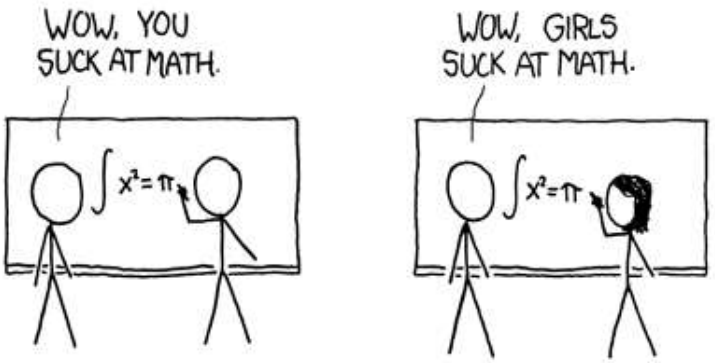
SCIENCE AND SOCIETY, 2022

THE GENDER OF SCIENCE

How (different) knowledge is produced on and by women?

a corpus constituted by Thomas Tari

FORCCAST
Formation par la Cartographie de Controverses à l'analyse des sciences et des techniques



Comic from xkcd.com

SUMMARY

1. Introduction

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Guidelines for the readings

• Does the body of the scientist matters in the scientific endeavour? To what extent? How does the scientist perceives his or her own body in the scientific endeavour? And the epistemology?

• How does a scientist proves his or her belonging to the scientific community ? What are his or her tools of legitimacy? Does gender impacts this belonging and legitimacy?

• How does the production of scientific knowledge on the female body impacts social life, accordingly to the gender of the scientist who produced this knowledge? Have knowledge over bodies a political role?

• What practical impacts can knowledge developed by male researchers have on the female body?

• Does the gender of the scientists shape the representation of the bodies and genders? Can gender bias direct or affect research?

A Gendered Myth for the Origin of Humankind

In : *Ursula K. Le Guin, « The Carrier Bag Theory of Fiction », 1986, available online at https://theanarchistlibrary.org/library/ursula-k-le-guin-the-carrier-bag-theory-of-fiction*

In the temperate and tropical regions where it appears that hominids evolved into human beings, the principal food of the species was vegetable. Sixty-five to eighty percent of what human beings ate in those regions in Paleolithic, Neolithic, and prehistoric times was gathered; only in the extreme Arctic was meat the staple food. The mammoth hunters spectacularly occupy the cave wall and the mind, but what we actually did to stay alive and fat was gather seeds, roots, sprouts, shoots, leaves, nuts, berries, fruits, and grains, adding bugs and mollusks and netting or snaring birds, fish, rats, rabbits, and other tuskless small fry to up the protein. And we didn't even work hard at it — much less hard than peasants slaving in somebody else's field after agriculture was invented, much less hard than paid workers since civilization was invented. The average prehistoric person could make a nice living in about a fifteen-hour work week.

Fifteen hours a week for subsistence leaves a lot of time for other things. So much time that maybe the restless ones who didn't have a baby around to enliven their life, or skill in making or cooking or singing, or very interesting thoughts to think, decided to slope off and hunt mammoths. The skillful hunters would come staggering back with a load of meat, a lot of ivory, and a story. It wasn't the meat that made the difference. It was the story.

It is hard to tell a really gripping tale of how I wrestled a wild-oat seed from its husk, and then another, and then another, and then another, and then another, and then I scratched by gnat bites, and Ool said something funny, and we went to the creek and got a drink and watched newts for a while, and then I found another patch of oats.... No, it does not compare, it cannot compete with how I thrust my spear deep into the titanic hairy flank while Oob, impaled on one huge sweeping tusk, writhed screaming, and blood sprouted everywhere in crimson torrents, and Boob was crushed to jelly when the mammoth fell on him as I shot my unerring arrow straight through eye to brain.

That story not only has Action, it has a Hero. Heroes are powerful. Before you know it, the men and women in the wild-oat patch and their kids and the skills of makers and the thoughts of the thoughtful and the songs of the singers are all part of it, have all been pressed into service in the tale of the Hero. But it isn't their story. It's his.

When she was planning the book that ended up as *Three Guineas*, Virginia Woolf wrote a heading in her notebook, "Glossary"; she had thought of reinventing English according to her new plan, in order to tell a different story. One of the entries in this glossary is *heroism*, defined as "botulism." And *hero*, in Woolf's dictionary, is "bottle." The hero as bottle, a stringent reevaluation. I now propose the bottle as hero.

Not just the bottle of gin or wine, but bottle in its older sense of container in general, a thing that holds something else.

If you haven't got something to put it in, food will escape you — even something as uncombative and unresourceful as an oat. You put as many as you can into your stomach while they are handy, that being the primary container; but what about tomorrow morning when you wake up and it's cold and raining and wouldn't it be good to have just a few handfuls of oats to chew on and give little Oom to make her shut up, but how do you get more than one stomachful and one handful home? So you get up and go to the damned soggy oat patch in the rain, and wouldn't it be a good thing if you had something to put Baby Oo Oo in so that you could pick the oats with both hands? A leaf a gourd shell a net a bag a sling a sack a bottle a pot a box a container. A holder. A recipient.

The first cultural device was probably a recipient.... Many theorizers feel that the earliest cultural inventions must have been a container to hold gathered products and some kind of sling or net carrier.

So says Elizabeth Fisher in *Women's Creation* (McGraw-Hill, 1975). But no, this cannot be. Where is that wonderful, big, long, hard thing, a bone, I believe, that the Ape Man first bashed somebody in the movie and then, grunting with ecstasy at having achieved the first proper murder, flung up into the sky, and whirling there it became a space ship thrusting its way into the cosmos to fertilize it and produce at the end of the movie a lovely fetus, a boy of course, drifting around the Milky Way without (oddly enough) any womb, and matrix at all? I don't know. I don't even care. I'm not telling that story. We've heard it, we've all heard about all the sticks and spears and swords, the things to bash and poke and hit with, the long, hard things, but we have not heard about the thing to put things in, the container for the thing contained. That is a new story. That is news.

And yet old. Before — once you think about it, surely long before — the weapon, a late, luxurious, superfluous tool; long before the useful knife and ax; right along with the indispensable whacker, grinder, and digger — for what's the use of digging up a lot of potatoes if you have nothing to lug the ones you can't eat home in — with or before the tool that forces energy outward, we made the tool that brings energy home. It makes sense to me. I am an adherent of what Fisher calls the Carrier Bag Theory of human evolution.

This theory not only explains large areas of theoretical obscurity and avoids large areas of theoretical nonsense (inhabited largely by tigers, foxes, and other highly territorial mammals); it also grounds me, personally, in human culture in a way I never felt grounded before. So long as culture was explained as originating from and elaborating upon the use of long, hard objects for sticking, bashing, and killing, I never thought that I had, or wanted, any particular share in it. ("What Freud mistook for her lack of civilization is woman's lack of *loyalty* to civilization," Lillian Smith observed.) The society, the civilization they were talking about, these theoreticians, was evidently theirs; they owned it, they liked it; they were human, fully human, bashing, sticking, thrusting, killing. Wanting to be human too, I sought for evidence that I was; but if that's what it took, to make a weapon and kill with it, then evidently I was either extremely defective as a human being, or not human at all.

That's right, they said. What you are is a woman. Possibly not human at all, certainly defective. Now be quiet while we go on telling the Story of the Scent of Man the Hero.

Go on, say I, wandering off towards the wild oats, with Oo Oo in the sling and little Oom carrying the basket. You just go on telling how the mammoth fell on Boob and how Cain fell on Abel and how the bomb

fell on Nagasaki and how the burning jelly fell on the villagers and how the missiles will fall on the Evil Empire, and all the other steps in the Ascent of Man.

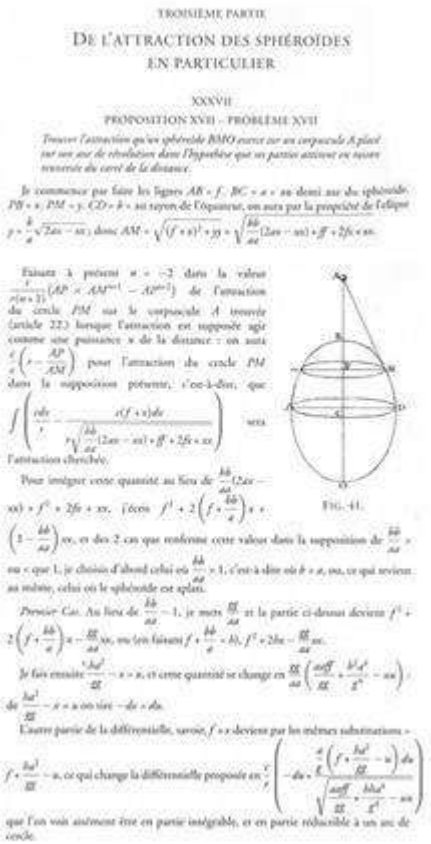
If it is a human thing to do to put something you want, because it's useful, edible, or beautiful, into a bag, or a basket, or a bit of rolled bark or leaf, or a net woven of your own hair, or what have you, and then take it home with you, home being another, larger kind of pouch or bag, a container for people, and then later on you take it out and eat it or share it or store it up for winter in a solider container or put it in the medicine bundle or the shrine or the museum, the holy place, the area that contains what is sacred, and then next day you probably do much the same again — if to do that is human, if that's what it takes, then I am a human being after all. Fully, freely, gladly, for the first time. […]

2. The Role of Women in the Production of Knowledge

Émilie du Châtelet, between Science and Sociability

In : *Mary Terrall. "Émilie Du Châtelet and the Gendering of Science." History of Science, vol. 33, no. 3 Sept. 1995, pp. 283–310*

Émilie Le Tonnelier de Breteuil, Marquise du Châtelet, has gone down in history first of all as Voltaire's mistress and secondly as the only French woman of her time seriously to develop her talent for mathematics and physics. Until recently, her story has been told primarily in the light of Voltaire's, as if he were what made her interesting. As a strong-minded, energetic, ambitious woman, Du Châtelet has elicited the sympathies of twentieth-century feminist scholars — and rightly so, for she struggled against restrictive stereotypes and accomplished a good deal of impressive work. But taking her as a modern feminist distorts the historical context and her place in it.



TROISIÈME PARTIE

DE L'ATTRACTION DES SPHÉROÏDES EN PARTICULIER

XXXVII

PROPOSITION XVII - PROBLÈME XVII

FIG. 41.

Given that Du Châtelet' s particular interests and skills were so unusual among her female contemporaries, we might wonder about the strategies she adopted in her efforts to enter into contemporary debates about the nature of physical and metaphysical reality. These efforts entailed finding a voice and then working to convince an audience of intellectually élite men of the legitimacy of that voice. Hers is not a story of heroic feminism, or of dauntless courage in the face of injustice, or simply of exclusion and élitism. It is a story fraught with ambivalence and ambiguity. As women have often done when trying to redefine female roles, she sought legitimacy through men. This meant maintaining a self-denigrating posture of humility and deference toward men with established reputations, even when she criticized them privately. Her manuscripts contain strong statements about the inherent equality of women's and men's minds and the deplorable state of opportunities for women, but she refrained from publishing such claims. At the same time, she carefully crafted the relatively few texts that represented her public face to the literate world. Her published work included an essay on the chemical and physical properties of fire, a textbook on physics and its metaphysical foundations, and a technical pamphlet on the mathematical measure of force. Just before her premature death in 1749, she completed another major work, a translation with commentary of Isaac Newton's Mathematical principles of natural philosophy, however, it did not appear in print until ten years later. (see figure above) [...]

Scientific Sociability and Patronage

Émilie de Breteuil came from one old noble family and married into another. Her husband was an army officer who lived mostly apart from her after their three children were born in the first years of marriage. Though she enjoyed a certain freedom in her personal life, engaging in romantic liaisons with several men, she remained on friendly terms with the Marquis du Châtelet. She devoted a good deal of time to family obligations, especially a time-consuming lawsuit in a Brussels court over property claimed by her husband' s family. Du Châtelet initiated her contacts with men of science in the uppercrust Parisian social world of informal salon gatherings, where men and women mingled freely. In the 1730s, Parisian salons had not yet assumed the oppositional political role they played in the later part of the century, but they did function as places where science, fine arts and philosophy overlapped in conversation. The feminocentric salons of the seventeenth century had given way by this time to social circles revolving around famous men like Fontenelle and Houdard de la Motte, but the hostesses of these gatherings played a visible role in facilitating intellectual exchange. Salon culture represented itself as replacing the hierarchical status relations of court life with an egalitarian ideal of circulating individuals and ideas. In actuality, of course, hostesses maintained a certain amount of control over access to their salons. Nevertheless, academicians did move through the social world of salons and cafés where aristocrats, philosophes and women could meet and converse on a nominally equal footing.' At mid-century, boundaries between court and salon, café and academy were permeable, as individuals went from one arena to another. For men, salons and cafés provided an alternative to the formality and hierarchy of the academy (and the court, for those invited there). The different venues required different codes of behaviour and provided different sorts of rewards. For women, salons (and sometimes cafés) gave immediate access to men and ideas otherwise closeted in exclusive male institutions. Because women could not cross into these institutions themselves, the sociability of the salons carried different meanings and possibilities for men and for women.

The fluidity of the Parisian intellectual and social scene allowed Du Châtelet to interact with people at the forefront of scientific and philosophical controversies. The culture of high society — dinners, excursions, theatre and opera — linked the closed world of the academy to the broader reading and discussing public. Newtonian physics and English philosophy provided grist for the conversational mill. Newtonianism became a kind of banner for criticism and enlightenment, especially in the hands of Voltaire, but also in the more technically sophisticated work of some academicians. Among these were the men who were to provide Du Châtelet with substantial intellectual support and even collaboration, Pierre-Louis Maupertuis and Alexis Clairaut. Because of its association with young and fashionably unconventional mathematicians, Newtonianism carried an obvious appeal for a philosophical outsider like Du Châtelet, and she made a point of aligning herself with the Newtonian "party" , as they called themselves.

However important the flexible sociability of the salon for facilitating intellectual exchange, the concentrated work of reading, calculating and writing of course took place in more private spaces. But the ties developed in sociable public settings could be carried over into the study, through letters or private conversation. Over the years Du Châtelet proved remarkably adept at moving from social engagements and obligations to intensely solitary work. She found, however, that learning enough mathematics to study physics beyond the popular level was impossible on her own. Accordingly, she arranged with Maupertuis, a regular on the salon and café circuit as well as a rising star in the academy, to teach her mathematics.

The model for such an arrangement between a noblewoman and a male expert would certainly have been patronage, broadly defined as a personal relationship entailing asymmetrical status and some sort of reciprocal obligations between the two parties. One common form of patronage was the domestic arrangement between an (often female) aristocrat and a tutor, whose place in the household could lead to further and more advantageous patronage positions for him. Patronage conferred status on the client while reflecting back on the higher status of the patron, thus reinforcing the hierarchy while opening up options for the client. At the same time, of course, the patron acquired access to the expertise of the tutor.

The son of a recently ennobled rich Breton merchant, Maupertuis had no reason to enter into an explicitly dependent relationship with Du Châtelet. Besides, he had already cultivated connections to other noble families and had been elected to the prestigious Academy of Sciences. Their dealings seem to have been complicated for a time by a sexual relationship, which apparently followed from their ' lessons'. Reading her letters, it is impossible to untangle her demands for emotional and erotic attention from demands for more help with algebra. Though there are hints of patronage in this relationship, it was not always clear who was the patron and who the client. [...]

The Perils of Publishing

Du Châtelet and Voltaire set up housekeeping at her husband's provincial property in Cirey, following Voltaire's brush with the royal censors in 1734. They read Newton, Locke, Boerhaave and Musschenbroek together, but Du Châtelet also spent long hours on projects kept secret from Voltaire, projects through which she hoped to earn a reputation for herself, independent of the great man. When Voltaire decided to enter the 1738 prize essay competition of the Paris Academy of Sciences, Du Châtelet followed suit, without letting him know of her plan. These competitions allowed the academy to exercise its privilege to judge the merit of texts sent to Paris from all over Europe; they also provided various kinds of outsiders with the opportunity to gain recognition from the establishment. (Some were amateurs and some were illustrious foreigners.) Because the judging was officially anonymous, amateurs of all stripes risked little by sending in their work.

The subject for 1738 was the nature and propagation of fire, and Voltaire ordered instruments from Paris for a series of experiments. Observing his attempts to measure weight changes in iron when heated and cooled, Du Châtelet found herself disagreeing with Voltaire's explanation of his results. Where he followed Musschenbroek in assigning weight to the matter of fire, she argued that fire must be an imponderable, expansible fluid similar to the description given by the Dutch chemist Herman Boerhaave. She went further to speculate that fire might be a special kind of substance, neither matter nor spirit. It seems likely that her substantial disagreements with Voltaire prompted her decision to submit an essay, staking out her own position and in the process asserting her independence from Voltaire. She did not intend her essay on fire as a definitive treatment of the subject, but as a kind of tentative challenge to the academy and to herself. "I wanted to test my strength under cover of anonymity, as I imagined that I would never be recognized", she wrote to Maupertuis.

Though neither Voltaire nor Du Châtelet won the prize, the academy agreed to publish their essays anyway, in the light of the identity of the authors, revealed after the judging. Du Châtelet welcomed the chance to have her work accorded even this much recognition; as Voltaire noted, with characteristic hyperbole, "Everyone knows that to be printed by order of this company is in effect to be crowned a winner".

Nevertheless, she entered into protracted negotiations with the academy over what her printed text would look like. [...]

Textual Strategies

Without entering into a detailed analysis of Du Châtelet's *Institutions de physique*, I would like to look at what it reveals about her strategies for establishing her scientific reputation. She chose first of all to cast her book as a pedagogical work, directly addressing the student-reader, identified in the beginning as the author's young son. The decidedly non-academic conceit of a parent providing for a child's education removed the text from the territory policed by the academy. Again, the form of Du Châtelet's text contrasts sharply with Fontenelle's canonical popularization. *Entretiens sur la pluralité des mondes*. Fontenelle framed his dialogues within the conventions of polite conversation and plotted the narrative in terms of seduction: "If you grant a small favour to a lover, you will soon afterward have to grant him more, and eventually that can go far. In the same way, grant a mathematician the slightest principle and he will draw a consequence from it that you'll have to grant him too, and from that consequence, yet another; and in spite of yourself, he will lead you farther than you would ever have thought possible"' Du Châtelet aims at cultivating her audience's capacities, with the narrator in the role of wise and experienced mother rather than sophisticated seducer. This stance shielded her often controversial claims behind a measured didactic tone. Situating her son in the same social world as Fontenelle's marquise ("I want to save (garantir) you from the ignorance that is only too common among people Of your rank"), she contrasts the pleasures of reasoning with the "pleasure-seeking (plaisanterie déplacée)" that characterizes worldly pastimes.' She then implicitly extends the language of maternal concern from the education of her own child to the re-education of dogmatic followers of either Descartes or Newton. [...]

The spectator status of the female public (or readership) functioned not simply to exclude women. The distinction between passive watching and active doing elevated the status of specialized knowledge beyond the reach of spectators. At the same time, the female audience served to validate the truth of the science being popularized, by giving proof of its intelligibility. [...] Du Châtelet meant to enable at least some of her readers, irrespective of their sex, to learn enough to be able to do calculations." By addressing her son (and by extension other children or neophytes) she reversed the order of the hierarchical relations between male author and female spectator/reader. Here the female author controls access to esoteric knowledge, which she imparts to her (male) readers. [...]

Conclusion

[... Du Châtelet's] strategies were riddled with ambiguity: should she make herself as much like a man as possible, or should she rather attempt to feminize the practice of science and philosophy? We can discern both impulses in her life and work, and we should not be surprised to find the tensions between them unresolved. On the one hand, she embraced the opportunity to appear as the noble pupil in the frontispiece to Algarotti's popularization of Newton, a book she roundly criticized as simple-minded. On the other hand, she rebelled against that kind of typecasting by writing a technically sophisticated book that refused the spectator role for women. In her actual dealings with male scientists though, maintaining that desired identity as active participant was enormously difficult. Given the homosocial bonds that grounded

virtually all scientific collaboration and exchange, crossing into that territory clearly resembled entering a holy sanctuary reserved for a masculine priesthood. [...]

In another social context Du Châtelet' s strategies and the responses they provoked might have been different. In Italy, for example, academies did not categorically shut out women. Du Châtelet's contemporary, Laura Bassi, made a career as member of the Academy of the Institute for Sciences of Bologna and ultimately as professor of physics at the University of Bologna. Though both Du Châtelet and Bassi were regarded as prodigies — glaring exceptions who posed no substantial threat to the masculine pattern of science — Bassi found resources available in Bologna totally unlike those available in France. When the Bolognese academy elected Du Châtelet as a foreign member, she recognized that the Italians were legitimizing not just her work, but the very possibility of female academicians. She welcomed her election not just as flattering to herself, but also as "*an encouragement... to persons of my sew; in effect, what more flattering motive could one offer them for cultivating the sciences (where prejudice has up til now seemed to exclude them) than the hope of seeing oneself one day elected to such an illustrious body.*" [...]

The egalitarian ideal expressed in salon conversation was far from the reality of social relations in the Republic of Letters. Du Châtelet tried to find a niche in a cultural space that put up substantial resistance to her efforts. The problematic nature of the separation of the private/secret from the public/open permeated her attempts to publish texts that would ensure her reputation not just as a femme savante but as an active contributor to the scientific enterprise. The shifting ground of scientific patronage made her task more difficult, and the sociability of salons did not approach science closely enough to validate the efforts of a woman pushing the envelope of the female spectator role.

In resisting that role, Du Châtelet at times denied her feminine identity and fashioned herself as "one of the boys". She tried hiding behind the mask of anonymity; she tried wrapping herself in a cloak and riding alone under cover of darkness to the bachelor retreat of Maupertuis and Clairaut outside of Paris; she tried employing the tropes of aristocratic virility in her dispute with Mairan. At other times, in her unpublished writings on moral philosophy or in acknowledging her authorship of her contentious physics textbook, she positioned herself in the vanguard of female accomplishment. In private correspondence, she railed against prevailing prejudices against women's intellectual capacities and she applauded the Bologna academy's openness to women. In spite of this, Du Châtelet does not fit the role of feminist heroine because she was never clear about whether she wanted female participation or only her own participation, as a special individual.

In the final analysis, Du Châtelet failed in her attempts to broaden the definition of femininity to include rationalism and mathematical accomplishment. The ambivalences that characterized her strategies led her contemporaries to question her authenticity as a mathematician or philosopher. As the Marquise du Deffand remarked, "*Madame takes so much care to appear something she is not, that one no longer knows what she really is*". And Voltaire, writing to Frederick the Great after Du Châtelet's premature death, summed up his grief in the following terms: "*I have lost a friend of twenty-five years, a great man whose only fault was being a woman*."

Women of Science in Early-Modern European Colonial Travels

In : *Londa Schiebinger, Plants and Empire, Colonial Bioprospecting in The Atlantic World, Harvard University Press, Cambridge (MA), 2004, p. 30-35*

Maria Sibylla Merian

Sloane and Merian are both central to the story of abortifacients; each identified the peacock flower, later known as the *Poinciana,* while in the Caribbean. To my knowledge, Merian was the only European woman who voyaged exclusively in pursuit of her science in the seventeenth or eighteenth centuries. Amazingly, it is possible to list other women botanic travelers in a single page. Merian was accompanied by her daughter, Dorothea Maria, who served as her assistant. Merian's other daughter, Johanna Helena, also collected *naturalia* in Surinam, traveling in 1711 with her husband, who administered an orphanage there. […]

Merian, born in 1647, was indeed bold to travel to Surinam in search of exotic insects, accompanied only by her twenty-one-year-old daughter, whom she had trained from childhood as a painter and assistant. Bodily and moral imperatives kept the vast majority of Europe's women close to home. Medical men differed in their views about the physical effects of the tropical climate on female physiology. Some, like Thomas Trapham, a Jamaican physician, emphasized that the air in the West Indian islands — made hot by the sun and moist by the moon — was exceedingly agreeable to women, "beneficial to their living, including their conceptions and facilitating their births." Although as the "moistest sex" women suffered greatly from worms, the "vivifying hot" and "multiplyingly moist" air made women fecund like "all other produces in the Indies." Writing from Saint Domingue, Nicolas-Louis Bourgeois celebrated the tropics as a paradise for women: the heat of the climate eased childbirth and allowed women to live to an old age. Thunberg, traveling in the tropics of the East Indies, agreed that women held out better than men against the dysenteries and putrid fevers that put Europeans in early graves, but, he added, "those who come from Europe with rosy cheeks lose this species of beauty in a short time, and are afterwards as pale as corpses."

More often, however, physicians emphasized the grave dangers of travel to the Torrid Zone. In the seventeenth century, many taught that crossing the equator led to infertility. For this reason Dutch women were reluctant to migrate to Brazil. Summing up medical opinion at the end of the eighteenth century, Johann Blumenbach, a German physiologist, emphasized that white women taken to very warm climates succumbed to "copious menstruation, which almost always ended, in a short space of time, in fatal hemorrhages of the uterus." Many women feared that if they gave birth in the tropics, they would deliver children resembling the native peoples of those areas. The intense African sun, it was thought, produced black babies regardless of the parents' complexions. The French physician Jean-Baptiste-René Pouppé-Desportes warned that women aged more quickly under the intense tropical sun; their menstrual cycles also ended at an earlier age, leaving them open to a host of dangerous maladies. Even tropical products were sometimes cause for alarm: women in France, for example, feared that if they consumed too much chocolate, they ran the risk of birthing black babies.

Apart from the real and imagined dangers involved, one important reason women did not travel is that they were never hired by trading companies, scientific academies, or governments as voyaging naturalists. Like Alexander von Humboldt and a few others, Merian financed her own voyage. Unlike Humboldt, however, Merian had no inheritance to rely upon and instead raised the money for her trip by selling a large collection of her paintings and specimens in addition to subscriptions to her prospective Surinam book. Although Merian did not have official sponsorship, her travels to this strange and sometimes unwelcoming land were facilitated, to some extent, by her long-standing connections with the Labadists, a religious group with whom Merian had close contact and which had members living also in Surinam.

Merian sailed from her home in Amsterdam, although she had been born in the free imperial city of Frankfurt am Main. The German princely states and free imperial cities did not hold colonies like many of their European neighbors, despite the strong shipping traditions of Hansa cities such as Lubeck and Hamburg. Nonetheless naturalists from German- speaking areas were well represented among scientific voyagers. Paul Hermann, who finished his life as professor of botany at Leiden, was perhaps the most prominent, but many, like Merian, found their ways to port cities and joined the ecumenical investigation of the world's flora and fauna. Early on, Spanish monarchs had requested German mathematicians aboard their ships to chart the movement of the stars, the position of the oceans, and the flow of the tides because of their precision as astronomers and astrologers.

Merian did not fit the profile of the usual male naturalist — young and unmarried — in this period. Although unmarried, having divorced her artist husband, Johann Andreas Graff, at a relatively young age in order to follow her own interests, at age 52 when she set sail, Merian was considerably older than most voyagers. She was also not trained in medicine as were many voyaging botanists in this period. Maria Sibylla numbered among the few artists who voyaged with scientific expeditions. These included Aimé Bonpland, who traveled with Humboldt, drying herbarium specimens in small smoky huts closed off against the humidity of the tropics; Pierre Jossigny, who voyaged with Commerson; and Alexander Buchan and Sydney Parkinson, who voyaged with Joseph Banks and died probably of malaria or dysentery on the voyage.

Merian had been born into a prominent family of painters, engravers, and publishers. From an early age she served an informal apprenticeship with her stepfather, guild painter Jacob Marrel, after her own father, the famous Matthäus Merian the Elder, died. A contemporary, Joachim von Sandrart, confirmed that "in her home, Merian received good training in sketching and in painting (both oil and water-color) all manner of flowers, fruit, and birds, and in particular […] worms, flies, mosquitoes, spiders." She also learned to engrave copper plates and mix paints. It was not un- usual for women to serve as botanical illustrators (despite restrictions such as the Nürnberg Painters' Code of 1596, which prohibited women from using oils). Barbara Dietzch and Maria Moninckx worked in Merian's style in Amsterdam. Moninckx painted with her father, Jan, for Agnes Block, who owned extensive private gardens, and for Caspar Commelin, director of the Amsterdam Botanical Garden. In France, Madeleine Basseporte recorded on vellum the rare plants at the Jardin du Roi from 1735 until her death in 1780.

Art, not medicine, gave Merian entrée to natural history exploration. She did not travel in the service of a botanist, as did many other artists and illustrators, but instead set her own scientific agenda. Having studied in- sects since the age of thirteen in Frankfurt and Nürnberg, she moved in 1691 to Amsterdam, the hub of Dutch global commerce, to study the extensive collections of rarities from the East and West Indies, especially the natural history collections of the mayor, also director of the East India Company, and his

nephew. Merian was disappointed, however, that these collections contained only dead specimens; what interested her was the metamorphosis and life cycles of caterpillars. She thus set out to do her own research: "This all resolved me to undertake a great and expensive trip to Surinam (a hot and humid land) where these gentlemen had obtained these insects, so that I could continue my observations."

Although Merian's scientific biography differs from that of many naturalists, it also resembles theirs in a number of revealing ways. Throughout her life, Merian, like Sloane, combined science and art with commerce. In Nürnberg, Frankfurt, and Amsterdam she established thriving businesses — selling fine silks, satins, and linens painted with flowers of her own design from which she earned a comfortable living. Her colors (for which she had developed new techniques to enhance their durability) be- came so renowned that she was commissioned by an army general to paint his field tent with all manner of birds and flowers — even on the battlefield, the general wanted to feel that he was enjoying the quiet of a garden house.

Like many male naturalists, Merian also joined commercial interests to her scientific voyage. In the same way that Sloane sought a substitute for the valuable Peruvian bark in Jamaica, Merian sought other varieties of caterpillars in Surinam that, like silkworms, might produce fine thread. Silk was, in this period, big business. In 1700, the Academy of Sciences in Berlin tried (unsuccessfully) to fund their scientific endeavors through a silk monopoly; Merian's own stepuncle was in the silk trade in Frankfurt. Silk indeed became important in colonial manufactory: in the late eighteenth century, the "Lady Governess" of the English East India Company in India, for instance, directed a plantation of mulberry trees at the female orphanage in Madras where at least one hundred girls were profitably engaged producing silk.

In Surinam Merian found one potential silkworm (today identified as the *Rothschildia aurota*) that feeds on what she called a "China tree." The caterpillar produced an "ochre colored thread" that she believed could "produce good silk and bring a good profit." […]

Like Sloane and other male naturalists, Merian relied on Amerindians and African slaves — whom she referred to as "my slaves" *(myne Slaven)* — for aid in finding choice specimens and for safety in travel. Her slaves hacked openings for her in the dense rain forest, dug up roots, helped her tend her botanical garden, paddled her and her assistants upriver, and supplied choice maggots, fireflies, and shells. For two years she and her daughter collected, studied, and drew insects and plants of the region, gathering specimens early in the cool of the day and preparing them in the evening. When writing commentaries to her plates featuring her finds, she added — as was common in this period — "information from the Indians." These included uses of plants in medicine (cotton and senna leaves cool and cure wounds), foods (a recipe for cassava bread), buildings, clothing, and jewelry. According to the historian Natalie Zemon Davis, Merian brought her "Indian woman" with her to Amsterdam. Nothing more is known about this woman.

Overcome with malaria, Merian was forced to leave the Torrid Zone in 1701, sooner than she had intended. Upon her return to Amsterdam, she, like other heroic voyagers, began compiling her travel account, in this case her *Metamorphosis insectorum Surinamensium,* portraying the repro- duction and development of numerous insects and the many plants they feed upon "never before described or drawn." Invoking familiar tropes of voyaging literature, she advertised her book as "the first and strangest work painted in America": "This work is rare and will remain rare […] since the trip is costly and the heat makes living [in Surinam] extremely difficult."

The Death of Nature
Women and the Scientific Revolution

In : *Carolyn Merchant,* The Death of Nature ; Women, Ecology and the Scientific Revolution*, 1980. Harper & Row Publishers, San Francisco. Chapter 6. "Production, Reproduction, and the Female".*

Women and Production

Until the seventeenth century, midwifery was the exclusive province of women: it was improper for men to be present at such a private and mysterious occurrence as the delivery of a child. Midwives were professionals, usually well trained through apprenticeship and well paid for their services to both rural and urban, rich and poor women. Yet no organization of midwives existed that could set standards to prevent untrained or poverty-stricken women from taking up the practice. Moreover, women were excluded from attending universities and medical schools where anatomy and medicine were being taught.

Seventeenth-century London midwives, rightly or wrongly, considered themselves a responsible, well-trained group of women. But by 1634, the midwife profession was being threatened by the licensing of male surgeons who wished to practice midwifery with forceps, a technology that would be available only to licensed physicians. The midwives had complained to the bishop of London that such a practice was often marked by violence and that men had insufficient experience with deliveries. The Chamberlen family, which had invented the forceps, was attempting to establish educational and legal restrictions on their use. Earlier, in 1616, the Drs. Peter Chamberlen, elder and younger, had tried to form a corporation of midwives. The midwives doubted the Chamberlen's ostensible motives to educate and organize them because they feared that the latter would attempt to assume sole licensing authority. They favored the older delivery methods of which they had knowledge and called the new forceps method a violent practice. Their 1634 petition directed against Peter Chamberlen III stated, "*Dr. Chamberlane ... hath no experience in [midwifery] but by reading .... And further Dr. Chamberlane's work and the work belonging to midwives are contrary one to the other, for he delivers none without the use of instruments by extraordinary violence in desperate occasions, which women never practiced nor desired, for they have neither parts nor hands for that art.*"

In addition to the Chamberlens, other doctors of the period were sharply critical of the practices of midwives. William Harvey, noted for his discovery of the circulation of the blood, and one of the four censors of the Royal College of Physicians responsible for enforcing the College's monopoly over licensing laws, took issue with some of their methods in his essay "On Parturition" at the end of his *Exercitationes de Generatione Animalium (On Generation)*, 1651:

> *Hence it is that midwives are so much to blame, especially the younger and more meddlesome ones, who make a marvellous pother when they hear the woman cry out with her pains and implore assistance, daubing their hands with oil, and distending the passages, so as not to appear ignorant in their art-giving besides medicines to excite the expulsive powers, and when they would hurry the labor, retarding it and making it unnatural, by leaving behind portions of the membranes, or even of the*

placenta itself, besides exposing the wretched woman to the air, wearing her out on the labor stool, and making her, in fact, run great risks of life. In truth, it is far better with the poor, and those who become pregnant by mischance, and are secretly delivered without the aid of a midwife; for the longer birth is retarded the more safely and easily is the process completed.

Harvey's *De Generatione* did not deal extensively with human reproduction, and his examples of difficult births by women were not a significant contribution to the period's inadequate gynecological science. Yet in spite of obvious lacunae in the state of obstetrical knowledge, Harvey's contributions have been eulogized by historians of medicine as the work of a "grand broad intellect which could at the same time teach the profoundest physicians and the most ignorant midwives" 'and "whose beneficial influence ... can scarcely be overestimated."

During the 1630s and 1640s, male physicians in addition to Harvey wrote treatises that helped to discredit midwives, contributing to the decline of female midwifery. Male physicians who wrote disparagingly about female practices included Peter Chamberlen the Elder and the Younger, who had petitioned Francis Bacon in 1616 to incorporate the "ignorant midwives"; Peter Chamberlen III, who wrote *A Voice in Rhama: Or the Crie of Women and Children* (1647), probably in retaliation for the midwives' opposition in 1634; Hugh Chamberlen the Elder, Paul Chamberlen, author of Dr. Chamberlain's Midwifes Practice: *Or a guide for women in that high concern of conception, breeding and nursing children* (1665); and Percivall Willughby (1596-1685) whose *Observations of Midwifery* praised Harvey's obstetrical directions. Since most historical accounts of midwifery in this period are based on the data supplied by male writers and male midwives-some of whom, like the Chamberlens, had political motives-an accurate assessment of the state of midwifery as a woman's art is difficult to make.

After the middle of the century, English midwives such as Jane Sharp (fl. 1671) and Elizabeth Cellier (fl. 1680), along with medical practitioner Nicolas Culpeper (1616-1654), wrote midwifery handbooks in an attempt to make obstetrical and gynecological training available to women in the profession. In France, a school of midwifery was established where anatomy was taught through dissection, and surgeons examined women apprentices. Yet despite these attempts by a few persons to upgrade and include women in the advancing medical and scientific knowledge of the period, women began to lose control over midwifery and thus over their own reproductive functions. By the end of the century, childbirth was passing into the hands of male doctors and "man-midwives." […]

The older organic order of nature and society was breaking up as the new mercantile activities threatened the ideology of natural stratification in society. Symbolic of these changes were the midwife and the witch. From the perspective of the male, the witch was a symbol of disorder in nature and society, both of which must be brought under control. The midwife symbolized female incompetence in her own natural sphere, reproduction, correctable through a technology invented and controlled by men-the forceps. But from a female perspective, witchcraft represented a form of power by which oppressed lower-class women could retaliate against social injustices, and a source of healing through the use of spirits and the regenerative powers of nature. For women, the midwife symbolized female control over the female reproductive function. But until medical training became available to women and licensing regulations were equalized for both women and men, women had no opportunity to compare the effectiveness of the older, shared traditions of midwifery as an art with the new medical science.

3. Knowledge Production on Women

In the Late Eighteenth Century, Human Sexual Nature Changed

In : *Thomas Laqueur. “Orgasm, Generation, and the Politics of Reproductive Biology.” Representations, no. 14, 1986, pp. 1–41.*

Sometime in the late Eighteenth century, human sexual nature changed, to paraphrase Virginia Woolf. This essay gives an account of the radical eighteenth-century reconstitution of female, and more generally human, sexuality in relation to the equally radical Enlightenment political reconstitution of "Man"-the universalistic claim, stated with starkest clarity by Condorcet, that the "rights of men result simply from the fact that they are sentient beings, capable of acquiring moral ideas and of reasoning concerning these ideas. [And that] women, having these same qualities, must necessarily possess equal rights."

Condorcet moves immediately to biology and specifically to reproductive biology. Exposure to pregnancy, he says, is no more relevant to women's political rights than is male susceptibility to gout. But of course the facts or supposed facts of female physiology were central to Condorcet, to Mill, to feminists as well as antifeminists, to liberalism in its various forms and also to its enemies. Even the political pornography of Sade is grounded in a theory of generation. The body generally, but especially the female body in its reproductive capacity and in distinction from that of the male, came to occupy a critical place in a whole range of political discourses. It is the connection between politics and a new disposition of male and female that concerns me here.

Near the end of the century of Enlightenment, medical science and those who relied upon it ceased to regard the female orgasm as relevant to generation. Conception, it was held, could take place secretly, with no tell-tale shivers or signs of arousal. For women the ancient wisdom that "apart from pleasure nothing in mortal kind comes into existence" was uprooted. We ceased to regard ourselves as beings "compacted in blood, of the seed of man, and the pleasure that [comes] with sleep." We no longer linked the loci of pleasure with the mysterious infusing of life into matter. Routine accounts, like that in a popular Renaissance midwifery text of the clitoris as that organ "which makes women lustful and take delight in copulation," without which they "would have no desire, nor delight, nor would they ever conceive;' came to be regarded as controversial if not manifestly stupid.

Sexual orgasm moved to the periphery of human physiology. Previously a deeply embedded sign of the generative process-whose existence was no more open to debate than was the warm, pleasurable glow that usually accompanies a good meal-orgasm became simply a feeling, albeit an enormously charged one, whose existence was a matter for empirical inquiry or armchair philosophizing. Jacques Lacan's provocative characterization of female orgasm, "la jouissance, ce qui ne sert a rien," is a distinctly modern possibility.

The new conceptualization of the female orgasm, however, was but one formulation of a more radical eighteenth-century reinterpretation of the female body in relation to that of the male. For several thousand years it had been a commonplace that women have the same genitals as men, except that, as Nemesius, bishop of Emesa in the sixth century, put it: "Theirs are inside the body and not outside it." Galen,

who in the second century A.D. developed the most powerful and resilient model of the homologous nature of male and female reproductive organs, could already cite the anatomist Herophilus (third century B.C.) in support of his claim that a woman has testes with accompanying seminal ducts very much like the man's, one on each side of the uterus, the only difference being that the male's are contained in the scrotum and the female's are not.

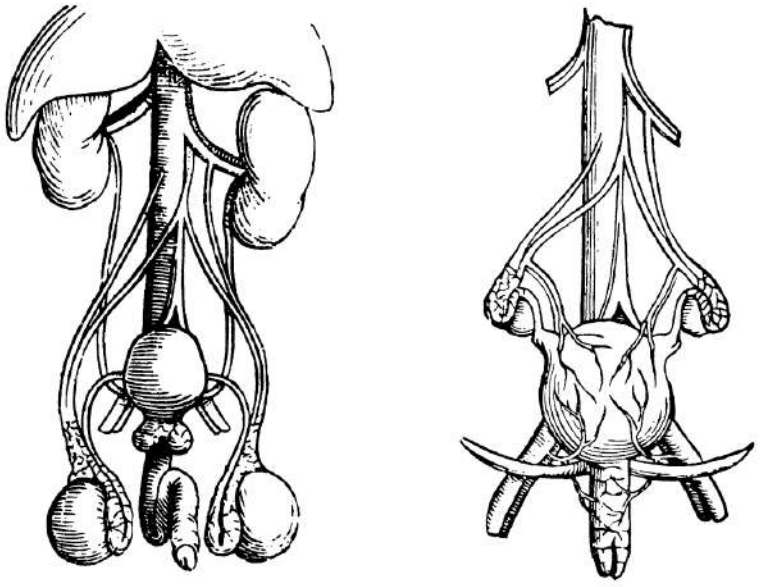
For two millennia the organ that by the early nineteenth century had become virtually a synecdoche for woman had no name of its own. Galen refers to it by the same word he uses for the male testes, orchis, allowing context to make clear with which sex he is concerned. Regnier de Graaf, whose discoveries in 1672 would eventually make the old homologies less plausible, continues to call the ovaries he is studying by their old Latin name, testiculi. A century later the Montpelierian physiologist Pierre Roussel, a man obsessed with the biological distinctiveness of women, notes that the two oval bodies on either side of the uterus "are alternatively called ovaries or testicles, depending on the system which one adopts." As late as 1819, the London Medical Dictionary is still somewhat muddled in its nomenclature: "Ovaria: formerly called female testicles; but now supposed to be the recepticles of ova or the female seed." Indeed, doggerel verse of the nineteenth century still sings of these hoary homologies after they have disappeared from learned texts:

... though they of different sexes be,

Yet on the whole they are the same as we,

For those that have the strictest seachers been,

Find women are but men turned outside in.



FIGURES 2 and 3. Andreas Vesalius, male and female reproductive organs, *Tabulae Sex.* From *The Anatomical Drawings of Andreas Vesalius,* ed. Charles D. O'Malley and J. B. de C. M. Saunders (New York, 1982).

By 1800 this view, like that linking orgasm to conception, had 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. In 1803, for example, Jacques Moreau de la Sarthe, one of the founders of "moral anthropology,' argued passionately against the nonsense written by Aristotle, Galen, and their modern followers on the subject of women in relation to men. Not only are the sexes different, they are different in every conceivable respect of body and soul, in every physical and moral aspect. To the physician or the naturalist the relation of woman to man is "a series of oppositions and contrasts." Thus the old model, in which men and women were arrayed according to their degree of metaphysical perfection, their vital heat, along an axis whose telos was male, gave way by the late eighteenth century to a new model of difference, of biological divergence. An anatomy and physiology of incommensurability replaced a metaphysics of hierarchy in the representation of women in relation to men. [...]

Instead of being the consequence of increased scientific knowledge, new ways of interpreting the body were rather, I suggest, new ways of representing and indeed of constituting social realities. As Mary Douglas wrote, "The human body is always treated as an image of society and ... there can be no natural way of considering the body that does not involve at the same time a social dimension." Serious talk about sexuality is inevitably about society. Ancient accounts of reproductive biology, still persuasive in the early eighteenth century, linked the experiential qualities of sexual delight to the social and indeed the cosmic order. Biology and human sexual experience mirrored the metaphysical reality on which, it was thought, the social order too rested. The new biology, with its search for fundamental differences between the sexes and its tortured questioning of the very existence of women's sexual pleasure, emerged at precisely the time when the foundations of the old social order were irremediably shaken, when the basis for a new order of sex and gender became a critical issue of political theory and practice. [...]

Neither advances in reproductive biology nor anatomical discoveries seem sufficient to explain the dramatic revaluation of the female orgasm that occurred in the late eighteenth century and the even more dramatic reinterpretation of the female body in relation to that of the male. Rather, a new model of incommensurability triumphed over the old hierarchical model in the wake of new political agendas. Writers from the eighteenth century onward sought in the facts of biology a justification for cultural and political differences between the sexes that were crucial to the articulation of both feminist and antifeminist arguments. Political theorists beginning with Hobbes had argued that there is no basis in nature for any specific sort of authority-of a king over his people, of slaveholder over slave, nor, it followed, of man over woman. There seemed no reason why the universalistic claims made for human liberty and equality during the Enlightenment should exclude half of humanity. And, of course, revolution, the argument made in blood that mankind in all its social and cultural relations could be remade, engendered both a new feminism and a new fear of women. But feminism itself, and indeed the more general claims made by and for women to public life-to write, to vote, to legislate, to influence, to reform-was also predicated on difference.

Thus, women's bodies in their corporeal, scientifically accessible concreteness, in the very nature of their bones, nerves, and, most important, reproductive organs came to bear an enormous new weight of cultural meaning in the Enlightenment. Arguments about the very existence of female sexual passion, about women's special capacity to control what desires they did have, and about their moral nature generally were all part of a new enterprise seeking to discover the anatomical and physiological characteristics that

distinguished men from women. As the natural body itself became the gold standard of social discourse, the bodies of women became the battleground for redefining the most ancient, the most intimate, the most fundamental of human relations: that of woman to man.

It is relatively easy to make this case in the context of explicit resistance to the political, economic, or social claims of women. Prominent male leaders in the French Revolution, for example, strenuously opposed increased female participation in public life on the grounds that women's physical nature, radically distinguished from that of men and represented most powerfully in the organs of reproduction, made them unfit for public life and better suited to the private sphere. Susanna Barrows maintains that fears born of the Paris Commune and of the new political possibilities opened up by the Third Republic generated an extraordinarily elaborate physical anthropology of sexual difference to justify resistance to change. In the British context the rise of the women's suffrage movement in the 1870s elicited a similar response. Tocqueville argues that in the United States democracy had destroyed the old basis for patriarchal authority and that consequently it was necessary to trace anew and with great precision "two clearly distinct lines of action for the two sexes." In short, wherever boundaries were threatened arguments for fundamental sexual differences were shoved into the breach.

But reinterpretations of the body were more than simply ways of reestablishing hierarchy in an age when its metaphysical foundations were being rapidly effaced. Liberalism postulates a body that, if not sexless, is nevertheless undifferentiated in its desires, interests, or capacity to reason. In striking contrast to the old teleology of the body as male, liberal theory begins with a neuter body, sexed but without gender, and of no consequence to cultural discourse. The body is regarded simply as the bearer of the rational subject, which itself constitutes the person. The problem for this theory then is how to derive the real world of male dominion of women, of sexual passion and jealousy, of the sexual division of labor and cultural practices generally from an original state of genderless bodies. The dilemma, at least for theorists interested in the subordination of women, is resolved by grounding the social and cultural differentiation of the sexes in a biology of incommensurability that liberal theory itself helped bring into being. A novel construal of nature comes to serve as the foundation of otherwise indefensible social practices. [...]

Scientific advances, I have argued, did not destroy the hierarchical model that construed the female body as a lesser, turned-inward version of the male, nor did it banish female orgasm to the physiological periphery. Rather, the political, economic, and cultural transformations of the eighteenth century created the context in which the- articulation of radical differences between the sexes became culturally imperative. In a world in which science was increasingly viewed as providing insight into the fundamental truths of creation, in which nature as manifested in the unassailable reality of bones and organs was taken to be the only foundation of the moral order, a biology of incommensurability became the means by which such differences could be authoritatively represented. New claims and counterclaims regarding the public and private roles of women were thus contested through questions about the nature of their bodies as distinguished from those of men. In these new discursive wars feminists as well as antifeminists sacrificed the idea of women as inherently passionate; sexual pleasure as a sign in the flesh of reproductive capacity fell victim to political exigencies.

Abortion and Gendered Politics in European Colonies

In : *Londa Schiebinger, Plants and Empire, Colonial Bioprospecting in The Atlantic World, Harvard University Press, Cambridge (MA), 2004*

Merian's Peacock Flower

My attention was first drawn to the topic of abortion by Maria Sibylla Merian's vivid report of slave women (in this case both Amerindian and African) aborting their offspring, which appeared in a book on the meta- morphosis of caterpillars. Merian immediately placed abortion within the context of colonial struggles, identifying the killing of slave progeny as a form of political resistance. According to Merian, slave women killed the children in their wombs for the same reasons that many of them hanged themselves from trees or ingested deadly poisons—to find release from the insufferable cruelty of New World slave masters.

Did naturalists introduce into Europe any of the exotic abortifacients they encountered in the Caribbean? To address this question I have chosen to trace the history of Merian's peacock flower, known today by its Latin/Linnaean name as the *Poinciana pulcherrima* (L) or *Caesalpinia pulcherrima* ([L] Sw). The French call this plant the *fleur de paradis;* English speakers know it as the Red Bird of Paradise, Dwarf Poinciana, Flower Fence, and Barbados Pride (it is the national flower of Barbados and adorns that country's coat of arms along with the bearded fig tree). The peacock flower grows profusely in Florida, Central and South America, India, and Africa, where in all these places it is still sometimes recognized as an emmenagogue (an agent that induces the menses) and an abortifacient. In some cases it is the flowers, in others the seeds or bark that are considered the effective part. Like most plants, the peacock flower has many uses. In Guatemala and Panama, for example, the leaves are used to poison fish and the seeds employed to execute criminals. The plant is also used as a remedy for sore throat, lung disease, fever, eye and liver complaints, constipation, and skin rashes, and for making black dyes and ink (allegedly "the most beautiful black ink in the world"). The brilliant beauty of its flowers has also made it a popular ornamental.

I have focused on Merian's peacock flower because of her moving remarks and also because the plant's abortive qualities were discovered independently in the West Indian colonial territories of the Netherlands (by Merian), England (by Sloane), and France (among others by Michel-Étienne Descourtilz, who confirmed Sloane's and Merian's findings with firsthand observations of his own). Sloane, working in Jamaica some years before Merian's travels in Surinam, discussed a plant he called the "flour fence of Barbados, wild sena, or Spanish carnations" and identified it later in his published work as the same plant as Merian's peacock flower. […].

The very first European notice of the peacock flower was recorded by General Philippe de Lonvilliers, chevalier de Poincy, governor of the French Antilles from 1647–1660. Poincy, not a naturalist but a military man concerned with the health of his troops, was taken with the plant's ability to cure fevers and dosed himself "to good effect." It was not until much later that Descourtilz, a French doctor sent by the government to Saint Domingue in 1799, highlighted the use of the *poincillade* as an abortifacient. This beautiful thorny

shrub, he wrote, is cultivated in some gardens in Europe but grows naturally in the Antilles. He reiterated other French physicians' reports that it was useful in treating lung ailments and fevers. After detailing its chemical properties and medical preparations, he added that a strong dose of the flower (not the seed, as reported by Merian) could be employed to induce the menses, but that it must be used with extreme caution: "ill-intentioned Negresses," he added, "use it to destroy the fruits of their guilty loves."

What is of interest is that Merian and Sloane each independently collected this plant as an abortifacient. Although Sloane cited Merian in his *Voyage,* he did not learn about the abortive qualities of this plant from her (or vice versa); her *Metamorphosis* is cited only in an appendix which included things that Sloane learned after the body of his *Voyage* had been written. Sloane and Merian never had a scholarly exchange, although one assumes that Sloane saw the copy of her *Metamorphosis* purchased in 1705 by James Petiver, a fellow of the Royal Society of London when Sloane was president. Although the flower had been brought into Europe from the East Indies long before either Merian or Sloane traveled to the West Indies, Merian's is the first European report of its abortive qualities that I have found.

Although Merian, Sloane, and Descourtilz all mentioned abortifacients, they placed the peacock flower in very different social contexts. Merian and Descourtilz both located it within the colonial struggle; she emphasized the importance of this plant for the physical and spiritual survival of West Indian slave women, while he stressed the "ill intentions" of the "Negresses" who used them (see below). I examine first Sloane's experience in Jamaica with the plant he called the flour fence.

John Stedman gave firsthand accounts of the extreme brutality slaves in the Caribbean endured. […] Slaves in French holdings were treated no better. The *Code noir* of 1685, celebrated at the time for its "humanity," required that fugitive slaves at large for a month have their ears cut off and be branded on one shoulder with the *fleur-de-lys.* If slaves escaped a second time, they were hamstrung and their other shoulder was branded. A third offense brought execution. Sloane described how slaves in Jamaica were burned for running away […].

Although Sloane was well aware that slaves "cut their own throats" to escape such treatment, he did not see his "flour fence" in this light. Sloane wrote rather dryly, "it provokes the Menstrua extremely, causes Abortion, etc. and does whatever Savin and powerful Emmenagogues will do." Sloane placed his discussion of abortive qualities of his flour fence in the context not of the colonial sufferings but of the growing conflict between doctors and women seeking assistance in abortion. In this instance, Sloane carried fully-formed notions concerning abortion with him to Jamaica; his attitudes toward abortion mirrored those of the majority of his male medical colleagues in Europe. Concerning his service as physician to the governor in Jamaica, he wrote:

In case women, whom I suspected to be with Child, presented themselves ill, coming in the name of others, sometimes bringing their own water, dissembling pains in their heads, sides, obstructions, etc. therby cunningly, as they think, designing to make the physician cause abortion by the medicines he may order for their cure. In such a case I used either to put them off with no medicines at all, or tell them Nature in time might relieve them without remedies, or I put them off with medicines that will signifie nothing either one way or other, till I be furthered satisfied about their malady.

Sloane finished his passage on abortion with a strict warning: “if women know how dangerous a thing it is to cause abortion, they would never attempt it […] One may as easily expect to shake off unripe Fruit from a tree, without injury or violence to the Tree, as endeavor to procure Abortion without injury or violence to the Mother.” Sloane did not discuss the social or political status of the women he treated in Jamaica in this regard, whether they were English, creole, or slave. Rather he accused “dissembling” women in general of seeking abortions from unsuspecting doc- tors. His attitudes were shared by many European physicians at this time. The German physician Johann Storch also reported “tricking” a pregnant woman, whom he suspected to be seeking an abortion, by prescribing only a mild laxative. Some physicians claimed that women even endured inoculation against smallpox, hoping that the operation would cause an abortion. Warnings to midwives, physicians, and apothecaries about giving unmarried women medicines that might induce abortion date to at least the sixteenth century.

European physicians who discussed abortion in the seventeenth and eighteenth centuries emphasized its dangers. It is possible that this correctly reflected their experience, since (male) physicians were generally called to attend women only when things went wrong. Sloane himself noted that when an abortion was absolutely necessary, he preferred “the hand” to herbal preparations. Following this ancient method dating back to the first century a.d. and perhaps further, a physician positioned a woman on her back across a bed where she was to be held down by three women with her knees pushed up to her chest (as advised by the seventeenth-century Parisian master-surgeon, François Mauriceau, who wrote extensively on birthing and female maladies). The doctor, sitting on a stool, anointed his hand with oil, fresh butter, or unsalted lard, and “gently” introduced his fingers, one by one, through the cervix and into the uterus until the whole hand slid inside. Herman Boerhaave suggested giving the woman opium to relax those parts. Once the physician’s hand was in the womb, he broke the membranes, took hold of the feet of the fetus, and “pulled it away.” Next he separated the placenta from the womb with his fingers and extracted it. Some physicians suggested that in the first few weeks of pregnancy, one finger, bent like a “blunt hook,” would suffice to draw the embryo from the womb. European physicians also suggested other nonherbal methods to induce abortion, including excessive bloodletting, various douches, vigorous jumping and horseback riding, and applying pressure to the main artery in the thigh (a technique known as the Hamilton method).

Given his disapproving attitudes toward abortion, how might Sloane have procured information in Jamaica about abortifacients? Merian informed her readers that she learned about the abortive qualities of the pea- cock flower directly from the enslaved women of Surinam. When I began my research, I had conjectured that abortion and contraceptives were women’s business and that Merian’s report on the abortive qualities of her peacock flower was as unique as her presence in the field. John Riddle, an historian of pharmacy, confirmed my notions in his fine two-volume his- tory of contraceptives and abortifacients in ancient and early modern Europe. Likewise, Edward Shorter, an historian of medicine, argued in his history of women’s health care that birth control was women’s knowledge. And it is true that birthing in the Caribbean, as in Europe, was generally a female affair. A slave woman typically gave birth in her own hut with the assistance of a slave midwife, perhaps a nurse, and several of her kin or friends. After 1780, large Caribbean plantations offered infirmaries or “hothouses,” as many were called, with lying-in rooms for slaves. These hospitals were typically run by a female slave, in the French islands called a *hôpitalière*, usually an older woman no longer able to work the fields. The *hôpitalière* generally took care of birthing and was assisted by several younger nurses (mostly female), a cook, and sometimes an additional midwife, either slave or free. As an observer noted in the 1790s, those attending slave births on plantations were

"Negresses." Only if a birth were extremely difficult was a costly surgeon called. Throughout the seventeenth and eighteenth century, local white physicians or surgeons visited the plantations under their care once or twice a week to supervise slave nurses. Planters' wives (when present) might oversee preparations of medicines for the plantation.

Not only were European physicians removed from slave birthing, several physicians serving in the Caribbean mentioned that they did not deal with the diseases of women and children at all. Thomas Dancer, a Jamaican physician, wrote in *The Medical Assistant; or Jamaica Practice of Physic: Designed Chiefly for the Use of Families and Plantations* (1801) that modesty did not allow "the sex" (that is, women) to seek advice from physicians in the West Indies, the majority of whom were "young bachelors." He encouraged women (and particularly the matrons among them) to learn "how to manage themselves in their various situations." Philippe Fermin, working in Surinam in the mid 1700s, further confirmed that physicians and surgeons had "little to do with women […] who hardly complain of anything but headaches or some constipation." Apart from a terrible suppression of the menses ("which can almost never be cured"), according to Fermin, "the sex" in Surinam did not seek help from physicians.

European doctors in the islands were far removed from slave birthing and so were European midwives, who generally lived in towns. Until the end of the eighteenth century, few European midwives set up practices in the colonies. In Saint Domingue, for example, of the 102 French medical personnel (physicians, surgeons, apothecaries, and the like) working there between 1704 and 1803, only five were midwives and these were typically under the supervision of a male royal physician and *accoucheur* for the colony. All five practiced in Cap Français. One of these midwives, a Demoiselle Renouts, cared for women in her home (an expensive proposition) and also taught "Negresses" from the plantations the art of delivering pregnant women. Charles Arthaud reported, however, that even where French midwives were available, "white" women often preferred the ser- vices of "women of color." In some islands, such as Barbados, European (Quaker) midwives were more plentiful. They were at times called to attend slave births, but usually only when a slave woman was not available.

Clearly much information concerning the use of contraceptives and abortifacients passed from woman to woman, neighbor to neighbor, midwife to client. But things were more complicated than they seem. Riddle's own examples show that some men — some learned, some not — were privy to these secrets. In some instances, it was the male partner who provided a woman with a contraceptive herb — but he might hold that information secret so that she could not betray him with another man. In other recorded instances, women went to apothecaries, barbers, or even their priest lovers for contraceptives. Mauriceau noted that "the ancients, Avicenna and Aëtius, taught us many remedies to induce abortion when it is judged necessary." And as we have seen through the examples of Sloane and Descourtilz, European physicians had firsthand experience with abortion.

Certainly Sloane collected reliable information about the abortive qualities of his "flour fence" while in Jamaica. He also treated numerous women during his stay. In his *Voyage,* he discussed cases involving some thirty-eight English women and four African women with various complaints. He also looked in on sick nuns when summoned en route by their abbess on Madeira, the Portuguese-held islands off the coast of northwest Africa. So although many women knew about abortifacients and often employed them, many men were also familiar with these herbs.

I do not want to make too much of the differences among the attitudes of Sloane, Descourtilz, and Merian toward abortion. Merian, to my knowledge, discussed only one abortifacient. Her chief interest was insects, and she described plants primarily as they related to insects (her passage concerning the peacock flower is devoted to the caterpillars that live on the plant's leaves). Whether women "do science differently" is currently a topic of heated debate in feminist theory; distinctions should not be drawn too sharply between individual men and women scientists, however. Many European women — plantation owners' or governors' wives, for example — had little interest in their newly adopted countries, and most came and went without collecting any information from the indigenous populations or cultivating any special sympathies toward the women of the region.

4. Is Knowledge Gendered?

Primatology Is Politics by Other Means

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1. The Field: Origins

Adam and Eve, Robinson Crusoe and Man Friday, Tarzan and Jane: these are the figures who tell white western people about the origins and foundations of sociality. The stories make claims about "human" nature, "human" society. Western stories take the high ground from which man -- impregnable, potent, and endowed with a keen vision of the whole -- can survey the field. The sightings generate the aesthetic-political dialectic of contemplation/exploitation, the distorting mirror twins so deeply embedded in the history of science.
But the moment of origins in these western stories is solitary. Adam was alone, Robinson was alone, Tarzan was alone; they lacked human company. But each couple, each solution to the illogical insufficiency of a rational autonomous self, was fraught with the contradictions of domination that have provided the narrative materials of "the West's" accounts of its devastating collective history. The tragedy of the "West" is rooted in number: One is too few and two are too many. Memory, the origin, is about a lost oneness, sameness. The telos is about perfect union. The process of mediating the beginning and the end, called history, is a tale of escalating domination toward the apocalypse of the final transcendence of difference. Until the end, difference is dialectical, dynamic antagonism; at the end, difference is transubstantiation and communion.

This essay in the history of zoology and bio-anthropology is part of a world-wide oppositional effort, rooted in social movements like feminism and anti-racism, to retell these stories as a strategy to break their power. My narrative materials will be recent social constructions of the Primate order, a zoological classification powerfully implicated in the genesis of self and other, culture and nature, gender and sex, same and different. My thesis is that the scientific practices and discourses of modern primatology

participate in the preeminent political act in western history: the construction of Man. What it means to be human cannot escape the logic of the story of man. Self-construction evokes collective deconstruction.

Primatology is politics by other means, and women's place is in the jungle, arguing the nature of beginnings and ends. The life stories of monkeys and apes are industrial and post-industrial versions of the past and the future of them and us. Primatology is a complex scientific construction of self and other, culture and nature, gender and sex, human and animal, purpose and resource, actor and acted upon. This scientific field constrains who can count as "we". Mind and sex provide most of the drama. Primatology is also compelling soap opera. [...]

Primatology is a structured, contested field of scientific discourses about the foundations and origins of sociality. Like other major systems of myth and political theory in western story-telling traditions, primatology starts from a unit, a one, and tries to generate a whole, a we. And as in these other stories, the narrative tension in primatology comes from the drama of the dialectics of domination, the scandal of difference. Primatology is a utopian project, close to the heart of western political theory. The sciences of monkeys and apes are inherently about origins, about the nature of things. Even the name of the order, given by Linnaeus in 1758 in the 8th edition of the *Systema naturae*, means "first". The Primate order has never been stable, whether the debates were between Huxley and Owen on evolution in the 19th century or Adrienne Zihlman and Owen Lovejoy on bipedalism and reproduction in the 20th. (Zacharias 1984; Zihlman and Lowenstein 1983; Lovejoy 1981 and 1984). [...]

Primatology is also a branch of modern biology and anthropology, and as such is subject to the epistemic structuring of the life and human sciences. Although there is no contradiction between this characterization and those asserting the mythic and political nature of the sciences of monkeys and apes, there is a tension. Like the boundaries between nature and culture, sex and gender, animal and human, the scientific and mythic characters of primate discourses are not quite in phase; they evoke each other, echo each other, annoy each other, but are not identical to each other. Science and myth do not exclude or replace each other; they are versions of each other. In the 20th century in the United States, they structure each other. Reducing science to myth or vice versa would obscure precisely the field of gender politics -- and much else -- which I regard as real and interesting. Reduction is rarely a very rich explanatory strategy, least of all when the goal is to evoke mediating strands and complexities tying together social-technical-symbolic life across sacred boundaries. Reading primatology is itself an exercise in boundary transgression.

And to make matters even more tense, the life and human sciences are in a state of war, as f its any set of mythic twins, virtual images of each other. Biology, a natural science whose practitioners tend not to see themselves as interpreters but as discoverers moving from description to causal explanation, and anthropology, whose practitioners tend to argue their authority is the fruit of interpretation, set up a difference that structures primate science. In primatology, the stakes of the conflict are mundane -- publications, jobs, status hierarchies among monkey watchers, preferred metaphors, explanatory strategies, favorite graduate schools, versions of histories of the discipline, etc. Until recently, the stakes have also been gender of monkey watcher: many more women primatologists originally came from anthropology than from the biological disciplines, a matter of no little consequence in the sociobiology and behavioral ecology debates. The contest is for the allowable meanings of "adaptation". The anthropologists have inherited the story-telling strategy rooted in structural functionalism deeply tied to social and cultural anthropology, while

the biologists have inherited the story-telling strategy of positivism and empiricism deeply tied to the hegemonic authority of physical sciences. Both inherit versions of political economy, anthropology more focused on the division of labor, role theory, and notions of social efficiency, and biology on market analysis, econometrics, investment strategies, and life insurance demographic techniques. One looks more for social role and functional integration, the other for game theory calculations and cost/benefit analysis simulations (e.g., Fedigan 1982 and Hrdy 1981). [...]

Women primatologists have focused on female primates' sex (sexuality? is that term reserved for humans?) partly to remove it from the inert, natural state it attained in the texts of their primatological brothers. The category female has been reconstructed in ways analogous to reconstructions of the category woman. Female sex was mere resource for male action that got animals to the border of humanity. But no more; female sex now has the promising dual properties, both active and natural, that let it serve also as the mediator for the passage to culture. No longer just the tokens of male exchange, female primates have become sexual brokers in their own right. Female sex has become very active, social, and interesting -- not to mention orgasmic across the primate order -- in the last 15 years. [...]

First, although primatology is full of ideology in the old simple senses, it is dull and wrong to consider the matter of sexual politics addressed through unmasking ideology. There is no conspiracy of capitalist patriarchs in the sky to create a science of animal behavior to naturalize the fantasies of 20th century American white males, no matter how tempting the evidence sometimes seems. And struggles for a feminist science cannot proceed only by writing the tales one wants to be true, though "we" all do it. It is important not to trivialize the very real difficulty of good scientific story telling. Gender and sex are central to the constitution of primatology, but in constantly complex ways in interaction with multiple other interlacing, structuring axes which form the web of western discourses. The very constitution of sex and gender as objects and conditions of knowledge -- and so political categories -- is at issue in feminism and in feminist readings/productions of primatology.

One of my primate informants, a senior male scientist, argued sex and gender do matter in primate science, determining how one knows, but the "variable" is swamped by a host of others obscuring differences between the sciences women and men craft. I am arguing he suggested the wrong metaphors. We are not looking at "variables" which could be ranged as dependent and independent and perhaps weighted through a savvy application of multivariate analysis, nor for essential differences between the practices of women and men as solutions to the key questions, though those differences are not trivial. We are looking instead at the practical and theoretical constructions of a narrative field in which the explanatory model is better drawn from semiotics and hermeneutics than from statistics. But I hope for a politicized semiotics, where politics are the search for a public world through many socially grounded practices, including primatology. How could primatology not be a territory of feminist struggle? Western women's place is indeed in the jungle. Whether other women and men occupy that material/mythic space when they watch monkeys and apes is a function of other histories and other stories.

2. The Jungle: Scenes

In moderation numbers never grounded the flight of interpretation. About how many women practice primatology for a living? That question is difficult to answer for many reasons. My focus is on field

primatology, i.e., studies of wild or semi-free ranging but provisioned animals in an environment that can be epistemically constructed to be "natural', a possible scene of evolutionary origins. But primatology is both a laboratory and field science that crosses dozens of disciplinary boundaries in zoology, ecology, anthropology, psychology, parasitology, biomedical research, psychiatry, conservation, demography, and so on. There are three major professional associations to which primatologists from the United States are likely to belong, but many of the individuals who have made major contributions and who allowed me to interview them and have access to their unpublished papers do not appear on the membership lists ever or for several years at a time.

The 1979 roster of the AAPA (founded 1918) lists 1200 persons, about 26% of whom appear to be women. [...] For comparison, the January 1982 National Science Foundation publication Women and Minorities in Science and Engineering notes that by 1978 in the U.S. women represented about 20% of employed social, life, and mathematical scientists, but only 9.4% of all employed scientists and engineers. [...] Together life sciences (30%), social sciences (17.2%), and psychology (14.7%) account for 61.9% of women scientists. This is the pool from which primatologists come, and they come in numbers roughly characteristic of other life and social sciences. Nowhere does the representation of women equal 30% of these global field listings. Except in psychology, in no category of sciences does the representation of doctoral women equal 20%. In the face of these unspectacular showings, women primatologists stand out slightly. Their impact has been greater than their numbers, compared to most other areas of anthropology and all other areas of biology. For this conclusion, I turn to their practice and their publications. [...]

Because it is a kind of summing up and celebration of primate females and the women who made them visible, i.e., a construction of a "we", Female Primates deserves a full analysis, but for now I will content myself with a brief look at two pieces for their strategy in introducing subsequent papers and thus framing the whole enterprise.

Each piece raises the question of the difference it makes that women do primatology focused on female animals, but each also adopts a philosophy of science and ideology of progressive improvement of knowledge which block an investigation of an epistemic field structured by sex and gender. From the point of view of the framing pieces, "male bias" exists but can be corrected fairly simply. There is no need for dangerously political social relations within primatology and no need for the matter to challenge the practitioners'"native" account of how knowledge is made, at least not in public. Bias cancels bias; cumulative knowledge emerges. The root reasons given, however, hint at a stronger position: only bias ("empathy") permits certain "real" phenomena to be knowable, or only explanation from the point of view of one group, not the point of view of an illusory whole which actually masks an interested part, gets at the "real" world. In this case bias or point of view turn out to be the social and epistemic operator, sex-gender. The major scientific-political question is how such a potent point of view is constructed. In the construction of the female animal, the primatologist is also reconstructed, given a new genealogy. But the rebirth is within the boundaries of the "West", within its ubiquitous web of nature-culture. [...]

Empathy is part of the western scientific tool kit, kept in constant productive tension with its twin, objectivity. Empathy is coded dark, covert or implicit, and objectivity light, acknowledged or explicit. But each constructs the other in the history of modern "western" science, just as nature-culture and woman-man are mutually constructed in a logic of appropriation and progress. When Lancaster wants to see "balance" and Rowell writes about a "stereoscopic picture", they simultaneously raise and dismiss the messy matter of

scientific constructions of sex and gender as objects of knowledge and as conditions of knowing. Official (or native) philosophies of science among researchers obscure the complexity of their practice and the politics of "our" knowledge. [...]

3. The Text: Representations

Stories of the nature and possibility of citizenship and politics in western traditions regularly turn on versions of the origin of "the family". The stage has been set, so let us conclude with deliberately parodic, humorous tales by Adrienne Zihlman and Sarah Hrdy, two bio-anthropologists otherwise committed to very different story-telling strategies.

Both Hrdy and Zihlman are unrepentent feminists, convinced that such commitments matter to their doing *good* science. Their meanings of feminism and their ways of doing science are in sharp conflict, but they both take "stories" seriously as part of their craft, not spare-time pursuits. Their task, within the contested constraints of discourses structured by nature/culture and sex/gender, is to give an evolutionary account of the human place in nature and society. Their best writing displays a complex reflexiveness about their own ideologies that emerges through conscious oppositional practice within simultaneously privileged and oppressive contexts. [...]

The tales considered here were told in response to interpretations of the recent reappearance in the paleoanthropological field in Haadar, Ethiopia, of a diminutive, ancient (say 3 million year-old) hominid grandmother -- of erect and bipedal habit, but small mind -- named by her adamic founders, Lucy, after the drug culture that gave their generation of students historical identity. (Johanson and Edey 1981). The reference was to "Lucy in the Sky with Diamonds". Lucy could be Lucien, but let's give her her sex, since it is crucial to the story at hand. The paucity of African names in paleo-anthropological and primatological literature says a fair amount about the limitations of Adam's claim to species fatherhood.) Lucy's near-complete skeleton was dug out of the earth by the skilled hands of a brotherhood, which recognized in her and associated skeletons a resource for re-establishing potent masculinist versions of "The Origin of Man". (Lovejoy 1981). Lucy was quickly made into a hominid mother and faithful wife, a more efficient reproducing machine than her apish sisters and a reliable, if poorly upholstered, sex doll. These are the qualities essential to the male-dominant, "monogamous", heterosexual family, named "the family" with mind-numbing regularity. Lucy's bones were incorporated into a scientific fetish-fantasy, dubbed irreverently the "love and joy" hypothesis in Sarah Hrdy's response. (Hrdy and Bennett 1981, p. 7). But women still "dub", while men "name".

What makes Lovejoy's interpretations of Lucy "masculinist", as opposed to simply distasteful and controversial for his scientific opponents? The answer is his unwitting discipleship to the father of biology, Aristotle. Lovejoy's "Origin of Man" is enmeshed in the narrative of active, potent, dynamic, self-realizing manhood achieving humanity through reproductive politics: paternity is the key to humanity. And paternity is a world historical achievement. Maternity is inherently conservative and requires husbanding to become truly fruitful, to move from animal to human. Standard in western masculinist accounts, disconnection from the category "nature" is essential to man's natural place: human self realization (transcendence, culture) requires it. Here is the node where nature/culture and sex/gender intersect.

Lovejoy argues that the transition to a savannah-mosaic environment at the temporal boundary (late Miocene) marking hominization placed pre-hominids in a reproductive crisis requiring either closer birth spacing or greater survivorship of offspring or both. Expulsion from the forest garden meant a reproductive burden of species-making proportions. The narrative of matrifocal, female-centered worlds of apes had to give way to the more dynamic "human" family. "In the proposed hominid reproductive strategy, the process of pair bonding would not only lead to direct involvement of males in the survivorship of offspring[;] in primates as intelligent as extant hominoids, it would establish paternity, and thus lead to a gradual replacement of the matrifocal group by a 'bifocal' one -- the primitive nuclear family." (Lovejoy 1981, pp. 347-348). The anthropologist Carol Delaney (1985) has pointed out that paternity, in the hoary disputes in her discipline about whether real human peoples ever lived who really did not know about it, does not mean simply knowledge of a male biological contribution in conception. In western patriarchal culture, it means what Aristotle meant: male reproductive causality in the medium of the receptive female. The blindness induced by masculinist privilege in the culture of the anthropologist made their own specific meaning of paternity opaque to them; so they sought to account for difference as irrationality or immaturity. But Lovejoy is clear about the definition; it is a question of rational property in children.

Nothing a female could do could lead the species across the hominoid-hominid boundary; she was already doing the best nature allowed. "She would have to devote more energy to parenting. But natural selection has already perfected her maternal skills over the millions of years her ancestors have occupied West Africa. There is, however, an untapped pool of reproductive energy in most primate species -- the male." (Lovejoy 1984, p. 26). Through provisioning his now pair-bonded and sedentary mate at a home base with the fruits of plant and small animal gathering, a male could lead the species across the boundary to the origin of man in the assurance of fatherhood. Lovejoy gave up hunting to mark manhood, but he could not dispense with paternity. Mothers could have lots of babies, the role Theodore Roosevelt so hoped for in his 1905 analysis of modern (white) "race suicide", that concept for dawning consciousness of the politics of differential reproduction. The species had reason to stand upright at last, even if not too efficiently at the start. Man was on the long lonesome road. And women's place in this revolution is where it was imagined cross-racially in a fair section of U.S. 1960s politics -- prone. As Lovejoy put it, women did not "lose" estrus; they constantly display its signs. For the new strategy to succeed, "the female must remain constantly attractive to the male... . While the mystery of bipedality has not been completely solved, the motive is becoming apparent." (Lovejoy 1984, p. 28). Small wonder that Lovejoy cites his brother-colleague for evidence that "[human] females are continually sexually receptive." (Lovejoy 1981, p. 346) [...]

So primatology is politics by other means. In myriad mundane ways, primatology is a practice for the negotiation of the possibility of community, of a public world, of rational action. It is the negotiation of the time of origins, the origin of the family, the boundary between self and other, hominid and hominoid, human and animal. Primatology is about the principle of action, mutability, change, energy, about the possibility and constraints of politics. The reading of Lucy's bones is about all those things. In other times and places, people might have cast Lucy's bones in the rituals of necromancy for purposes western observers called "magical". But western people cast her bones into "scientific" patterns for insight into a human future made problematic by the very material working-out of the western stories of apocalypse and transcendence. The past, the animal, the female, nature: these are the contested zones in the allochronic discourse of primatology.

How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles

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In : *Emily Martin, “The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles.” Signs, vol. 16, no. 3, 1991, pp. 485–501.*

Egg and sperm: A scientific fairy tale

At a fundamental level, all major scientific textbooks depict male and female reproductive organs as systems for the production of valuable substances, such as eggs and sperm. In the case of women, the monthly cycle is described as being designed to produce eggs and prepare a suitable place for them to be. Fertilized and grown-all to the end of making babies. But the enthusiasm ends there. By extolling the female cycle as a productive enterprise, menstruation must necessarily be viewed as a failure. Medical texts describe menstruation as the "debris" of the uterine lining, the result of necrosis, or death of tissue. The descriptions imply that a system has gone awry, making products of no use, not to specification, unsalable, wasted, scrap. An illustration in a widely used medical text shows menstruation as a chaotic disintegration of form, complementing the many texts that describe it as "ceasing," "dying', "losing," "denuding," "expelling."

Male reproductive physiology is evaluated quite differently. One of the texts that sees menstruation as failed production employs a sort of breathless prose when it describes the maturation of sperm: "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." In the classic text *Medical Physiology*, edited by Vernon Mountcastle, the male/female, productive/destructive comparison is more explicit: "Whereas the female sheds only a single gamete each month, the seminiferous tubules produce hundreds of millions of sperm each day". The female author of another text marvels at the length of the microscopic seminiferous tubules, which, if uncoiled and placed end to end, "would span almost one-third of a mile!" She writes, "In an adult male these structures produce millions of sperm cells each day." Later she asks, "How is this feat accomplished?" None of these texts expresses such intense enthusiasm for any female processes. It is surely no accident that the "remarkable" process of making sperm involves precisely what, in the medical view, menstruation does not: production of something deemed valuable.

One could argue that menstruation and spermatogenesis are not analogous processes and, therefore, should not be expected to elicit the same kind of response. The proper female analogy to spermatogenesis, biologically, is ovulation. Yet ovulation does not merit enthusiasm in these texts either. Textbook descriptions stress that all of the ovarian follicles containing ova are already present at birth. Far from being produced, as sperm are, they merely sit on the shelf, slowly degenerating and aging like overstocked inventory: "At birth, normal human ovaries contain an estimated one million follicles [each], 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 400, 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 50 years of age." Note the "marked contrast" that this description sets up between male and female: the male, who continuously produces fresh germ cells, and the female, who has stockpiled germ cells by birth and is faced with their degeneration.

Nor are the female organs spared such vivid descriptions. One scientist writes in a newspaper article that a woman's ovaries become old and worn out from ripening eggs every month, even though the woman herself is still relatively young: "When you look through a laparoscope ... at an ovary that has been through hundreds of cycles, even in a superbly healthy American female, you see a scarred, battered organ."

To avoid the negative connotations that some people associate with the female reproductive system, scientists could begin to describe male and female processes as homologous. They might credit females with "producing" mature ova one at a time, as they're needed each month, and describe males as having to face problems of degenerating germ cells. This degeneration would occur throughout life among spermatogonia, the undifferentiated germ cells in the testes that are the long-lived, dormant precursors of sperm.

But the texts have an almost dogged insistence on casting female processes in a negative light. The texts celebrate sperm production because it is continuous from puberty to senescence, while they portray egg production as inferior because it is finished at birth. This makes the female seem unproductive, but some texts will also insist that it is she who is wasteful.'? In a section heading for *Molecular Biology of the Cell*, a best-selling text, we are told that "Oogenesis is wasteful." The text goes on to emphasize that of the seven million oogonia, or egg germ cells, in the female embryo, most degenerate in the ovary. Of those that do go on to become oocytes, or eggs, many also degenerate, so that at birth only two million eggs remain in the ovaries. Degeneration continues throughout a woman's life: by puberty 300,000 eggs remain, and only a few are present by menopause. "During the 40 or so years of a woman's reproductive life, only 400 to 500 eggs will have been released," the authors write. "All the rest will have degenerated. It is still a mystery why so many eggs are formed only to die in the ovaries." The real mystery is why the male's vast production of sperm is not seen as wasteful. Assuming that a man "produces" 100 million (10^8) sperm per day (a conservative estimate) during an average reproductive life of sixty years, he would produce well over two trillion sperm in his lifetime. Assuming that a woman "ripens" one egg per lunar month, or thirteen per year, over the course of her forty-year reproductive life, she would total five hundred eggs in her lifetime. But the word "waste" implies an excess, too much produced. Assuming two or three offspring, for every baby a woman produces, she wastes only around two hundred eggs. For every baby a man produces, he wastes more than one trillion (10^{12}) sperm.

How is it that positive images are denied to the bodies of women? A look at language-in this case, scientific language-provides the first clue. Take the egg and the sperm. It is remarkable how "femininely" the egg behaves and how "masculinely" the sperm. The egg is seen as large and passive. It does not move or journey, but passively "is transported," "is swept," or even "drifts" along the fallopian tube. In utter contrast, sperm are small, "streamlined," and invariably active. They "deliver" their genes to the egg, "activate the developmental program of the egg" and have a "velocity" that is often remarked upon. Their tails are "strong" and efficiently powered. Together with the forces of ejaculation, they can "propel the semen into

the deepest recesses of the vagina." For this they need "energy," "fuel," so that with a "whiplashlike motion and strong lurches" they can "burrow through the egg coat" and "penetrate" it.

At its extreme, the age-old relationship of the egg and the sperm takes on a royal or religious patina. The egg coat, its protective barrier, is sometimes called its "vestments," a term usually reserved for sacred, religious dress. The egg is said to have a "corona," a crown, and to be accompanied by "attendant cells." It is holy, set apart and above, the queen to the sperm's king. The egg is also passive, which means it must depend on sperm for rescue. Gerald Schatten and Helen Schatten liken the egg's role to that of Sleeping Beauty: "a dormant bride awaiting her mate's magic kiss, which instills the spirit that brings her to life." Sperm, by contrast, have a "mission," which is to "move through the female genital tract in quest of the ovum." One popular account has it that the sperm carry out a "perilous journey" into the "warm darkness," where some fall away "exhausted." "Survivors" "assault" the egg, the successful candidates "surrounding the prize." Part of the urgency of this journey, in more scientific terms, is that "once released from the supportive environment of the ovary, an egg will die within hours unless rescued by a sperm." The wording stresses the fragility and dependency of the egg, even though the same text acknowledges elsewhere that sperm also live for only a few hours. In 1948, in a book remarkable for its early insights into these matters, Ruth Herschberger argued that female reproductive organs are seen as biologically interdependent, while male organs are viewed as autonomous, operating independently and in isolation.

[...] Bringing out another aspect of the sperm's autonomy, an article in the journal *Cell* has the sperm making an "existential decision" to penetrate the egg: "Sperm are cells with a limited behavioral repertoire, one that is directed toward fertilizing eggs. To execute the decision to abandon the haploid state, sperm swim to an egg and there acquire the ability to effect membrane fusion." Is this a corporate manager's version of the sperm's activities-"executing decisions" while fraught with dismay over difficult options that bring with them very high risk? There is another way that sperm, despite their small size, can be made to loom in importance over the egg. In a collection of scientific papers, an electron micrograph of an enormous egg and tiny sperm is titled "*A Portrait of the Sperm*." This is a little like showing a photo of a dog and calling it a picture of the fleas. Granted, microscopic sperm are harder to photograph than eggs, which are just large enough to see with the naked eye. But surely the use of the term "portrait," a word associated with the powerful and wealthy, is significant. Eggs have only micrographs or pictures, not portraits.

One depiction of sperm as weak and timid, instead of strong and powerful-the only such representation in western civilization, so far as I know-occurs in Woody Allen's movie *Everything You Always Wanted To Know About Sex, But Were Afraid to Ask*. Allen, playing the part of an apprehensive sperm inside a man's testicles, is scared of the man's approaching orgasm. He is reluctant to launch himself into the darkness, afraid of contraceptive devices, afraid of winding up on the ceiling if the man masturbates. The more common picture-egg as damsel in distress, shielded only by her sacred garments; sperm as heroic warrior to the rescue-cannot be proved to be dictated by the biology of these events. While the "facts" of biology may not always be constructed in cultural terms, I would argue that in this case they are. The degree of metaphorical content in these descriptions, the extent to which differences between egg and sperm are emphasized, and the parallels between cultural stereotypes of male and female behavior and the character of egg and sperm all point to this conclusion. [...]

Further research would show us exactly what social effects are being wrought from the biological imagery of egg and sperm. At the very least, the imagery keeps alive some of the hoariest old stereotypes about weak damsels in distress and their strong male rescuers. That these stereotypes are now being written in at the level of the cell constitutes a powerful move to make them seem so natural as to be beyond alteration.

The stereotypical imagery might also encourage people to imagine that what results from the interaction of egg and sperm-a fertilized egg-is the result of deliberate "human" action at the cellular level. Whatever the intentions of the human couple, in this microscopic "culture" a cellular "bride" (or femme fatale) and a cellular "groom" (her victim) make a cellular baby. Rosalind Petchesky points out that through visual representations such as sonograms, we are given "images of younger and younger, and tinier and tinier, fetuses being 'saved.' " This leads to "the point of visibility being 'pushed back' indefinitely." Endowing egg and sperm with intentional action, a key aspect of personhood in our culture, lays the foundation for the point of viability being pushed back to the moment of fertilization. This will likely lead to greater acceptance of technological developments and new forms of scrutiny and manipulation, for the benefit of these inner "persons": court-ordered restrictions on a pregnant woman's activities in order to protect her fetus, fetal surgery, amniocentesis, and rescinding of abortion rights, to name but a few examples.

Even if we succeed in substituting more egalitarian, interactive metaphors to describe the activities of egg and sperm, and manage to avoid the pitfalls of cybernetic models, we would still be guilty of endowing cellular entities with personhood. More crucial, then, than what kinds of personalities we bestow on cells is the very fact that we are doing it at all. This process could ultimately have the most disturbing social consequences.

One clear feminist challenge is to wake up sleeping metaphors in science, particularly those involved in descriptions of the egg and the sperm. Although the literary convention is to call such metaphors "dead," they are not so much dead as sleeping, hidden within the scientific content of texts-and all the more powerful for it. Waking up such metaphors, by becoming aware of when we are projecting cultural imagery onto what we study, will improve our ability to investigate and understand nature. Waking up such metaphors, by becoming aware of their implications, will rob them of their power to naturalize our social conventions about gender.