks 1981b, p. 14.

86. For a detailed historical account of the making of gay male private spaces and culture in New York City, see Chauncey 1994.

87. See, for example, Kates 1995. Leslie Feinberg presents a fascinating history of people who cross-dressed and assumed cross-gendered identities, pointing out that in more than a few cases, individuals who transgressed gender divides also engaged in other revolutionary actions: peasant revolts, religious rebellions, and more. Her book breaks new ground, painstakingly stitching together fragments of history. Although in the genre of "recovered history" typical of the beginning of new social movements, it presents a challenge to historians to look more deeply into the cases she brings to light (Feinberg 1996).

88. For the importance of technology in the emergence of transsexualism and contemporary definitions of gender, see Hausman 1995. For the history of cosmetic surgery more generally, consult Haiken 1997. Both books illustrate the importance of technology in the processes of producing sex and gender.

89. The medical anthropologist Margaret Lock concurs with this point when she writes that most accounts of the body in culture do not "take into account the powerful transformations of the material brought about by technoscience or consider the impact this has on subjectivity, representation and the politics of everyday life" (Lock 1997, p. 269).

90. My attempt to provide a visual map of systems of human sexual development was inspired by the work of the science studies scholar Peter J. Taylor. The first working principle is that social and natural processes cannot be separated. The second is that quite different modes of inquiry offer important insight into complex puzzles. Taylor applies a systems approach to two different examples, one involving ecosystems and the other a mental illness—severe depression. Consider the process of soil erosion in a Mexican village. Taylor says it can be understood only by the simultaneous consideration of the region's social and political history, the character of agriculture and ecology ("natural" factors such as rainfall, soil structure, etc.), the nature of local social and economic institutions, and regional demographic changes. Traditionally, scholars study each of these factors as if they were independent entities. Taylor, however, represents them as horizontal parallel lines crisscrossed by vertical hen tracks. The hen tracks represent events such as regulation of goat grazing or the use of terracing, which change the nature of the parallel lines. An accurate picture of the current situation can be grasped only by looking at all four lines and their interconnections (Taylor 1995, 1997, 1998, and 1999).

91. Although he did not use the stacking-doll metaphor, many years ago the embryologist Paul Weiss used a diagram of development that resembles a cross section of a Russian doll. He included more of the organismal layers than I do, but the idea is quite similar (Weiss 1959). Others have used more complex diagrams to visualize human development. See, for example, Wapner and Demick 1998, fig. 13.1. They use Dewey and Bentley's notion of transaction to describe the "organism in environment" system, which they characterize in terms of levels of integration. These range from activities within the individual organism to what Wapner and Demick call the "person in the world system" (p. 767).

92. Dewey and Bentley use the words *extradermal* and *intradermal* to communicate this idea. They also are very wary of the idea of "the mind." They write: "The 'mind' as 'actor,' still in use in present-day psychologies and sociologies, is the old self-acting 'soul' with its immortality stripped off, grown dessicated and crotchety. 'Mind' or 'mental' as a preliminary word in casual phrasing is a sound word to indicate a region or at least a general locality in need of investigation; as such it is unobjectionable. 'Mind,' 'faculty,' 'I.Q.' or what not as an actor in charge of behavior is a charlatan, and 'brain' as a substitute for such a 'mind' is worse. Such words insert a name in place of a problem" (Dewey and Bentley 1949, pp. 131–32). I use the idea of mind or psyche as a placeholder for processes we can examine, but not as descriptions of a mechanism.

93. Of course there are smaller units within the cells—organelles, molecules, etc. But the cell is the last of the independently functioning unit systems. A nucleus and its genes cannot create an organism outside a cell.

94. Harding 1995.

95. This is a paraphrase of "Primatology Is Politics by Other Means," Haraway 1986, p. 77.