

Medical Metaphors of Women's Bodies

MENSTRUATION AND MENOPAUSE

Emily Martin

Lavoisier makes experiments with substances in his laboratory and now he concluded that this and that takes place when there is burning. He does not say that it might happen otherwise another time. He has got hold of a definite world-picture—not of course one that he invented: he learned it as a child. I say world-picture and not hypothesis, because it is the matter-of-course foundation for his research and as such also goes unmentioned.

—Ludwig Wittgenstein,

On Certainty

It is difficult to see how our current scientific ideas are infused by cultural assumptions; it is easier to see how scientific ideas from the past, ideas that now seem wrong or too simple, might have been affected by cultural ideas of an earlier time. To lay the groundwork for a look at contemporary scientific views of menstruation and menopause, I begin with the past.

It was an accepted notion in medical literature from the ancient Greeks until the late eighteenth century that male and female bodies were structurally similar. As Nemesius, bishop of Emesa, Syria, in the fourth century, put it, "women have the same genitals as men, except that theirs are inside the body and not outside it." Although increasingly detailed anatomical understanding (such as the discovery of the nature of the ovaries in the last half of the seventeenth century) changed the details, medical

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scholars from Galen in second-century Greece to Harvey in seventeenth-century Britain all assumed that women's internal organs were structurally analogous to men's external ones.¹

Although the genders were structurally similar, they were not equal. For one thing, what could be seen of men's bodies was assumed as the pattern for what could not be seen of women's. For another, just as humans as a species possessed more "heat" than other animals, and hence were considered more perfect, so men possessed more "heat" than women and hence were considered more perfect. The relative coolness of the female prevented her reproductive organs from extruding outside the body but, happily for the species, kept them inside where they provided a protected place for conception and gestation.²

During the centuries when male and female bodies were seen as composed of analogous structures, a connected set of metaphors was used to convey how the parts of male and female bodies functioned. These metaphors were dominant in classical medicine and continued to operate through the nineteenth century:

The body was seen, metaphorically, as a system of dynamic interactions with its environment. Health or disease resulted from a cumulative interaction between constitutional endowment and environmental circumstance. One could not well live without food and air and water; one had to live in a particular climate, subject one's body to a particular style of life and work. Each of these factors implied a necessary and continuing physiological adjustment. The body was always in a state of becoming—and thus always in jeopardy.³

Two subsidiary assumptions governed this interaction: first, that "every part of the body was related inevitably and inextricably with every other" and, second, that "the body was seen as a system of intake and outgo—a system which had, necessarily, to remain in balance if the individual were to remain healthy."⁴

Given these assumptions, changes in the relationship of body functions occurred constantly throughout life, though more acutely at some times than at others. In Edward Tilt's influential mid-nineteenth-century account, for example, after the menopause blood that once flowed out of the body as menstruation was then turned into fat:

Fat accumulates in women after the change of life, as it accumulates in animals from whom the ovaries have been removed. The withdrawal of the

sexual stimulus from the ganglionic nervous system, enables it to turn into fat and self-aggrandisement that blood which might otherwise have perpetuated the race.⁵

During the transition to menopause, or the "dodging time," the blood could not be turned into fat, so it was either discharged as hemorrhage or through other compensating mechanisms, the most important of which was "the flush":

As for thirty-two years it had been habitual for women to lose about 3 oz. of blood every month, so it would have been indeed singular, if there did not exist some well-continued compensating discharges acting as waste-gates to protect the system, until health could be permanently re-established by striking new balances in the allotment of blood to the various parts . . . The flushes determine the perspirations. Both evidence a strong effect of conservative power, and as they constitute the most important and habitual safety-valve of the system at the change of life, it is worth while studying them.⁶

In this account, compensating mechanisms like the "flush" are seen as having the positive function of keeping intake and outgo in balance.

These balancing acts had exact analogues in men. In Hippocrates' view of purification, one that was still current in the seventeenth century,

women were of colder and less active disposition than men, so that while men could sweat in order to remove the impurities from their blood, the colder dispositions of women did not allow them to be purified in that way. Females menstruated to rid their bodies of impurities.⁷

Or in another view, expounded by Galen in the second century and still accepted into the eighteenth century, menstruation was the shedding of an excess of blood, a plethora.⁸ But what women did through menstruation men could do in other ways, such as by having blood let.⁹ In either view of the mechanism of menstruation, the process itself not only had analogues in men, it was seen as inherently health-maintaining. Menstrual blood, to be sure, was often seen as foul and unclean,¹⁰ but the process of excreting it was not intrinsically pathological. In fact, failure to excrete was taken as a sign of disease, and a great variety of remedies existed even into the nineteenth century specifically to reestablish menstrual flow if it stopped.¹¹

By 1800, according to Laqueur's important recent study, this long-established tradition that saw male and female bodies as similar both in structure and in function began to come "under devastating attack. Writers of all sorts were determined to base what they insisted were fundamental differences between male and female sexuality, and thus between man and woman, on discoverable biological distinctions."¹² Laqueur argues that this attempt to ground differences between the genders in biology grew out of the crumbling of old ideas about the existing order of politics and society as laid down by the order of nature. In the old ideas, men dominated the public world and the world of morality and order by virtue of their greater perfection, a result of their excess heat. Men and women were arranged in a hierarchy in which they differed by degree of heat. They were not different in kind.¹³

The new liberal claims of Hobbes and Locke in the seventeenth century and the French Revolution were factors that led to a loss of certainty that the social order could be grounded in the natural order. If the social order were merely convention, it could not provide a secure enough basis to hold women and men in their places. But after 1800 the social and biological sciences were brought to the rescue of male superiority. "Scientists in areas as diverse as zoology, embryology, physiology, heredity, anthropology, and psychology had little difficulty in proving that the pattern of male-female relations that characterized the English middle classes was natural, inevitable, and progressive."¹⁴

The assertion was that men's and women's social roles themselves were grounded in nature, by virtue of the dictates of their bodies. In the words of one nineteenth-century theorist, "the attempt to alter the present relations of the sexes is not a rebellion against some arbitrary law instituted by a despot or a majority—not an attempt to break the yoke of a mere convention; it is a struggle against Nature; a war undertaken to reverse the very conditions under which not man alone, but all mammalian species have reached their present development."¹⁵ The doctrine of the two spheres—men as workers in the public, wage-earning sphere outside the home and women (except for the lower classes) as wives and mothers in the private, domestic sphere of kinship and morality inside the home—replaced the old hierarchy based on body heat.

During the latter part of the nineteenth century, new metaphors that posited fundamental differences between the sexes began to appear. One nineteenth-century biologist, Patrick Geddes, perceived two opposite kinds of processes at the level of the cell: "upbuilding, constructive, synthetic processes," summed up as anabolism, and a "disruptive, descending series of

chemical changes," summed up as katabolism.¹⁶ The relationship between the two processes was described in frankly economic terms:

The processes of income and expenditure must balance, but only to the usual extent, that expenditure must not altogether outrun income, else the cell's capital of living matter will be lost,—a fate which is often not successfully avoided . . . Just as our expenditure and income should balance at the year's end, but may vastly outstrip each other at particular times, so it is with the cell of the body. Income too may continuously preponderate, and we increase in wealth, or similarly, in weight, or in anabolism. Conversely, expenditure may predominate, but business may be prosecuted at a loss; and similarly, we may live on for a while with loss of weight, or in katabolism. This losing game of life is what we call a katabolic habit.¹⁷

Geddes saw these processes not only at the level of the cell, but also at the level of entire organisms. In the human species, as well as in almost all higher animals, females were predominantly anabolic, males katabolic. Although in the terms of his saving-spending metaphor it is not at all clear whether katabolism would be an asset, when Geddes presents male-female differences, there is no doubt which he thought preferable:

It is generally true that the males are more active, energetic, eager, passionate, and variable; the females more passive, conservative, sluggish, and stable . . . The more active males, with a consequently wider range of experience, may have bigger brains and more intelligence; but the females, especially as mothers, have indubitably a larger and more habitual share of the altruistic emotions. The males being usually stronger, have greater independence and courage; the females excel in constancy of affection and in sympathy.¹⁸

In Geddes, the doctrine of separate spheres was laid on a foundation of separate and fundamentally different biology in men and women, at the level of the cell. One of the striking contradictions in his account is that he did not carry over the implications of his economic metaphors to his discussion of male-female differences. If he had, females might have come off as wisely conserving their energy and never spending beyond their means, males as in the "losing game of life," letting expenditures outrun income.

Geddes may have failed to draw the logical conclusions from his meta-

phor, but we have to acknowledge that metaphors were never meant to be logical. Other nineteenth-century writers developed metaphors in exactly opposite directions: women spent and men saved. The Rev. John Todd saw women as voracious spenders in the marketplace, and so consumers of all that a man could earn. If unchecked, a woman would ruin a man, by her own extravagant spending, by her demands on him to spend, or, in another realm, by her excessive demands on him for sex. Losing too much sperm meant losing that which sperm was believed to manufacture: a man's lifeblood.¹⁹

Todd and Geddes were not alone in the nineteenth century in using images of business loss and gain to describe physiological processes. Susan Sontag has suggested that nineteenth-century fantasies about disease, especially tuberculosis, "echo the attitudes of early capitalist accumulation. One has a limited amount of energy, which must be properly spent . . . Energy, like savings, can be depleted, can run out or be used up, through reckless expenditure. The body will start 'consuming' itself, the patient will 'waste away.'"²⁰

Despite the variety of ways that spending-saving metaphors could be related to gender, the radical difference between these metaphors and the earlier intake-outgo metaphor is key. Whereas in the earlier model, male and female ways of secreting were not only analogous but desirable, now the way became open to denigrate, as Geddes overtly did, functions that for the first time were seen as uniquely female, without analogue in males. For our purposes, what happened to accounts of menstruation is most interesting: by the nineteenth century, the process itself was seen as soundly pathological. In Geddes's terms,

*it yet evidently lies on the borders of pathological change, as is evidenced not only by the pain which so frequently accompanies it, and the local and constitutional disorders which so frequently arise in this connection, but by the general systemic disturbance and local histological changes of which the discharge is merely the outward expression and result.*²¹

Whereas in earlier accounts the blood itself may have been considered impure, now the process itself is seen as a disorder.

Nineteenth-century writers were extremely prone to stress the debilitating nature of menstruation and its adverse impact on the lives and activities of women.²² Medical images of menstruation as pathological were remarkably vivid by the end of the century. For Walter Heape, the militant antisuffragist and Cambridge zoologist, in menstruation the entire epithelium was torn away,

leaving behind a ragged wreck of tissue, torn glands, ruptured vessels, jagged edges of stroma, and masses of blood corpuscles, which it would seem hardly possible to heal satisfactorily without the aid of surgical treatment.²³

A few years later, Havelock Ellis could see women as being "periodically wounded" in their most sensitive spot and "emphasize the fact that even in the healthiest woman, a worm however harmless and unperceived, gnaws periodically at the roots of life."²⁴

If menstruation was consistently seen as pathological, menopause, another function which by this time was regarded as without analogue in men, often was too: many nineteenth-century medical accounts of menopause saw it as a crisis likely to bring on an increase of disease.²⁵ Sometimes the metaphor of the body as a small business that is either winning or losing was applied to menopause too. A late-nineteenth-century account specifically argued against Tilt's earlier adjustment model: "When the period of fruitfulness is ended the activity of the tissues has reached its culmination, the secreting power of the glandular organs begins to diminish, the epithelium becomes less sensitive and less susceptible to infectious influences, and atrophy and degeneration take the place of the active up-building processes."²⁶ But there were other sides to the picture. Most practitioners felt the "climacteric disease," a more general disease of old age, was far worse for men than for women.²⁷ And some regarded the period after menopause far more positively than it is being seen medically in our century, as the "Indian summer" of a woman's life—a period of increased vigor, optimism, and even of physical beauty."²⁸

Perhaps the nineteenth century's concern with conserving energy and limiting expenditure can help account for the seeming anomaly of at least some positive medical views of menopause and the climacteric. As an early-twentieth-century popular health account put it,

[Menopause] is merely a conservative process of nature to provide for a higher and more stable phase of existence, an economic lopping off of a function no longer needed, preparing the individual for different forms of activity, but is in no sense pathologic. It is not sexual or physical decrepitude, but belongs to the age of invigoration, marking the fullness of the bodily and mental powers.²⁹

Those few writers who saw menopause as an "economic" physiological function might have drawn very positive conclusions from Geddes's description

of females as anabolic, stressing their "thriftiness" instead of their passivity, their "growing bank accounts" instead of their sluggishness.

If the shift from the body as an intake-outgo system to the body as a small business trying to spend, save, or balance its accounts is a radical one, with deep importance for medical models of female bodies, so too is another shift that began in the twentieth century with the development of scientific medicine. One of the early-twentieth-century engineers of our system of scientific medicine, Frederick T. Gates, who advised John D. Rockefeller on how to use his philanthropies to aid scientific medicine, developed a series of interrelated metaphors to explain the scientific view of how the body works:

It is interesting to note the striking comparisons between the human body and the safety and hygienic appliances of a great city. Just as in the streets of a great city we have "white angels" posted everywhere to gather up poisonous materials from the streets, so in the great streets and avenues of the body, namely the arteries and the blood vessels, there are brigades of corpuscles, white in color like the "white angels," whose function it is to gather up into sacks, formed by their own bodies, and disinfect or eliminate all poisonous substances found in the blood. The body has a network of insulated nerves, like telephone wires, which transmit instantaneous alarms at every point of danger. The body is furnished with the most elaborate police system, with hundreds of police stations to which the criminal elements are carried by the police and jailed. I refer to the great numbers of sanitary glands, skilfully placed at points where vicious germs find entrance, especially about the mouth and throat. The body has a most complete and elaborate sewer system. There are wonderful laboratories placed at convenient points for a subtle brewing of skillful medicines . . . The fact is that the human body is made up of an infinite number of microscopic cells. Each one of these cells is a small chemical laboratory, into which its own appropriate raw material is constantly being introduced, the processes of chemical separation and combination are constantly taking place automatically, and its own appropriate finished product being necessary for the life and health of the body. Not only is this so, but the great organs of the body like the liver, stomach, pancreas, kidneys, gall bladder are great local manufacturing centers, formed of groups of cells in infinite numbers, manufacturing the same sorts of products, just as industries of the same kind are often grouped in specific districts.³⁰

Although such a full-blown description of the body as a model of an industrial society is not often found in contemporary accounts of physiology, elements of the images that occurred to Gates are commonplace. In recent years, the "imagery of the biochemistry of the cell [has] been that of the factory, where functions [are] specialized for the conversion of energy into particular products and which [has] its own part to play in the economy of the organism as a whole."³¹ There is no doubt that the basic image of cells as factories is carried into popular imagination, and not only through college textbooks: an illustration from the April 30, 1984, copy of *Time* magazine depicts cells explicitly as factories (and AIDS virus cells as manufacturing armored tanks! [p. 67]).

Still more recently, economic functions of greater complexity have been added: ATP is seen as the body's "energy currency": "Produced in particular cellular regions, it [is] placed in an 'energy bank' in which it [is] maintained in two forms, those of 'current account' and 'deposit account.' Ultimately, the cell's and the body's energy books must balance by an appropriate mix of monetary and fiscal policies."³² Here we have not just the simpler nineteenth-century saving and spending, but two distinct forms of money in the bank, presumably invested at different levels of profit.

Development of the new molecular biology brought additional metaphors based on information science, management, and control. In this model, flow of information between DNA and RNA leads to the production of protein.³³ Molecular biologists conceive of the cell as "an assembly line factory in which the DNA blueprints are interpreted and raw materials fabricated to produce the protein end products in response to a series of regulated requirements."³⁴ The cell is still seen as a factory, but, compared to Gates's description, there is enormous elaboration of the flow of information from one "department" of the body to another and exaggeration of the amount of control exerted by the center. For example, from a college physiology text:

All the systems of the body, if they are to function effectively, must be subjected to some form of control . . . The precise control of body function is brought about by means of the operation of the nervous system and of the hormonal or endocrine system . . . The most important thing to note about any control system is that before it can control anything it must be supplied with information . . . Therefore the first essential in any control system is an adequate system of collecting information about the state of the body . . . Once the CNS [central nervous system] knows what is happening, it must

then have a means for rectifying the situation if something is going wrong. There are two available methods for doing this, by using nerve fibres and by using hormones. The motor nerve fibres . . . carry instructions from the CNS to the muscles and glands throughout the body . . . As far as hormones are concerned the brain acts via the pituitary gland . . . the pituitary secretes a large number of hormones . . . the rate of secretion of each one of these is under the direct control of the brain.³⁵

Although there is increasing attention to describing physiological processes as positive and negative feedback loops so that like a thermostat system no single element has preeminent control over any other, most descriptions of specific processes give preeminent control to the brain, as we will see below.

Metaphors in Descriptions of Female Reproduction

In overall descriptions of female reproduction, the dominant image is that of a signaling system. Lein, in a textbook designed for junior colleges, spells it out in detail:

Hormones are chemical signals to which distant tissues or organs are able to respond. Whereas the nervous system has characteristics in common with a telephone network, the endocrine glands perform in a manner somewhat analogous to radio transmission. A radio transmitter may blanket an entire region with its signal, but a response occurs only if a radio receiver is turned on and tuned to the proper frequency . . . the radio receiver in biological systems is a tissue whose cells possess active receptor sites for a particular hormone or hormones.³⁶

The signal-response metaphor is found almost universally in current texts for premedical and medical students (emphasis in the following quotes is added):

The hypothalamus *receives signals* from almost all possible sources in the nervous system.³⁷

The endometrium *responds directly* to stimulation or withdrawal of estrogen and progesterone. In turn, regulation of the secretion of these steroids involves a well-integrated, highly structured series of activities by

the hypothalamus and the anterior lobe of the pituitary. Although the ovaries do not function autonomously, they *influence*, through *feedback* mechanisms, the level of performance *programmed* by the hypothalamic-pituitary axis.³⁸

As a result of strong stimulation of FSH, a number of follicles *respond* with growth.³⁹

And the same idea is found, more obviously, in popular health books:

Each month from menarche on, [the hypothalamus] acts as elegant interpreter of the body's rhythms, *transmitting messages* to the pituitary gland that set the menstrual cycle in motion.⁴⁰

Each month, *in response to a message* from the pituitary gland, one of the unripe egg cells develops inside a tiny microscopic ring of cells, which gradually increases to form a little balloon or cyst called the Graafian follicle.⁴¹

Although most accounts stress signals or stimuli traveling in a "loop" from hypothalamus to pituitary to ovary and back again, carrying positive or negative feedback, one element in the loop, the hypothalamus, a part of the brain, is often seen as predominant. The female brain-hormone-ovary system is usually described not as a feedback loop like a thermostat system but as a hierarchy, in which the "directions" or "orders" of one element dominate (emphasis in the following quotes from medical texts is added):

Both positive and negative feedback control must be invoked, together with *superimposition* of control by the CNS through neurotransmitters released into the hypophyseal portal circulation.⁴²

Almost all secretion by the pituitary is *controlled* by either hormonal or nervous signals from the hypothalamus.⁴³

The hypothalamus is a collecting center for information concerned with the internal well-being of the body, and in turn much of this information is used *to control* secretions of the many globally important pituitary hormones.⁴⁴

As Lein puts it into ordinary language, "The cerebrum, that part of the brain that provides awareness and mood, can play a significant role in the control of the menstrual cycle. As explained before, it seems evident that these higher regions of the brain exert their influence by modifying the

actions of the hypothalamus. So even though the hypothalamus is a kind of master gland dominating the anterior pituitary, and through it the ovaries also, it does not act with complete independence or without influence from outside itself . . . there are also pathways of control from the higher centers of the brain."⁴⁵

So this is a communication system organized hierarchically, not a committee reaching decisions by mutual influence.⁴⁶ The hierarchical nature of the organization is reflected in some popular literature meant to explain the nature of menstruation simply: "From first menstrual cycle to menopause, the hypothalamus acts as the conductor of a highly trained orchestra. Once its baton signals the downbeat to the pituitary, the hypothalamus-pituitary-ovarian axis is united in purpose and begins to play its symphonic message, preparing a woman's body for conception and child-bearing." Carrying the metaphor further, the follicles vie with each other for the role of producing the egg like violinists trying for the position of concertmaster; a burst of estrogen is emitted from the follicle like a "clap of tympani."⁴⁷

The basic images chosen here—an information-transmitting system with a hierarchical structure—have an obvious relation to the dominant form of organization in our society.⁴⁸ What I want to show is how this set of metaphors, once chosen as the basis for the description of physiological events, has profound implications for the way in which a change in the basic organization of the system will be perceived. In terms of female reproduction, this basic change is of course menopause. Many criticisms have been made of the medical propensity to see menopause as a pathological state.⁴⁹ I would like to suggest that the tenacity of this view comes not only from the negative stereotypes associated with aging women in our society, but as a logical outgrowth of seeing the body as a hierarchical information-processing system in the first place. (Another part of the reason menopause is seen so negatively is related to metaphors of production, which I discuss later in this essay.)

What is the language in which menopause is described? In menopause, according to a college text, the ovaries become "unresponsive" to stimulation from the gonadotropins, to which they used to respond. As a result the ovaries "regress." On the other end of the cycle, the hypothalamus has gotten estrogen "addiction" from all those years of menstruating. As a result of the "withdrawal" of estrogen at menopause, the hypothalamus begins to give "inappropriate orders."⁵⁰ In a more popular account, "the pituitary gland during the change of life becomes disturbed when the ovaries fail to respond to its secretions, which tends to affect its control over other glands. This results in a temporary imbalance existing among all the endocrine glands of

the body, which could very well lead to disturbances that may involve a person's nervous system."⁵¹

In both medical texts and popular books, what is being described is the breakdown of a system of authority. The cause of ovarian "decline" is the "decreasing ability of the aging ovaries to respond to pituitary gonadotropins."⁵² At every point in this system, functions "fail" and falter. Follicles "fail to muster the strength" to reach ovulation.⁵³ As functions fail, so do the members of the system decline: "breasts and genital organs gradually atrophy,"⁵⁴ "wither,"⁵⁵ and become "senile."⁵⁶ Diminished, atrophied relics of their former vigorous, functioning selves, the "senile ovaries" are an example of the vivid imagery brought to this process. A text whose detailed illustrations make it a primary resource for medical students despite its early date describes the ovaries this way:

the *senile ovary* is a shrunken and puckered organ, containing few if any follicles, and made up for the most part of old corpora albicantia and corpora atretica, the bleached and functionless remainders of corpora lutea and follicles embedded in a dense connective tissue stroma.⁵⁷

Ovaries cease to respond and fail to produce. Everywhere else there is regression, decline, atrophy, shrinkage, and disturbance.

The key to the problem connoted by these descriptions is functionlessness. Susan Sontag has written of our obsessive fear of cancer, a disease that we see as entailing a nightmare of excessive growth and rampant production. These images frighten us in part because in our stage of advanced capitalism, they are close to a reality we find difficult to see clearly: broken-down hierarchy and organization members who no longer play their designated parts represent nightmare images for us. One woman I have talked to said her doctor gave her two choices for treatment of her menopause: she could take estrógen and get cancer or she could not take it and have her bones dissolve. Like this woman, our imagery of the body as a hierarchical organization gives us no good choice when the basis of the organization seems to us to have changed drastically. We are left with breakdown, decay, and atrophy. Bad as they are, these might be preferable to continued activity, which because it is not properly hierarchically controlled, leads to chaos, unmanaged growth, and disaster.

But let us return to the metaphor of the factory producing substances, which dominates the imagery used to describe cells. At the cellular level DNA communicates with RNA, all for the purpose of the cell's production of pro-

teins. In a similar way, the system of communication involving female reproduction is thought to be geared toward production of various things. My discussion in this essay is confined to the normal process of the menstrual cycle. It is clear that the system is thought to produce many good things: the ovaries produce estrogen, the pituitary produces FSH and LH, and so on. Follicles also produce eggs in a sense, although this is usually described as "maturing" them since the entire set of eggs a woman has for her lifetime is known to be present at birth. Beyond all this the system is seen as organized for a single pre-eminent purpose: "transport" of the egg along its journey from the ovary to the uterus⁵⁸ and preparation of an appropriate place for the egg to grow if it is fertilized. In a chapter titled "Pregnancy Reproductive Functions of the Female, and the Female Hormones," Guyton puts it all together: "Female reproductive functions can be divided into two major phases: first, preparation of the female body for conception and gestation, and second, the period of gestation itself."⁵⁹ This view may seem commonsensical and entirely justified by the evolutionary development of the species, with its need for reproduction to ensure survival.

Yet I suggest that assuming this view of the purpose for the process slants our description and understanding of the female cycle unnecessarily. Let us look at how medical textbooks describe menstruation. They see the action of progesterone and estrogen on the lining of the uterus as "ideally suited to provide a hospitable environment for implantation and survival of the embryo"⁶⁰ or as intended to lead to "the monthly renewal of the tissue that will cradle [the ovum]."⁶¹ As Guyton summarizes, "The whole purpose of all these endometrial changes is to produce a highly secretory endometrium containing large amounts of stored nutrients that can provide appropriate conditions for implantation of a fertilized ovum during the latter half of the monthly cycle."⁶² Given this teleological interpretation of the purpose of the increased amount of endometrial tissue, it should be no surprise that when a fertilized egg does not implant, these texts describe the next event in very negative terms. The fall in blood progesterone and estrogen "deprives" the "highly developed endometrial lining of its hormonal support," "constriction" of blood vessels leads to a "diminished" supply of oxygen and nutrients, and finally "disintegration starts, the entire lining begins to slough, and the menstrual flow begins." Blood vessels in the endometrium "hemorrhage" and the menstrual flow "consists of this blood mixed with endometrial debris."⁶³ The "loss" of hormonal stimulation causes "necrosis" (death of tissue).⁶⁴

The construction of these events in terms of a purpose that has failed is beautifully captured in a standard text for medical students (a text otherwise

noteworthy for its extremely objective, factual descriptions) in which a discussion of the events covered in the last paragraph (sloughing, hemorrhaging) ends with the statement "When fertilization fails to occur, the endometrium is shed, and a new cycle starts. This is why it used to be taught that 'menstruation is the uterus crying for lack of a baby.'"⁶⁵

I am arguing that just as seeing menopause as a kind of failure of the authority structure in the body contributes to our negative view of it, so does seeing menstruation as failed production contribute to our negative view of it. We have seen how Sontag describes our horror of production gone out of control. But another kind of horror for us is *lack* of production: the disused factory, the failed business, the idle machine. In his analysis of industrial civilization, Winner terms the stopping and breakdown of technological systems in modern society "apraxia" and describes it as "the ultimate horror, a condition to be avoided at all costs."⁶⁶ This horror of idle workers or machines seems to have been present even at earlier stages of industrialization. A nineteenth-century inventor, Thomas Ewbank, elaborated his view that the whole world "was designed for a Factory."⁶⁷ "It is only as a Factory, a *General Factory*, that the whole materials and influences of the earth are to be brought into play."⁶⁸ In this great workshop, humans' role is to produce: "God employs no idlers—creates none."⁶⁹

Like artificial motors, we are created for the work we can do—for the useful and productive ideas we can stamp upon matter. Engines running daily without doing any work resemble men who live without labor; both are spendthrifts dissipating means that would be productive if given to others.⁷⁰

Menstruation not only carries with it the connotation of a productive system that has failed to produce, it also carries the idea of production gone awry, making products of no use, not to specification, unsalable, wasted, scrap. However disgusting it may be, menstrual blood will come out. Production gone awry is also an image that fills us with dismay and horror. Amid the glorification of machinery common in the nineteenth century were also fears of what machines could do if they went out of control. Capturing this fear, one satirist wrote of a steam-operated shaving machine that "sliced the noses off too many customers."⁷¹ This image is close to the one Melville created in "The Bell-Tower," in which an inventor, who can be seen as an allegory of America, is killed by his mechanical slave,⁷² as well as to Mumford's sorcerer's apprentice applied to modern machinery:⁷³

Our civilization has cleverly found a magic formula for setting both industrial and academic brooms and pails of water to work by themselves, in

ever-increasing quantities at an ever-increasing speed. But we have lost the Master Magician's spell for altering the tempo of this process, or halting it when it ceases to serve human functions and purposes.⁷⁴

Of course, how much one is gripped by the need to produce goods efficiently and properly depends on one's relationship to those goods. While packing pickles on an assembly line, I remember the foreman often holding up improperly packed bottles to us workers and trying to elicit shame at the bad job we were doing. But his job depended on efficient production, which meant many bottles filled right the first time. This factory did not yet have any effective method of quality control, and as soon as our supervisor was out of sight, our efforts went toward filling as few bottles as we could while still concealing who had filled which bottle. In other factories, workers seem to express a certain grim pleasure when they can register objections to company policy by enacting imagery of machinery out of control. Noble reports an incident in which workers resented a supervisor's order to "shut down their machines, pick up brooms, and get to work cleaning the area. But he forgot to tell them to stop. So, like the sorcerer's apprentice, diligently and obediently working to rule, they continued sweeping up all day long."⁷⁵

Perhaps one reason the negative image of failed production is attached to menstruation is precisely that women are in some sinister sense out of control when they menstruate. They are not reproducing, not continuing the species, not preparing to stay at home with the baby, not providing a safe, warm womb to nurture a man's sperm. I think it is plain that the negative power behind the image of failure to produce can be considerable when applied metaphorically to women's bodies. Vern Bullough comments optimistically that "no reputable scientist today would regard menstruation as pathological,"⁷⁶ but this paragraph from a recent college text belies his hope:

If fertilization and pregnancy do not occur, the corpus luteum degenerates and the levels of estrogens and progesterone decline. As the levels of these hormones decrease and their stimulatory effects are withdrawn, blood vessels of the endometrium undergo prolonged spasms (contractions) that reduce the bloodflow to the area of the endometrium supplied by the vessels. The resulting lack of blood causes the tissues of the affected region to degenerate. After some time, the vessels relax, which allows blood to flow through them again. However, capillaries in the area have become so weakened that blood leaks through them. This blood and the deteriorating endometrial tissue are discharged from the uterus as the menstrual flow.

As a new ovarian cycle begins and the level of estrogens rises, the functional layer of the endometrium undergoes repair and once again begins to proliferate.⁷⁷

In rapid succession the reader is confronted with "degenerate," "decline," "withdrawn," "spasms," "lack," "degenerate," "weakened," "leak," "deteriorate," "discharge," and, after all that, "repair."

In another standard text, we read:

The sudden lack of these two hormones [estrogen and progesterone] causes the blood vessels of the endometrium to become spastic so that blood flow to the surface layers of the endometrium almost ceases. As a result, much of the endometrial tissue dies and sloughs into the uterine cavity. Then, small amounts of blood ooze from the denuded endometrial wall, causing a blood loss of about 50 ml during the next few days. The sloughed endometrial tissue plus the blood and much serous exudate from the denuded uterine surface, all together called the *menstrum*, is gradually expelled by intermittent contractions of the uterine muscle for about 3 to 5 days. This process is called *menstruation*.⁷⁸

The illustration that accompanies this text captures very well the imagery of catastrophic disintegration: "ceasing," "dying," "losing," "denuding," and "expelling."

These are not neutral terms; rather, they convey failure and dissolution. Of course, not all texts contain such a plethora of negative terms in their descriptions of menstruation. But unacknowledged cultural attitudes can seep into scientific writing through evaluative words. Coming at this point from a slightly different angle, consider this extract from a text that describes male reproductive physiology. "The mechanisms which guide the remarkable cellular transformation from spermatid to mature sperm remain uncertain . . . Perhaps the most amazing characteristic of spermatogenesis is its sheer magnitude: the normal human male may manufacture several hundred million sperm per day (emphasis added)."⁷⁹ As we will see, this text has no parallel appreciation of female processes such as menstruation or ovulation, and it is surely no accident that this "remarkable" process involves precisely what menstruation does not in the medical view: production of something deemed valuable. Although this text sees such massive sperm production as unabashedly positive, in fact, only about one out of every 100 billion sperm ever makes it to fertilize an egg; from the very

same point of view that sees menstruation as a waste product, surely here is something really worth crying about!

When this text turns to female reproduction, it describes menstruation in the same terms of failed production we saw earlier.

The fall in blood progesterone and estrogen, which results from *regression* of the corpus luteum, *deprives* the highly developed endometrial lining of its hormonal support; the immediate result is *profound constriction* of the uterine blood vessels due to production of vasoconstrictor prostaglandins, which leads to *diminished* supply of oxygen and nutrients. *Disintegration* starts, and the entire lining (except for a thin, deep layer which will regenerate the endometrium in the next cycle) begins to slough . . . The endometrial arterioles dilate, resulting in *hemorrhage* through the weakened capillary walls; the menstrual flow consists of this blood mixed with endometrial *debris* . . . The menstrual flow ceases as the endometrium *repairs* itself and then grows under the influence of rising blood estrogen concentration. [Emphasis added.]⁸⁰

And ovulation fares no better. In fact part of the reason ovulation does not merit the enthusiasm that spermatogenesis does may be that all the ovarian follicles containing ova are already present at birth. Far from being *produced* as sperm is, they seem to merely sit on the shelf, as it were, slowly degenerating and aging like overstocked inventory.

At birth, normal human ovaries contain an estimated one million follicles, and no new ones appear after birth. Thus, in marked contrast to the male, the newborn female already has all the germ cells she will ever have. Only a few, perhaps four hundred, are destined to reach full maturity during her active productive life. All the others degenerate at some point in their development so that few, if any, remain by the time she reaches menopause at approximately fifty years of age. One result of this is that the ova which are released (ovulated) near menopause are thirty to thirty-five years older than those ovulated just after puberty; it has been suggested that certain congenital defects, much commoner among children of older women, are the result of aging changes in the ovum.⁸¹

How different it would sound if texts like this one stressed the vast excess of follicles produced in a female fetus, compared to the number she will actually need. In addition, males are also born with a complement of germ

cells (spermatogonia) that divide from time to time, and most of which will eventually differentiate into sperm. This text could easily discuss the fact that these male germ cells and their progeny are also subject to aging, much as female germ cells are. Although we would still be operating within the terms of the production metaphor, at least it would be applied in an evenhanded way to both males and females.

One response to my argument would be that menstruation just *is* in some objective sense a process of breakdown and deterioration. The particular words are chosen to describe it because they best fit the reality of what is happening. My counterargument is to look at other processes in the body that are fundamentally analogous to menstruation in that they involve the shedding of a lining to see whether they also are described in terms of breakdown and deterioration. The lining of the stomach, for example, is shed and replaced regularly, and seminal fluid picks up shedded cellular material as it goes through the various male ducts.

The lining of the stomach must protect itself against being digested by the hydrochloric acid produced in digestion. In the several texts quoted above, emphasis is on the *secretion* of mucus,⁸² the *barrier* that mucous cells present to stomach acid,⁸³ and—in a phrase that gives the story away—the periodic *renewal* of the lining of the stomach.⁸⁴ There is no reference to degenerating, weakening, deteriorating, or repair, or even the more neutral shedding, sloughing, or replacement.

The primary function of the gastric secretions is to begin the digestion of proteins. Unfortunately, though, the wall of the stomach is itself constructed mainly of smooth muscle, which itself is mainly protein. Therefore, the surface of the stomach must be exceptionally well protected at all times against its own digestion. This function is performed mainly by mucus that is secreted in great abundance in all parts of the stomach. The entire surface of the stomach is covered by a layer of very small *mucous cells*, which themselves are composed almost entirely of mucus; this mucus prevents gastric secretions from ever touching the deeper layers of the stomach wall.⁸⁵

In this account from an introductory physiology text, the emphasis is on production of mucus and protection of the stomach wall. It is not even mentioned, although it is analogous to menstruation, that the mucous cell layers must be continually sloughed off (and digested). Although all the general physiology texts I consulted describe menstruation as a process of disinte-

gration needing repair, only specialized texts for medical students describe the stomach lining in the more neutral terms of "sloughing" and "renewal."⁸⁶ One can choose to look at what happens to the lining of stomachs and uteruses negatively as breakdown and decay needing repair or positively as continual production and replenishment. Of these two sides of the same coin, stomachs, which women and men have, fall on the positive side; uteruses, which only women have, fall on the negative.

One other analogous process is not handled negatively in the general physiology texts. Although it is well known to those researchers who work with male ejaculates that a very large proportion of the ejaculate is composed of shedded cellular material, the texts make no mention of a shedding process let alone processes of deterioration and repair in the male reproductive tract.⁸⁷

What applies to menstruation once a month applies to menopause once in every lifetime. As we have seen, part of the current imagery attached to menopause is that of a breakdown of central control. Inextricably connected to this imagery is another aspect of failed production. Recall the metaphors of balanced intake and outgo that were applied to menopause up to the mid-nineteenth century, later to be replaced by metaphors of degeneration. In the early 1960s new research on the role of estrogens in heart disease led to arguments that failure of female reproductive organs to produce much estrogen after menopause was debilitating to health.

This change is marked unmistakably in successive editions of a major gynecology text. In the 1940s and 1950s menopause was described as usually not entailing "any very profound alteration in the woman's life current."⁸⁸ By the 1965 edition dramatic changes had occurred: "In the past few years there has been a radical change in viewpoint and some would regard the menopause as a possible pathological state rather than a physiological one and discuss therapeutic prevention rather than the amelioration of symptoms."⁸⁹

In many current accounts menopause is described as a state in which ovaries fail to produce estrogen.⁹⁰ The 1981 World Health Organization report defines menopause as an estrogen-deficiency disease.⁹¹ Failure to produce estrogen is the leitmotif of another current text: "This period during which the cycles cease and the female sex hormones diminish rapidly to almost none at all is called the *menopause*. The cause of the menopause is the 'burning out' of the ovaries . . . Estrogens are produced in subcritical quantities for a short time after the menopause, but over a few years, as the final remaining primordial follicles become atretic, the production of estrogens by the ovaries falls almost to zero." Loss of ability to produce estrogen is seen as central to a woman's life: "At the time of the menopause a woman must

readjust her life from one that has been physiologically stimulated by estrogen and progesterone production to one devoid of those hormones."⁹²

Of course, I am not implying that the ovaries do not indeed produce much less estrogen than before. I am pointing to the choice of these textbook authors to emphasize above all else the negative aspects of ovaries failing to produce female hormones. By contrast, one current text shows us a positive view of the decline in estrogen production: "It would seem that although menopausal women do have an estrogen milieu which is lower than that necessary for *reproductive* function, it is not negligible or absent but is perhaps satisfactory for *maintenance of support tissues*. The menopause could then be regarded as a physiologic phenomenon which is protective in nature—protective from undesirable reproduction and the associated growth stimuli."⁹³

I have presented the underlying metaphors contained in medical descriptions of menopause and menstruation to show that these ways of describing events are but one method of fitting an interpretation to the facts. Yet seeing that female organs are imagined to function within a hierarchical order whose members signal each other to produce various substances, all for the purpose of transporting eggs to a place where they can be fertilized and then grown, may not provide us with enough of a jolt to begin to see the contingent nature of these descriptions. Even seeing that the metaphors we choose fit very well with traditional roles assigned to women may still not be enough to make us question whether there might be another way to represent the same biological phenomena. In my other writings I examine women's ordinary experience of menstruation and menopause looking for alternative visions.⁹⁴ Here I suggest some other ways that these physiological events could be described.

First, consider the teleological nature of the system, its assumed goal of implanting a fertilized egg. What if a woman has done everything in her power to avoid having an egg implant in her uterus, such as birth control or abstinence from heterosexual sex. Is it still appropriate to speak of the single purpose of her menstrual cycle as dedicated to implantation? From the woman's vantage point, it might capture the sense of events better to say the purpose of the cycle is the production of menstrual flow. Think for a moment how that might change the description in medical texts: "A drop in the formerly high levels of progesterone and estrogen creates the appropriate environment for reducing the excess layers of endometrial tissue. Constriction of capillary blood vessels causes a lower level of oxygen and nutrients and paves the way for a vigorous production of menstrual fluids. As a part of the renewal of the remaining endometrium, the capillaries begin to reopen, contributing some blood and serous fluid to the volume of endometrial mater-

ial already beginning to flow." I can see no reason why the menstrual blood itself could not be seen as the desired "product" of the female cycle, except when the woman intends to become pregnant.

Would it be similarly possible to change the nature of the relationships assumed among the members of the organization—the hypothalamus, pituitary, ovaries, and so on? Why not, instead of an organization with a controller, a team playing a game? When a woman wants to get pregnant, it would be appropriate to describe her pituitary, ovaries, and so on as combining together, communicating with each other, to get the ball, so to speak, into the basket. The image of hierarchical control could give way to specialized function, the way a basketball team needs a center as well as a defense. When she did not want to become pregnant, the purpose of this activity could be considered the production of menstrual flow.

Eliminating the hierarchical organization and the idea of a single purpose to the menstrual cycle also greatly enlarges the ways we could think of menopause. A team which in its youth played vigorous soccer might, in advancing years, decide to enjoy a quieter "new game" where players still interact with each other in satisfying ways but where gentle interaction *itself* is the point of the game, not getting the ball into the basket—or the flow into the vagina.

NOTES

1. Thomas Laqueur, "Female Orgasm, Generation, and the Politics of Reproductive Biology." *Representations* 14 (Spring 1986): 1–82.
2. *Ibid.*, p. 10.
3. Charles E. Rosenberg, "The Therapeutic Revolution: Medicine, Meaning, and Social Change in Nineteenth-Century America." In Morris J. Vogel and Charles E. Rosenberg, ed., *The Therapeutic Revolution: Essays in the Social History of American Medicine*, p. 5 (Philadelphia: University of Pennsylvania Press, 1979).
4. *Ibid.*, pp. 5–6.
5. Edward John Tilt, *The Change of Life in Health and Disease* (London: John Churchill, 1857), p. 54.
6. *Ibid.*, pp. 54, 57.
7. Patricia Crawford, "Attitudes to Menstruation in Seventeenth-Century England." *Past and Present* 91 (1981): 50.
8. *Ibid.*, p. 50.
9. William G. Rothstein, *American Physicians in the Nineteenth Century: From Sects to Science* (Baltimore: John Hopkins University Press, 1972), pp. 45–49.

10. Crawford, *Attitudes to Menstruation*, p. 63.
11. See Kristen Luker, *Abortion and the Politics of Motherhood* (Berkeley: University of California Press, 1984), p. 18; Crawford, *Attitudes to Menstruation*, pp. 53–54; and Vieda Skultans, "The Symbolic Significance of Menstruation and the Menopause," *Man* 5, no. 4 (1970): 639–51.
12. Laqueur, "Female Orgasm," p. 4.
13. *Ibid.*, p. 8.
14. Elizabeth Fee, "Science and the Woman Problem: Historical Perspectives. In Michael S. Teitelbaum, ed., *Sex Difference: Social and Biological Perspectives*, (New York: Doubleday, 1976), p. 190.
15. Walter Bagehot, quoted in Fee, *Science*, p. 190.
16. Patrick Geddes and J. Arthur Thompson, *The Evolution of Sex* (New York: Scribner and Wilford, 1890). p. 122.
17. *Ibid.*, p. 123.
18. *Ibid.*, pp. 270–71.
19. G. J. Barker-Benfield, *The Horrors of the Half-Known Life: Male Attitudes Toward Women and Sexuality in Nineteenth-Century America* (New York: Harper and Row, 1976), pp. 195–96.
20. Susan Sontag, *Illness as Metaphor* (New York: Vintage, 1979), pp. 61–62.
21. Geddes and Thompson, *Evolution of Sex*, p. 244; see also Carroll Smith-Rosenberg, "Puberty to Menopause: The Cycle of Femininity in Nineteenth-Century America." In Mary Hartman and Lois W. Bonner, ed., *Clio's Consciousness Raised* (New York: Harper and Row, 1974), pp. 28–29.
22. Smith-Rosenberg, "Puberty to Menopause," pp. 25–27.
23. Quoted in Laqueur, "Female Orgasm," p. 32.
24. Havelock Ellis, *Men and Women* (London: Walter Scott, 1904), pp. 284, 293, quoted in Laqueur, "Female Orgasm," p. 32.
25. Smith-Rosenberg, "Puberty to Menopause," pp. 30–31; Joel Wilbush, "What's in a Name? Some Linguistic Aspects of the Climacteric." *Maturitas* 3 (1981): 5.
26. Andrew F. Currier, *The Menopause* (New York: Appleton, 1897), pp. 25–26.
27. Carole Haber, *Beyond Sixty-Five: The Dilemma of Old Age in America's Past* (Cambridge: Cambridge University Press, 1983), p. 69. See John Mason Good, *The Study of Medicine*, vol. 2 (New York: Harper and Row, 1843), pp. 23–25 for an explanation of why the climacteric affects men more severely than women.
28. Smith-Rosenberg, "Puberty to Menopause," p. 30.
29. J. Madison Taylor, "The Conservation of Energy in Those of Advancing Years," *Popular Science Monthly* 64 (1904), p. 413.
30. Quoted in Howard Berliner, "Medical Modes of Production." In Peter Wright and Andrew Treacher, ed., *The Problem of Medical Knowledge: Examining the*

Social Construction of Medicine, pp. 170–71 (Edinburgh: Edinburgh University Press, 1982).

31. R. C. Lewontin, Steven Rose, and Leon J. Kamin, *Not in Our Genes: Biology, Ideology, and Human Nature*, p. 58 (New York: Pantheon, 1984).

32. Lewontin et al., *Not in Our Genes*, p. 59; see also Arthur C. Guyton, *Textbook of Medical Physiology*, 7th. ed. (Philadelphia: Saunders, 1986), pp. 23–24.

33. In an extremely important series of papers, Donna Haraway has traced the replacement of organic functional views in biology by cybernetic systems views and shown the permeation of genetics and population biology by metaphors of investment, quality control, and maximization of profit. See Haraway, "Animal Sociology and a Natural Economy of the Body Politic," *Signs* 4 (1978): 21–36, and "The Biological Enterprise: Sex, Mind, and Profit from Human Engineering to Sociobiology," *Radical History Review* 20 (1979): 206–37.

34. Lewontin et al., *Not in Our Genes*, p. 59.

35. David F. Horrobin, *Introduction to Human Physiology* (Philadelphia: Davis, 1973), pp. 7–8. See also Guyton, *Physiology of the Human Body*, 6th. ed. (Philadelphia: Saunders, 1984), p. 7. In general, more sophisticated advanced texts such as Guyton, *Textbook*, p. 879 give more attention to feedback loops.

36. Allen Lein, *The Cycling Female: Her Menstrual Rhythm* (San Francisco: Freeman, 1979), p. 14.

37. Guyton, *Textbook*, p. 885.

38. Ralph C. Benson, *Current Obstetric and Gynecologic Diagnosis and Treatment* (Los Altos, Calif.: Lange, 1982), p. 129.

39. Frank H. Netter, *A Compilation of Paintings on the Normal and Pathologic Anatomy of the Reproductive System* (The CIBA Collection of Medical Illustrations, vol. 2) (Summit, N.J.: CIBA, 1965), p. 115.

40. Ronald V. Norris, *PMS: Premenstrual Syndrome* (New York: Berkeley, 1984), p. 6.

41. Katharina Dalton and Raymond Greene, "The Premenstrual Syndrome," *British Medical Journal* (May 1983): 6.

42. Vernon B. Mountcastle, *Medical Physiology*, 14th. ed, vol. 2 (St. Louis, Mo.: Mosby, 1980), p. 1615.

43. Guyton, *Textbook*, p. 885.

44. *Ibid.*

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49. Frances B. McCrea, "The Politics of Menopause: The 'Discovery' of a Deficiency Disease," *Social Problems* 31 (1983): 111-23.
50. Lein, *The Cycling Female*, pp. 79, 97.
51. Daniel J. O'Neill 1982:11.
52. Arthur J. Vander, James H. Sherman, and Dorothy S. Luciano, *Human Physiology: The Mechanisms of Body Functions*, 4th. ed. (New York: McGraw Hill, 1985), p. 597.
53. Norris, *PMS*, p. 181.
54. Vander et al., *Human Physiology*, p. 598.
55. Norris, *PMS*, p. 181.
56. Netter, *A Compilation*, p. 121.
57. *Ibid.*, p. 116.
58. Vander et al., *Human Physiology*, p. 580.
59. Guyton, *Textbook*, p. 968.
60. Vander et al., *Human Physiology*, p. 576.
61. Lein, *The Cycling Female*, p. 43.
62. Guyton, *Textbook*, p. 976.
63. Vander et al., *Human Physiology*, p. 577.
64. Guyton, *Textbook*, p. 976; see very similar accounts in Lein, *The Cycling Female*, p. 69; Mountcastle, *Medical Physiology*, p. 1612; Elliot B. Mason, *Human Physiology* (Menlo Park, Calif.: 1983), p. 518; Benson, *Current Obstetric*, pp. 128-29.
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68. *Ibid.*, p. 23.
69. *Ibid.*, p. 27.
70. *Ibid.*, p. 141; on Ewbank, see John F. Kasson, *Civilizing the Machine: Technology and Republican Values in America, 1796-1900* (New York: Penguin, 1976), pp. 148-51.
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76. Vern Bullough, "Sex and the Medical Model," *The Journal of Sex Research* 11, no. 4 (1975): 298.
77. Mason, *Human Physiology*, p. 525.
78. Guyton, *Physiology*, p. 624.
79. Arthur J. Vander et al., *Human Physiology*, 3d. ed. (1980), pp. 483–84. The latest (4th.) edition of this text has removed the first of these sentences but kept the second (see 4th. ed. [1985], p. 557).
80. Vander et al., *Human Physiology*, 4th. ed., p. 577.
81. *Ibid.*, pp. 567, 568.
82. Mason, *Human Physiology*, p. 419; Vander et al. *Human Physiology*, 4th. ed., p. 483.
83. Ganong, *Review*, p. 776.
84. Mason, *Human Physiology*, p. 423.
85. Guyton, *Physiology*, pp. 498–99.
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87. Vander et al., *Human Physiology*, 4th. ed., pp. 557–58; Ganong, *Review*, p. 356.
88. Emil Novak, *Textbook of Gynecology*, 2d. ed. (Baltimore: Williams and Wilkins 1944), p. 536; Novak and Edmund Novak, *Textbook of Gynecology* (Baltimore: Williams and Wilkins, 1952), p. 600.
89. Edmund Novak, Georgeanna Seegar Jones, and Howard W. Jones, *Textbook of Gynecology*, 7th. ed. (Baltimore: Williams and Wilkins, 1965), p. 642.
90. See Frances B. McCrea and Gerald E. Markle, "The Estrogen Replacement Controversy in the USA and UK: Different Answers to the Same Question?," *Social Studies of Science* 14 (1984): 1–26, for the very different clinical treatment for this lack in the United States and the United Kingdom.
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92. Guyton, *Textbook*, p. 979.

3. Howard Jones and Georgeanna Seegar Jones, *Novak's Textbook of Gynecology*, 11th ed. (Baltimore: Williams and Wilkins, 1981), p. 799.
4. Sadly enough, even the women's health movement literature contains the negative view of menstruation—failed production—as does scientific medicine. See Boston Women's Health Book Collective, *The New Our Bodies Ourselves* (New York: Simon and Schuster, 1984), p. 217 and Federation of Feminist Women's Health Centers, *A New View of a Woman's Body* (New York: Simon and Schuster, 1981), p. 14. As in the case of prepared childbirth literature, this is evidence of the invisibility of the ideology of the dominant culture.