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Cleaning Up After Sex: An Environmental History of Contraceptives in the United States, 1873—2010

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BY

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DISSERTATION

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ABSTRACT

I argue in my dissertation, "Cleaning Up After Sex: An Environmental History of Contraceptives in the United States, 1873–2010," that through the processes of contraceptive production, consumption, and disposal, over time, the role of contraceptives in human/nature interactions has become more significant and the impact more direct. I examine the production, consumption, and disposal histories of condoms, diaphragms and cervical caps, intrauterine devices, and hormonal birth control. Production, consumption, and disposal of the birth control methods I study have determined physical experiences with both our bodies and with the non-human natural world, but those three processes have also shaped discourse about nature and bodies. Likewise, discourse about nature and bodies helped to determine which contraceptives were made, how they were made, who had access to them, the manners in which they could be used, and what happened to them when humans were done with them. This environmental history of contraceptives in the United States illustrates the interwoven,

contingent, and reciprocal relationships among device production, consumption, and disposal; contraceptive discourse; and human bodies.

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INTRODUCTION

Birth control, "naturally—from the cosmic to the intimate," proclaims an advertisement from 1975 for the contraceptive method *Lunaception*. Only one of thousands of ways Americans have come up with to have more sex with less offspring, Lunaception is in a small category of modern methods that explicitly link the natural non-human world to contraception. Based on the premise that the menstrual cycles of pre-industrial women corresponded to the lunar cycle, this method of birth control prescribed night-time exposure to synthetic moonlight for the modern woman to realign herself with the grand cosmic cycle. Consequently, she would always know, simply by looking up into the night sky, the likelihood of conceiving on any given night. The connections between "nature" and bodies here are as stunning as a full moon in a cloudless night sky. Lunaception was marketed on its naturalness, a status that could not be afforded most of the most effective and accessible contraceptives whose connection to the non-human natural world seemed in the 1970s, and still today, non-existent, or distant at best.[1]

Only in the context of 1970s feminism and health concerns over the birth control pill could a contraceptive method like Lunaception emerge and enjoy some degree of economic success and popularity. To understand the appeal of a method like Lunaception, or the success of any contraceptive method, I want to retrace the ways in which birth control advocates and opponents approached the body and thought about its

[1] Promotional description, Louise A. Lacey, *Lunaception: A Feminine Odyssey into Fertility and Contraception* (New York: Coward, McCann and Geoghegan, 1975). *Lunaception* was published in French for circulation in Canada, as well as in German. The author currently maintains a website http://www.lunaception.net/index.htm (accessed May 2010).

place in nature, and excavate the various ways popular contraceptives were made and used.

In this project, I trace the processes of contraceptive production, consumption, and disposal and argue that, over time, the role of contraceptives in human/nature interactions has become more significant and the impact more direct. These three contraceptive processes have determined physical experiences with both our bodies and with the non-human natural world. But contraceptive production, consumption, and disposal have also shaped how we understand and talk about the natural world, our bodies, and the connections between them. The making, selling, using, and disposing of birth control devices have created particular experiences with and discourses about nature. In this story, however, the door swings both ways: ways in which birth control advocates and opponents thought and talked about the relationships between our bodies and nature, also helped to determine which contraceptives were made, how they were made, who had access to them, the manners in which they could be used, and what happened to them when humans were done with them. This environmental history of contraceptives in the United States, then, illustrates the interwoven, contingent, and reciprocal relationships between device production, consumption, and disposal; contraceptive discourse; and human bodies.

The intersections of these stories are complex. To understand them, we need an arsenal of conceptual weapons to deconstruct and piece back together the life of any one contraceptive device, let alone people's experience with that device. I will begin by defining the key concepts and organizational categories used in this study: *nature* and *environment*; *production, consumption,* and *disposal*; and *contraceptive discourse*.

Environmental historians join cultural historians, anthropologists, ethnologists, and even ecologists in their attempts to define *nature*.[2] I use the terms *non-human nature* and *nature* to mean two separate things. By *nature* I mean all of the natural world, which includes both humans and the non-human—the notion that humans are not separate from, but rather part of "nature" is fundamental to this definition and this study. I use the term *environment* broadly to mean any kind of surroundings, and I distinguish between types of environments including those of the non-human natural world, human-made environments, and the environment of the body. In this study, I conceive of the human body as both its own environment—an ecosystem in which internal and external actors affect the health of the whole—and as part of a much larger, interconnected environment—nature.

The processes of making contraceptives have clear and direct impacts on the natural world. I show these impacts by tracing productive processes from their conceptual development, to the raw resources and technologies used to make them, to the research done to test their effectiveness, and finally to their mass manufacturing. I examine the technologies and substances used to create condoms, diaphragms and cervical caps,

[2] The literature on human/nature and nature/culture relationships is enormous. The works that have most influenced this study are: Daniel Botkin, *Discordant Harmonies: A New Ecology for the Twenty-First Century* (New York: Oxford University Press, 1990); William Cronon, ed., *Uncommon Ground: Toward Reinventing Nature* (New York: W.W. Norton, 1995); Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton, 1991); Roderick Nash, *Wilderness and the American Mind*, 4th ed. (New Haven, Conn.: Yale University Press, 2001); Michael Pollan, *Second Nature: A Gardener's Education* (New York: Delta, 1991); Jennifer Price, *Flight Maps: Adventures with Nature in Modern America* (New York: Basic Books, 1999); Richard White, *The Organic Machine* (New York: Hill and Wang, 1995); and Raymond Williams, *The Country and the City* (New York: Oxford University Press, 1973).

intrauterine devices (IUDs), and systemic hormone-based contraceptives.[3] Further, I examine how those technologies were informed by the culture in which they were rooted. Advances in technology or the discovery and/or access to new raw materials allowed for the improvement or creation of more effective birth control devices. Inexpensive, disposable, and comfortable condoms, for example, were developed through the technological discoveries of the vulcanization of rubber and, later, the use of latex in a mechanized production process. Likewise, the success of IUDs was predicated on the invention of malleable plastic in the 1950s, and polyethylene shortly thereafter.[4]

The raw materials needed to produce devices often connected the U.S. contraceptive market outward, beyond national boundaries. Because of these "roads outward," the histories of American contraceptives in "Cleaning Up After Sex" are not solely national, regional, or local ones, they are stories that must be told in the context of shifting spatial scales.[5] By looking at large and small, from the international to the local, contraceptive production networks, I paint a fuller picture of the effect of productive

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[3] I have chosen to examine only some of the contraceptive devices available to Americans during the time period covered by this dissertation. These have been chosen based on the availability of source material to examine how they were produced, consumed, used, and disposed. Abortion, while certainly a means of birth control for many women (sometimes used as birth control because of a lack of access to contraceptive devices and information about their proper use, or when contraceptives fail) is not considered as a contraceptive in this study, as it does not *prevent* conception.

[4] Andrea Tone, *Devices and Desires: A History of Contraceptives in America* (New York: Hill and Wang, 2001), 264.

[5] See Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson-Smith (1991; reprint, Oxford: Blackwell Publishers, 2001); Edward W. Soja, *Postmodern Geographies: The Reassertion of Space in Critical Social Theory* (New York: Verso, 1989); and Richard White, "The Nationalization of Nature," *The Journal of American History* vol. 86, no. 3 (December 1999): 976–86. On the concept of "roads outward," see William Cronon, "The Trouble with Wilderness," in *Uncommon Ground: Toward Reinventing Nature*, ed. Cronon (New York: W.W. Norton & Co., 1995).

processes on nature. One poignant example is the condom. U.S. companies rose to become leaders in the condom industry beginning in World War I, this status was possible only through the reshaping of environments halfway around the world. Condoms were certainly not the sole product to come from the harvesting of rubber in South America and Southeast Asia, but the point here is that their existence was possible *only* through a relationship between manufacturers in the United States and Europe and imported natural resources; thus directly linking contraceptive production to the larger forces of environmental exploitation and globalization.

In addition to existing on multiple spatial scales, productive processes were, in many cases, sites of the most dramatic push and pull between contraceptive discourse and contraceptive experience. Contraceptive discourses pre-defined appropriate acts of consumption, thus dictating in large part the development and research of new devices. For example, the intrauterine device known as the Lippes Loop was developed in the context of population control. Population control advocates, like the Population Council, sought birth control that was cheap, effective, and suitable for women they assumed to be incapable of understanding their own bodies and too irresponsible to be trusted with methods such as the Pill, which required consistent action by the woman.[6] Thus, the Population Council pursued *only* those methods that fit these criteria. The Lippes Loop and other IUDs were among the recipients of Population Council funding and clinical research tests because IUDs fit those criteria, while other contraceptive methods were simply dismissed as impractical.

[6] The Population Council was formed in 1952 by John D. Rockefeller, III to research and implement methods of curbing the expanding world population. For details on the Population Council and its funding of IUDs, see Chapter 3.

The processes of making contraceptives also involved human bodies in manufacturing spaces. Environmental historians have only recently begun to consider factory and labor conditions as part of a widening definition of what constitutes the field. "Cleaning Up After Sex" joins this trend by folding the environment of contraceptive manufacturing facilities and labor practices into the larger process of production. While human bodies play a central role in my discussion of consumption processes, they also play a role in contraceptive production. After all, it was bodies (not just machines) in very specific kinds of environments that were doing the productive work of manufacturing contraceptives. This study merges production, factory and labor issues, bodies, and nature into environmental history by examining, for example, gendered division of labor in condom factories and the ways that variations among bodies mandated the production of multiple forms, sizes, or shapes of IUDs.

Just as the process of contraceptive production linked Americans to environments both near and far, so too did the consumption of contraceptives bind ecosystems and people. I use the term *consumption* in this study to describe purchasing or otherwise accessing contraceptives *and* the act of using them. Together, these two parts of the consumption process form the experiential part of this study; I use clinical data and personal accounts to reconstruct the ways in which people encountered contraceptives in and on their bodies.

Issues of access, how and where people got contraceptives, are critical to unraveling the medical, moral, and social knots of power that bound human bodies.[7] The

[7] The growing literature that inserts discussions of body into environmental histories include: Christopher Sellers, "Thoreau's Body: Towards an Embodied Environmental History," *Environmental History* vol. 4, no. 4 (October 1999): 486–514;

consumption histories of the devices examined in "Cleaning Up After Sex" illustrate cases in which some people had greater access to particular contraceptives and cases in which groups of people were forced into only one contraceptive choice. In this study, I tell the histories of the creation of spaces in which contraceptives were consumed—what kind of spaces they are (drugstores, birth control clinics, etc.), where they are, who uses them. Here, as with the process of contraceptive production, a special relationship with the market existed where prices and availability were mediated by birth control organizations. For example, Margaret Sanger and the Planned Parenthood Federation of America (PPFA) negotiated with diaphragm manufacturer Holland-Rantos to purchase diaphragms at cost. The Population Council acted similarly by negotiating fixed, low prices with numerous domestic and overseas IUD manufacturing and distribution operations. Keeping costs down for clinics meant the clinics could pass on the savings to their patients, or in some cases simply give contraceptives for free. The result of these agreements between manufacturers and clinics were to drastically limit a patient's range

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Gregg Mitman, Michelle Murphy, and Christopher Sellers, eds., *Landscapes of Exposure: Knowledge and Illness in Modern Environments* (Chicago: University of Chicago Press, 2004); Mitman, *Breathing Space: How Allergies Shape our Lives and Landscapes* (New Haven, Conn.: Yale University Press, 2007); Conevery Bolton Valencius, *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002); Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2006); Linda Nash, "Finishing Nature: Harmonizing Bodies and Environments in Late-Nineteenth-Century California," *Environmental History* vol. 8, no. 1 (January 2003): 25–52; Ari Kelman, "New Orleans' Phantom Slave Insurrection of 1853: Racial Anxiety, Urban Ecology, and Human Bodies as Public Spaces," and Ellen Stroud, "Dead Bodies in Harlem: Environmental History and the Geography of Death," both in Andrew C. Isenberg, ed., *The Nature of Cities* (Rochester, N.Y.: Rochester University Press, 2006), 3–23 and 62–76 respectively; Nancy Langston, "Gender Transformed: Endocrine Disruptors in the Environment," in Virginia Scharff, ed., *Seeing Nature through Gender* (Lawrence: University Press of Kansas, 2003), 129–66; and Langston, *Toxic Bodies: Hormone Disruptors and the Legacy of DES* (New Haven, Conn.: Yale University Press, 2010).

of contraceptive options, ensure that a doctor or trained clinician was part of a patient's contraceptive experience, and to advance the success of certain contraceptive devices over others.

Consumption, however, is not simply an economic concept in this dissertation; it is also about how people consume contraceptives with their bodies. If environment is one's "surroundings, the material and spiritual influences which affect the growth, development and existence of a living being," then the human body itself is an environment.[8] The body is the site where contraceptive purpose, the device, efficacy, and side effects meet. Preventing conception has an impact on the body, for some women and men a desired one, for others forced.[9] Likewise, when contraceptives fail, one environmental consequence is the transformation of the female body, through pregnancy and sometimes through termination of that pregnancy. But there is even more at stake

[8] *New Webster's Dictionary and Thesaurus*, rev. ed. 1992, s.v. "Environment."

[9] Involuntary sterilization was carried out under eugenic ideology and as a punitive measure. Criminals, African Americans, Native Americans, the mentally "retarded" or ill, and those deemed "unfit" or promiscuous where the primary targets of forced sterilizations. Indiana was the first state to implement forced sterilization legislation in 1907, and the practice continued in the United States into the 1970s. On the history of forced sterilization, see Dorothy Roberts, *Killing the Black Body: Race, Reproduction, and the Meaning of Liberty* (New York: Pantheon, 1997); Harry Bruinius, *Better for All the World: The Secret History of Forced Sterilization and America's Quest for Racial Purity* (New York: Knopf, 2006); Philip Reilly, *The Surgical Solution: A History of Involuntary Sterilization in the United States* (Baltimore, Md.: Johns Hopkins University Press, 1991); Edward J. Larson, *Sex, Race, and Science: Eugenics in the Deep South* (Baltimore, Md.: Johns Hopkins University Press, 1995); Johanna Schoen, *Choice and Coercion: Birth Control, Sterilization, and Abortion in Public Health and Welfare* (Chapel Hill: University of North Carolina Press, 2005); Maria de Lourdes Lugo-Ortiz, "Sterilization, Birth Control, and Population Control: The News Coverage of *El Mundo, El Imparcial,* and *Claridad*" (Ph.D. diss., University of Wisconsin, 1994); and Alexandra Stern, *Eugenic Nation: Faults and Frontiers of Better Breeding in Modern America* (Berkeley: University of California Press, 2005).

than the physical consequences of these contraceptives. As feminists and other theorists have argued, the definition and shape of the body is "the focal point for struggles over the shape of power."[10] By constructing the body as environment in this project, I articulate the ways in which contraceptive technologies have liberated some women *and* how contraceptive technologies have inscribed existing systems of power onto bodies, both through the material technology and the discourses attached to them.[11]

The third process examined here as part of the life of a contraceptive is its disposal. In this study I answer the questions of what people do with used contraceptives, where used devices go, what kind of environmental effects their waste produces, and how humans re-encounter used contraceptives.

"Cleaning Up after Sex" makes new and critical additions to the field of environmental history. Gender analyses are central to the narrative of this study. With the exception of only a few of the newest scholarly works in American environmental history, the socially constructed meanings attached to biological sex difference have been relegated to a few brief paragraphs. Typical within the field are brief descriptions of gendered divisions of labor or essentialist claims about the ways men or women experience nature.[12] In this dissertation, gender is not simply the addition of women's or

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[10] Johnson quoted in Susan Bordo, "Feminism, Foucault and the Politics of the Body," in *Up against Foucault*, ed. Carole Ramazanoglu (New York: Routledge, 1993), 182.

[11] On bodies, experience and discourse, see Kathleen Canning, "Feminist History after the Linguistic Turn: Historicizing Discourse and Experience," *Signs: Journal of Women in Culture and Society* vol. 19, no. 2 (Winter 1994): 368–404; and Gill Kirkup, Linda James, Kathryn Woodward, and Fiona Hovenden, eds., *The Gendered Cyborg: A Reader* (New York: Routledge, 2000).

[12] Some important exceptions are Scharff, ed. *Seeing Nature through Gender*;

men's experiences, it is a tool of analysis. Second, "Cleaning Up after Sex" disrupts the common conclusion drawn by many environmental histories that technology alienates humans from nature. In this project, I show how some contraceptive technologies have made humans more acutely aware of both the environment of the human body and the larger non-human environment. For example, women reacting against early health concerns about the Pill turned in large numbers to cervical caps and diaphragms. The proper use of diaphragms and caps required a woman to possess at least some accurate knowledge of her reproductive system, familiarity with the uniqueness of her own body, and a lack of squeamishness to explore exactly where and exactly how the device acted in her body.

In addition to the production, consumption, and disposal of contraceptives, I examine the role of discourse in their histories. Four major discourses about bodies and nature surrounded Americans' discussions about contraceptives from 1873 to the present. These ways of thinking about contraception did not give way into one another neatly as time progressed. Rather, both birth control advocates and opponents repeated and modified these four discourses to suit their purposes. While a reciprocal relationship existed among the formulation of discourse and contraceptive production, consumption,

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Scharff, "Man and nature! Sex Secrets of Environmental History," in *Human/Nature: Biology, Culture, and Environmental History*, ed. John P. Herron and Andrew G. Kirk (Albuquerque: University of New Mexico Press, 1999); Carolyn Merchant, *Ecological Revolutions: Nature, Gender, and Science in New England* (Chapel Hill: University of North Carolina Press, 1989); Susan R. Schrepfer, *Nature's Altars: Mountains, Gender, and American Environmentalism* (Lawrence: University of Kansas Press, 2005); and Melissa Leach and Cathy Green, "Gender and Environmental History: From Representation of Women and Nature to Gender Analysis of Ecology and Politics," *Environment and History* vol. 3, no. 3, (October 1997): 343–70.

and disposal, this discourse was also shaped by the medical knowledge, politics, and social movements of any given time period.

The first of the four major contraceptive discourses that I identify in this study constructed contraception as "unnatural." Conceptions regarding the natural and unnatural slipped easily into ideas about morality. Numerous groups and individuals have adopted this view of contraception; I focus on three groups in particular. I begin my study in the late nineteenth-century in the wake of one of the largest victories for moral reformers against vice: the 1873 Comstock Act. In the 1860s, alarmed by a bourgeoning and increasingly commercialized sex industry in which pornography, erotica, prostitution, and risqué theatre were easily accessed and consumed, anti-vice organizations united for reform. To these moral reformers, contraceptives posed a threat to sexual norms and to social stability, and were consequently constructed as "unnatural." At the front and center of this crusade to protect American morality was Anthony Comstock. Comstock grew up in Connecticut in a devoutly religious home; he spent his adult life working for the Christian Commission (which fought against tobacco, alcohol, gambling, and atheism in the armed services), for the Young Men's Christian Association (YMCA), and as the head of the New York Society for the Suppression of Vice (NYSSV).[13]

[13] On Comstock, the NYSS, and late-nineteenth-century moral reformers, see Janet Brodie, *Contraception and Abortion in Nineteenth-Century America* (Ithaca, N.Y.: Cornell University Press, 1994); John D'Emilio and Estelle B. Freedman, *Intimate Matters: A History of Sexuality in America*, 2nd ed. (Chicago: University of Chicago Press, 1997); Tone, *Devices and Desires*; Linda Gordon, *The Moral Property of Women: A History of Birth Control Politics in America* (1976; reprint, Chicago: University of Illinois Press, 2002). On New York and the sex industry, see Timothy Gilfoyle, *City of Eros: New York City, Prostitution, and the Commercialization of Sex, 1790–1920* (New York: Norton, 1992); and George Chauncey, *Gay New York: Gender, Urban Culture, and the Makings of the Gay Male World, 1890–1940* (New York: Basic Books, 1994).

Comstock rallied with like-minded congressmen to influence legislation, which resulted in the 1873 Comstock Act. Birth control was included in this act that sought to curtail the trade in sexual material. The first section of the Comstock Act outlawed the sale, possession, or advertisement of pornography and "any drug or medicine, or any article whatever, for the prevention of conception . . . or abortion." This clause applied to the District of Columbia, any Territories of the United States, or any other place within "the exclusive jurisdiction of the United States." The remaining sections of the act prohibited the importation or circulation of contraceptive information and advertising through the U.S. mail.[14] Twenty-four states passed laws imitating the Comstock Act, forbidding the sale and advertisement of contraceptives within states lines. Connecticut and Massachusetts had the most restrictive laws, outlawing outright the manufacture, sale, and use of contraceptives.[15] Virtually overnight, the fledgling U.S. contraceptive industry was forced underground.

Moral crusaders were not the only group of Americans to oppose birth control, in fact, some of the staunchest opposition the birth control movement faced came from physicians. Prior to 1937, the American Medical Association's (AMA) policy on birth

[14] Comstock Act, chap. 258, 17 Stat. 598, 3 March 1878, 42nd cong., 3rd sess. The following were still territories in 1873 and thus subject to the strictest clause of the Comstock Act prohibiting sale and possession of contraceptives: New Mexico, Colorado, Oklahoma, Nebraska, South Dakota, North Dakota, Wyoming, Montana, Idaho, Washington, Utah, and Arizona.

[15] Carol Flora Brooks, "The Early History of the Anti-Contraceptive Laws in Massachusetts and Connecticut," *American Quarterly* vol. 18 (Spring 1966): 3–23; and Mary Dennett, *Birth Control Laws, Shall We Keep Them, Change Them, or Abolish Them?* (New York: H.F. Hitchock, Grafton Press, 1926).

control was that it was not a legitimate medical practice.[16] The AMA routinely answered inquiries about contraceptives from doctors and patients alike by responding that no known effective method of birth control existed other than abstinence, that any contraceptive on the market could be safely regarded as a quack remedy, and reminded their correspondents that providing information about birth control was illegal.[17] Although many individual doctors did recommend contraceptives to their patients, the AMA's ban on birth control helped to prevent the development of effective methods and buttressed essentialized and moral arguments about what human bodies should do.

Physicians and moral crusaders were joined by the Catholic Church in their opposition to what they considered to be "unnatural" birth control. Pope Paul VI's 1968 encyclical letter *Humanae Vitae*, a response in large part to the widespread use of the birth control pill, connects the human body, nature, and contraception explicitly. In his opening description of the problem, the Pope wrote:

> . . . the most remarkable development of all is to be seen in man's stupendous progress in the domination and rational organization of the forces of nature to the point that he is endeavoring to extend this control over every aspect of his own life—over his body, over his mind and emotions, over his social life, and even over the laws that regulate the transmission of life."[18]

This argument puts at odds human manipulation of bodies and natural law; the effect is to attach morality to and naturalize conception. Similar arguments on the basis of morality

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[16] Tone, *Devices and Desires*, 81.

[17] See the numerous letters to and responses from the AMA to such inquires in "Birth Control," folder 7 "Correspondence, 1912–1930" and folder 8 "General Correspondence, 1931–1932," box 85; and all folders, box 86, Birth Control Collection, American Medical Association Health Fraud Archives [hereafter AMAHFA], Chicago, Illinois.

[18] Pope Paul VI, *Humanae Vitae,* Encyclical of Pope Paul VI on the Regulation of Birth, July 25, 1968, I. Problem and Competency of the Magisterium.

and essentialized notions of "natural" bodies came from anti-feminists, and later with the rise of the New Right, this discourse was cemented into abstinence-only sex education programs during the 1980s and 1990s.

The second contraceptive discourse I examine is one that emphasized the need for female control over contraceptives. The primary concern of this discourse was that women not be reliant on husbands or partners to use condoms or to use the withdrawal method, but that women have a safe and reliable method they could use in secret if necessary. Although the need for female-controlled contraceptives was articulated by birth control advocates throughout the twentieth century, female control over contraception was actualized to varying degrees. Margaret Sanger was one of the first birth control advocates to develop this discursive strain, and as I note in Chapter 2, she used it to push for the manufacturing of and access to diaphragms in the United Sates. In the 1960s and 1970s, in the wake of worries about the health risks of the Pill, feminist groups like the Boston Women's Health Book Collective revived this discourse and advocated female-controlled contraceptives that limited the role of the predominately male medical profession in prescribing, monitoring, or instructing contraceptive use.

From the 1930s into the mid-1960s, the role of the physician in people's decisions about birth control steadily increased. This phenomenon was at once a reality and a discursive strand, which scholars have identified as the medicalization of birth control.[19] In this third model of thinking about bodies and nature in the context of birth control,

[19] Beth Bailey, *Sex in the Heartland* (Cambridge, Mass: Harvard University Press,. 1999); Carole R. McCann, *Birth Control Politics in the United States, 1916–1945* (Ithaca, N.Y.: Cornell University Press, 1994), 93–95; James Reed, *From Private Vice to Public Virtue: The Birth Control Movement and American Society Since 1830* (New York: Basic Books, 1978), 143–48; and Tone, *Devices and Desires*, 117–50, 233–60.

doctors emerge as the preeminent and sole authorities on women's bodies. The medicalization of birth control began with Sanger's attempts to legitimize the movement by gaining the support of the AMA and became entrenched with the advent of the Pill. The condom possessed a slightly different relationship with the medical community, as its dual roles of both prophylactic and contraceptive complicated the interplay between medicine, birth control, bodies, and nature.

A fourth discourse, which was present throughout the period under study in this dissertation, used eugenic and overpopulation arguments to advocate for certain kinds of contraceptives. This way of thinking about bodies, nature, and birth control clearly articulates issues of power based on race, class, geography, national security, and global resources. Simple hereditarian ideas about passing vice, sexual repression, or morality to offspring through genes gave way to ever more complex eugenic thought about not just who, but how we should reproduce.[20] Ideologies of race betterment during the 1930s and 1940s, and worries about the depopulation of white middle-class America limited access to contraceptives to some women and forced it upon others.[21] As eugenic ideology fell out of favor, a similar but much more subtle ideology emerged to take its place: alarm over the threat of overpopulation.[22] Spurred by neo-Malthusianism and popularized by

[20] On the relationship between the Eugenic and Birth Control movements see Gordon, *The Moral Property of Women*, chap. 5, 72–85; McCann, *Birth Control Politics in the United States*, chap 4, 99–134; Tone, *Devices and Desires*,139–45; and Reed, *From Private Vice to Public Virtue*, 134–37, 211–13.

[21] See works cited in footnote 9 on forced sterilization.

[22] The most comprehensive work to date on the population control movement is Matthew Connelly, *Fatal Misconception: The Struggle to Control World Population* (Cambridge, Mass.: The Belknap Press of Harvard University Press, 2008).

the publication of Paul R. Ehrlich's *The Population Bomb*, the issue of curbing the world's growing population became of interest to the American public and government alike.[23] A belief that too many bodies needing too few resources would collapse economies, threaten national security, and cause the rapid spread of disease, famine, and war led private organizations like the Population Council to focus their funds on creating and distributing contraceptives to populations they felt needed to be held in check. The discourse of population control is the closest of the four to giving the non-human natural world agency and voice. But in so doing, the rhetoric of overpopulation constructs bodies, very certain bodies, as threats to nature and constructs contraceptives as the most powerful weapon in the fight to save nature from human bodies.

The histories of how birth control advocates and opponents framed their discussions about bodies and nature and how particular contraceptives came into use are so interwoven, so complex, that telling any one story begins to seem impossible. But certain contraceptive devices stand out as particularly illustrative of the intersections among discourse; production, consumption, and disposal; bodies; and nature—either because of their widespread use or because they were heavily advocated by some group or individual. Some of the contraceptives I examine lend themselves to singular study within a chapter, while others are better examined together through the lens of a particular process. I have not, therefore, given production, consumption, and disposal histories for each contraceptive, rather, I have focused on the contraceptives and processes that best illustrate human/nature relationships.

[23] Paul R. Ehrlich, *The Population Bomb* (New York, Ballantine Books, 1968).

The first chapter, "Flexible Protection: Rubber Condom Production, 1870s–1940s," traces the production history of the condom. I situate the condom within the history of the rubber industry, examine how the dual roles of the condom as prophylactic and contraceptive alternately shaped its technological development, and trace the specific manufacturing processes of condom production. I also examine the factory spaces in which condoms were created; these factories were hazardous environments, occupied mostly by women workers. Manufacturers sought new technologies to improve these conditions, which radically altered the factory safety as well as the quality, price, and availability of the product.

In Chapter 2, "Beyond Barriers: Finding Technology and Nature in Contraceptive Diaphragms and Cervical Caps, 1920s–1980s," I examine how the production and consumption of diaphragms and cervical caps linked women's ideas about their bodies, women's physical bodies, and contraceptive production. I examine two moments in the history of the devices: the interwar period and the 1970s and early 1980s. During the interwar years, the diaphragm ushered in the medicalization of birth control, but at the same time, it put women in contact with their bodies in a way few had been previously. I further examine the ways women responded to this intimate contact with their own bodies, examine doctors' and birth control clinicians' views of the diaphragm and its use, and explore how manufacturers advertised the diaphragm as a sophisticated piece of technology as well as their response to women's uneasiness with diaphragm insertion.

During the 1970s, and in partial response to health concerns surrounding the Pill, feminist groups such as the Boston Women's Health Book Collective initiated a resurgence of interest in diaphragms and cervical caps, and re-imagined the device as the

contraceptive choice that was most effective and most "natural." This renaissance, though brief, significantly affected the contraceptive market and had lasting impact on women's views and experiences of their bodies.

My third chapter, "Machines in the Body: Overpopulation and the Intrauterine Contraceptive Device, 1950s–1960s," details the environmental history of the IUD. Although there are a number of intrauterine devices, I chose two that underwent the heaviest clinical research and were widely used: the Lippes Loop and Margulies spiral. During the 1960s, the male-dominated profession of gynecology supported a system of work, reward, and prestige that was one of several factors that *literally shaped* IUDs. The contraceptives' physical designs, and the language inventors and physicians used to describe their mode of action were animalistic and violent. IUDs were most heavily influenced by the discourse of overpopulation, and in fact, they owe their existence and success almost entirely to the work of the Population Council. I trace how the discourse of overpopulation overlapped with the production and consumption of these devices.

My final chapter, "Flushed: Treating the Water for Contraceptives, 1990s–Present," is an analysis of how contraceptive disposal, specifically of condoms and hormonal birth control, has altered nature—our bodies included. I tell the histories of real and imagined condom litter, and of how one Milwaukee wastewater treatment plant has dealt with "escaped" condoms in Lake Michigan. In addition, I trace the recent history of synthetic hormones found in systemic hormone-based contraceptives and explore the reactions of the scientific community, the Catholic Church, and the general public to the discovery of these hormones in U.S. waterways.

In “Cleaning Up After Sex,” I show how contraceptive production, consumption, disposal, and discourse each work to create human relationships with nature. The importance of this project extends beyond the boundaries of scholarly inquiry. Access to, and health policy about, birth control are subsets of the largest significance of this work, which is one of power—power over bodies. In this project, I put the human body into the equation of the human/nature relationships and consider these relationships on a range of scales, from the global to the biochemical. As we enter an age in which humans will have to forge new kinds of relationships with the non-human world to ensure our species survival, how will our own reproduction figure into those relationships? To ensure our answers and actions are just and responsible, we must examine the decisions of our reproductive past.

Chapter 1

FLEXIBLE PROTECTION: RUBBER CONDOM PRODUCTION, 1870s–1940s

The sun barely reaches through the thick vegetation, but the heat and humidity still cause beads of sweat to roll down the forehead of a *seringuero* as he trots down a well-worn path into the Brazilian rain forest. Using a small hatchet, the rubber tapper slices a sloping incision into the rough bark of a *Hevea brasiliensis* tree, brushing aside its wide, waxy leaves to release the sap that, like the beads of sweat on his brow, run slowly down the trunk of the plant where they are captured in a small cup. The seringuero travels from tree to tree, collecting as much of the milky sap as he can carry. At dusk, he returns to his hut in the forest and gets to work over an open fire smoking the sap, building it up on paddles until it is cured into dry sheets of rubber that he will take to town for trade and a meager profit.[24]

From the hands of the trader, to those of large rubber companies, onto steam ships, and across oceans, the sheets of gum rubber harvested and smoked by the seringuero eventually find their way from green jungle to the stone jungle, into the bustling ports of late nineteenth-century New York. At market, perhaps a dress-shield

[24] John Loadman, *Tears of the Tree: The Story of Rubber—A Modern Marvel* (New York: Oxford University Press, 2005), 22, 214; Warren Dean, *Brazil and the Struggle for Rubber: A Study in Environmental History* (New York: Cambridge University Press, 1987), 30; John B. Tuttle, *The Analysis of Rubber,* American Chemical Society Monograph Series (New York: printed for The Chemical Catalog Co., Inc., by J.J. Little and Ives Co., 1922), 16; and Michael Edward Stanfield, *Red Rubber, Bleeding Trees: Violence, Slavery, and Empire in Northwest Amazonia, 1850–1933* (Albuquerque: University of New Mexico Press, 1998), 24–25.

manufacturer purchases the leafs of thin rubber, and then in turn he sells some of those rubber sheets to a man who carries them down into a tiny basement "factory." In carefully constructed privacy with "windows so draped that the outside world may not peer in," the rubber is laid flat upon small zinc-covered tables. A handful of workers cut the rubber, place it on cylindrical formers, dip it into a curing solution and the process is complete: the milky sap of the Brazilian rubber tree has been transformed into a rubber sheath the purpose of which is to keep the milky sap of human men from reaching tiny female eggs.[25]

The production of rubber condoms was certainly not a driving force behind the harvesting of natural rubber in the Amazon, but the black market in rubber condoms that existed in the late-nineteenth-century United States, and which would grow to become a $38 million-dollar-a-year industry by 1938, could not have existed otherwise. Condoms were among the countless products that benefited from constantly emerging rubber technologies, so that by the middle of the twentieth century, the condom manufacturing process had evolved considerably from that of dark and illicit basement rooms of the nineteenth century into modern factories.

Although this study is an environmental history of *birth control*, in the case of the condom, its contraceptive history is so intertwined with its history as a prophylactic as to be inseparable. This duality makes the condom unique among contraceptives, as it remains even today the only device that prevents both pregnancy and infection from sexually transmitted diseases. Labor historians have studied urban environments, pollutants, occupational health and safety, and the reform movements that grew to

[25] T. J. B. Buckingham, "The Trade in Questionable Rubber Goods," *India Rubber World and Electrical Trades Review* (March 15, 1892): 164–65.

address these issues, but only relatively recently have environmental historians begun to integrate such histories into their own field by refiguring environment and workers as mutual historical agents. In this study, I combine these insights in the context of condom manufacturing and ask what kinds of workspaces were created by specific manufacturing processes, and what were the affects of those spaces on human bodies.

It is a sticky task to separate the contraceptive uses of the condom from its prophylactic uses; after all, they are rolled up together. The condom's status today as one of the least expensive, most widely used, and most easily accessible contraceptives is in large part due to its function as a prophylactic, particularly against HIV/AIDS. The device's effectiveness in preventing sexually transmitted diseases, however, has been acknowledged for hundreds of years. It was the Italian anatomist Gabriello Falloppio who first described in scientific literature the prophylactic properties of the condom. Falloppio noted the effectiveness of sheaths in preventing "French caries" or syphilis, which by the mid-1500s had reached epidemic proportions among the French upper class.[26]

Before such scientific claims as Falloppio's, the condom's history as a prophylactic and as a form of birth control is long, though disputed and rather sparsely documented. The device was known during the nineteenth and twentieth centuries by

[26] The female reproductive "fallopian tubes" are also named after Falloppio. Gabriele Falloppio, *De morbo gallico liber absolutissimus* (Patavii, Apud Lucam Bertellum & Socios, 1564), Chapter 89. On Falloppio, see, Aine Collier, *The Humble Little Condom, A History* (Amherst, N.Y.: Prometheus Books, 2007), 54; Robert Jütte, *Contraception: A History* (Cambridge, England: Polity Press, 2008), 96; James S. Murphy, *The Condom Industry in the United States* (Jefferson, N.C.: McFarland & Co., 1990), 7; and Jeannette Parisot, Bill McCann, and Geraldine Rudge, *Johnny Come Lately: A Short History of the Condom*, trans. Bill McCann (London: Journeyman Press, Ltd., 1987), 5.

many names—sheaths, shields, safes, skins, gentlemen's protectors, pouches, goldbeaters, merry widows, capotes, French secrets, English letters, membranes, envelopes, caps (which covered only the glans of the penis), and rubbers, to name but a few—but the origin of the term *condom* is clouded in mystery. Legend attributes the derivation of the word (alternatively spelled *condom, condon, caonton, controm, cundum,* and *kundum*) to an eighteenth-century royal physician of King Charles the II, Dr. Condum. The often repeated, though unverified story maintains that the king commissioned the doctor to invent a means of protection for the English Army against venereal diseases. A linen sheath with a silk ribbon tie was the doctor's solution. Whether the doctor conceived of this design independently or knew of the sheath from other sources is unknown, as is the legitimacy of the legend. What is undeniable, however, is that the device, by whatever name it is called, has a history that stretches back to the earliest human civilizations.[27]

Cultures around the globe have not only given condoms a multitude of names, they have also fashioned the devices out of numerous materials. The Egyptians, for example, used sheaths of papyrus; the Chinese used oiled silk paper. Until the advent of rubber condoms, the most common materials used for sheaths were animal intestines—especially those of lamb caeca—and fish bladders. In the United States, the earliest sheaths were homemade of animal intestines, but by the early nineteenth century were

[27] On the etymology of *condom*, see William E Kruck, *Looking for Dr. Condom* (University, Ala.: American Dialect Society by University of Alabama Press, 1981); Bertherand and Léon Duchesne, "Des préservatifs, de leur fabrication et de leur influence sur le dévloppement de la maladie vénérienne," *Lyons, Médical* (October 21, 1877); and Collier, *The Humble Little Condom*, 67–69.

commercially available for consumer purchase and advertised as both prophylactics and contraceptives.[28]

By the mid-1800s, a wide range of Americans were using condoms, which were either imported from Europe or manufactured in small factories for local U.S. markets. Although a perception of the condom as being associated with illicit sex acts and prostitution persisted into the twentieth century, the device was, in fact, being used across classes and within marriages. The Mosher Survey, questioned forty-five married women, most of who were born before 1870 and were well educated, white, and of the middle or upper class, revealed that ten of the women surveyed (22 percent) had used condoms for birth control. Despite the reality that condom use was widespread and was far from exclusively tied to illicit sex, the perception that condoms encouraged prostitution and vice remained strong among certain, influential elements of society.[29]

Those most offended by the condom were moralists who lobbied for, and won, anti-vice legislation. The 1873 passage of the federal Comstock Act spawned a number of even more restrictive state anti-vice laws. One way in which vice squads, present in most major U.S. cities, enforced federal and state Comstock laws was by targeting

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[28] The caecum is a piece of the intestine that is closed on one end and open on the other. Lamb caeca are the ideal size for a condom, roughly that of the average human penis. On the early history of the condoms see, Eric Chevallier, *The Condom: Three Thousand Years of Safer Sex*, trans. Patrik White (London: Puffin, 1995); Collier, *The Humble Little Condom*, 136*; and* Jeannette Parisot, et al., *Johnny Come Lately*, 19–21.

[29] On condom use in the nineteenth-century United States, see Celia Duel Mosher, *The Mosher Survey: Sexual Attitudes of 45 Victorian Women*, eds. James MaHood and Kristine Wenburg, intro. by Carl N. Degler (New York: Arno Press, 1980); Andrea Tone, "Making Room for Rubbers: Gender, Technology, and Birth Control before the Pill," *History and Technology* vol. 18, no. 1 (2004): 51–76; and Tone, "Contraceptive Entrepreneurs," Chapter 3 and "Black Market Birth Control," Chapter 4 in *Devices and Desires: A History of Contraceptives in America* (New York: Hill and Wang, 2001), 47–90.

condom manufacturers, arresting owners, and confiscating products. The result was to force condom manufacture underground; because the small and local networks of condom producers could now only operate on the black market, advances in manufacturing technologies and the emergence of industry leaders were slow to develop. Because of this forced secrecy, the landscape of condom manufacture remained largely unchanged from that of the late nineteenth century until the early 1900s.

During the late nineteenth and early twentieth centuries, it was the prophylactic nature of the condom, tied so strongly to prostitution and promiscuity, which thrust the device to the top of moral crusaders' list of items of vice that must be eliminated. For these crusaders, venereal disease was the result of immoral, illicit sexual behavior, and the only reason for the existence of prophylactics was to allow such behavior to take place. The striking irony is that in the twentieth century, it was that very effectiveness of condoms in preventing the spread of disease that would chip away at Comstock laws, spur the rise of a condom industry, and resurrect the prevalence of the device more than once.

Perhaps more than any other factor, the recognition of the prophylactic usefulness of the rubber condom during World War I spurred development of the condom industry. This recognition led to an increase in postwar availability and use of the device, which ultimately changed its legal status. During the war, the U.S. Armed Services battled not only their human enemies, but also against the tiny unseen bacteria of rapidly spreading venereal diseases, in particular syphilis and gonorrhea. A few key individuals within the army and the navy fought for preventative disease control in the form of condoms, but

lost. Comstock laws prevented the interstate shipment of the articles and the armed services were unable to officially distribute or endorse their use.

Military authorities, however, turned away from condoms more because of the extreme moralistic approach they adopted than because of legal restrictions. The armed services rightly advocated that the most effective means of fighting the spread of disease was to limit exposure. This philosophy became extreme in the manner it was applied, limiting exposure to women, rather than to disease. At home, authorities eliminated red light districts and organized the Commission on Training Camp Activities (CTCA) to campaign against prostitution and provide social hygiene education. The CTCA emphasized the suppression of sexual desire, disparaged soldiers who indulged in sex, and vilified women as disease carriers. The CTCA went as far as detaining, without bail, women even suspected of infection, be she a known prostitute or not. Abroad, especially in France where prostitution was legal, regulated, and impossible for the U.S. Army to eliminate, authorities simply forbade soldiers from visiting areas of town occupied by prostitutes, and tried to limit soldiers' leave and free time. Rather than promoting the use of condoms in a "weak" moment of submission to sexual desire, the army and navy mandated the less effective, more expensive, and painful chemical prophylaxis. The inconvenience and pain of the treatment, authorities hoped, would serve as a deterrent to future sexual liaisons. These measures proved to be sorely ineffective; by war's end, one in eleven soldiers were infected with syphilis or gonorrhea and the army had spent over $50 million in treatment for preventable diseases.[30]

[30] On the positions of the U.S. Armed Services on condoms, use of condoms among and morality of U.S. servicemen, see Allan M. Brandt, *No Magic Bullet: A Social History of Venereal Disease in the United States since 1880* (New York: Oxford

France and the United Kingdom, with no legal restrictions on the manufacture or shipment of condoms, and with decidedly more realistic views of soldiers' sexual behavior, relied on condoms as a primary tool to fight the spread of disease among soldiers. The increased demand for condoms oversees during the war opened up opportunities for small-time manufacturers to take their businesses to the next level. Germany, which up to this point had provided the largest numbers of condom exports, was no longer able to supply Europe with rubbers, and new manufacturers, mostly from the United States, seeped in and filled the hole. In fact, the companies that came to dominate the U.S. condom industry starting in the 1920s grew their companies during World War I by exporting condoms to the U.S. allies, even though such export was illegal.

The undeniable effectiveness of the condom in preventing the spread of syphilis and gonorrhea eventually gave the contraceptive a new legal status, and played a role in the gradual erosion of Comstock laws. Landmark court cases such as the 1918 Crane ruling, a New York Court of Appeals case decided by Judge Frederick Crane on the legality of Margaret Sanger's distribution of contraceptives and reproductive information in 1916, recognized the condom as a prophylactic, upheld the device as moral and decent, and acknowledged its dual purpose as both disease preventative and contraceptive. The same year of the Crane ruling, Congress established the division of Venereal Diseases within the U.S. Public Health Service and mounted a public education program. Such legal and governmental attention to venereal disease shifted the status of rubbers from

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University Press, 1985); Nancy K. Bristow, *Making Men Moral: Social Engineering during the Great War* (New York: New York University Press, 1996); Fred D. Baldwin, "The Invisible Armor," *American Quarterly* vol. 16, no. 3 (autumn 1964): 432–44; and Tone, "Salute to Prophylaxis," in *Devices and Desires*, 91–115.

one of disrepute to one of widespread legitimacy. After 1918, Americans could legally purchase, manufacture, and ship condoms as prophylactics, but the contraceptive benefits of condoms remained less publicized and more private. Who was to know if an individual intended to use the rubber as birth control as well—or instead?[31]

In the aftermath of the condom's newly acquired legal status, its production and availability grew exponentially, and the device could be cheaply purchased at drugstores, from peddlers, and through mail order. New manufacturing techniques (which I discuss in detail in the following pages) emerged in the late 1920s and early 1930s, making rubbers even less expensive and more disposable. Though ubiquitous, condoms were not without fault. The range in quality between brands and even between lines of condoms offered under the same brand name was so great that in the late 1930s, the Food and Drug Administration (FDA) interjected itself to establish standardized condom inspection. Federal regulation was made possible through the prophylactic function of the condom. The 1906 Federal Food and Drug Act and the revised 1938 Food, Drug, and Cosmetic Act defined a drug as: "any substance or mixture of substances intended to be used for the cure, mitigation, or prevention of disease." FDA quality control included testing for holes, strength, dirt, and imperfections. Under the auspices of the condom's role as a "drug," the new quality standards imposed by the FDA made the condom more effective in both its functions.[32]

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[31] *The People of the State of New York vs. Margaret H. Sanger*, Court of Appeals of New York, 118 N.E. 637. On the details and significance of the Crane ruling, see Morris L. Ernst, "How We Nullify," *The Nation* vol. 134, no. 3473 (January 27, 192): 113–14; Tone, *Devices and Desires*, 106–07; Reed, *From Private Vice to Public Virtue*, 107; and Tone, "Making Room for Rubbers," 65.

[32] *Food and Drug Act, U.S. Code*, vol. 21, sec. 321 (1938). Tests conducted on

Despite widespread use of and improved quality condoms, during the late 1930s and 1940s, birth control advocates and medical professionals turned to the diaphragm as the contraceptive of choice. In 1924, doctors had recommended condoms more than any other birth control method, but by 1940 diaphragms occupied this position. For birth control advocates, the advantage of the diaphragm was that the woman controlled its use, and for doctors it was preferable to condoms because physicians maintained control over its prescription and training in its proper use. Because of this medicalization of birth control, physicians and birth control advocates all but turned their backs on the condom, even though it remained the *only* proven method to prevent both pregnancy and the spread of venereal disease.[33]

A 1938 *Fortune* magazine article estimated that contraceptives were a $250 million industry, with condom sales taking in 15 percent ($38 million) and the rest of the profits divided among a plethora of devices and potions for use by women. The bulk of the industry was comprised of illegitimate, even harmful methods, with diaphragm sales being comparatively negligible (one manufacturer's gross sales were estimated at a meager $30,000 per year). Of this fact, the author of the article lamented: "One needs to

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condom quality prior to FDA regulation, included National Committee on Maternal Health physician Robert Latou Dickinson's 1924 study on failure rates of condoms at three clinics, and biochemist Cecil Voge's 1934–1935 examination of 2,000 condoms. Collier, *Humble Condom*, 225; Tone, *Devices and Desires*, 70, 198; and Reed, *From Private Vice to Public Virtue*, 244–45.

[33] Dorothy Bocker, *Birth Control Methods* (New York: Birth Control Clinical Research, 1924); Alan F. Guttmacher, "Conception Control and the Medical Profession: The Attitude of 3,381 Physicians toward Contraception and the Contraceptives They Prescribe," *Human Fertility* 12 (March 1947), 1–10; Ruth A. Robishaw, "A Study of 4,000 Patients Admitted for Contraceptive Advice and Treatment," *American Journal of Obstetrics and Gynecology* 31 (March 1936): 426–35; and Tone, *Devices and Desires*, 136.

remember only that the American woman's total contraceptive bill is more than $200 million a year to realize how grossly she is being misled." Condoms, more than any other single method had the largest percentage of the market, evidence of just how much the ancient device had proliferated.[34]

Quietly, beginning in the 1930s, the navy and army had reversed their WWI policies on condoms and had begun to test the devices for quality, even before the institution of FDA regulations. Even with the discovery of penicillin as a cure for syphilis and gonorrhea in 1943, the demand for prophylactics further increased during WWII, making condom business big business. Military authorities made high-quality condoms available to soldiers (at times distributing them for free), and educated soldiers in their proper use. The armed services officially and publicly endorsed condoms during the war. Even wartime rubber shortages did not hamper the condom industry; rather, American condom manufacturers saw record-breaking production and sales. The army alone supplied soldiers with fifty million condoms per month. By World War II, the condom industry had solidified into the hands of a few major manufacturers. This golden era of the condom, however, would not last forever.[35]

Between 1960 and the mid-1980s, condom use plummeted. In the 1960s the Pill and IUDs emerged, and were, for many Americans, more effective, easier, and more spontaneous contraceptives. Condoms had fallen so far off the public radar that in 1973,

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[34] "An Accident of Birth," *Fortune* vol. 8 (February 1938): 83–84, 112.

[35] On the military response to venereal diseases and condom use just before and during WWII, see Thomas Parran, *Shadow on the Land: Syphilis* (New York: Reynal and Hitchcock, 1937); Francis Sill Wickwar, "The Army Fights Venereal Disease," *Life* (13 October 1941): 128–30; Sidney Forman, *War and Sex in World War II from "D" Day to Victory* (Philadelphia: Xlibirs, 2000); and Brandt, *No Magic Bullet*, 122–82.

major condom manufacturers and distributers met at a conference to determine how they could reinvigorate the industry. Besides the introduction of new contraceptive technologies like the Pill and IUDs, rubbers fell victim to restrictive state laws that limited sale outlets and displays, bans on contraceptive advertising on radio and television, and few research dollars spent to improve the product.[36]

The rebirth of the industry came only with the unfortunate emergence of HIV/AIDS in the 1980s. Sales and use of rubbers increased dramatically between the mid-1980s and the 1990s, principally as a result a large-scale AIDS education publicity that touted condoms as the only proven method (besides abstinence) to prevent the spread of the new menace. Drug store sales of condoms in the United States rose by 25 million between 1985 and 1988 alone. By 2005, condom sales in the United States generated $398.3 million per year.[37]

Without its dual role as both contraceptive and prophylactic, the condom might have languished forever in the face of new contraceptive technologies such as diaphragms, IUDs, and the Pill. At least in regard to its twentieth-century history, the condom's ability to prevent disease has more dramatically shaped its development than has its ability to prevent pregnancy. The condom's prophylactic identity originally served to legalize the device, which allowed for technological advances; necessitated

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[36] Myron H. Redford, Gordon W. Duncan, and Denis J. Prager, eds., *The Condom: Increasing Utilization in the United States* (San Francisco, Calif.: San Francisco Press, Inc. for the Battelle Population Study Center, 1974).

[37] John S. Moran, et. al, "Increase in Condom Sales following AIDS Education and Publicity, United States," *American Journal of Public Health* vol. 80, no. 5 (May, 1990): 607–08; and Stephanie Rosenbloom, "Here's Your Syllabus, and Your Condom," *The New York Times*, September 24, 2006, <http://www.aegis.com/news/nyt/2006/NYT060920.html> (accessed October, 2009).

FDA regulation (well before any other form of birth control); and, after it lay nearly forgotten among the high-tech contraceptive options of the second half of the twentieth century, the condom's prophylactic usefulness resulted in its renaissance.

Whether individuals intended condoms to be prophylactics or contraceptives (or both) mattered little to early manufacturers of rubber condoms. These pioneers first appeared in the United States in the 1850s, making hand-cut and hand-sewn rubber caps, which required little skill or material to fashion, and which quickly evolved into full-length sheaths—the first iteration of the rubber condom.[38] One late-nineteenth-century account of the rubber condom trade admitted that "the process of making up [condoms] is simple." This keen observer, T. J. B. Buckingham, who boldly wrote about the illegal business in *India Rubber World*, noted the ease with which the "questionable goods" were manufactured. Rubber gum sheet was spread out smooth, cut into patterns using cutting dies, stitched up the sides on a form or mold, and dipped in a vulcanizing solution. An even easier method was to cut the rubber gum as a double pattern, knit together the edges, then inflate and dip the condom in vulcanizing solution. The author of this rare description of the rubber condom trade even notes the emergence of a new technology on the horizon, one which resembles what would become the standard production method for condoms until the 1920s: the cold-cure cement method.[39]

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[38] Janet Farrell Brodie, *Contraception and Abortion in Nineteenth-Century America* (Ithaca, N.Y.: Cornell University Press, 1994), 204–11; and Tone, *Devices and Desires*, 53.

[39] Buckingham, "The Trade in Questionable Rubber Goods," 164–65. See also discussions of this method of production in Murphy, *The Condom Industry*, 7; Tone, *Devices and Desires*, 54; and Brodie, *Contraception and Abortion in Nineteenth-Century America*, 209–10.

The cold-cure cement process, also called the seamless cement process, became one of two methods used to make rubber condoms in the United States during the twentieth century. The cold-cure vulcanization process was first discovered in 1846 by British chemist Alexander Parks. It was perfected in 1878 when the process to cure rubber using sulfur chloride vapor rather than solution was discovered. By the 1880s, dipped goods of all manner were mass produced—gloves, balloons, caps, catheters, to name but a few items. The cold-cure technique had been used to produce condoms in Germany as early as 1880, and at the center of the method's evolution in the United States was a Jewish German immigrant, Julius Schmid.[40]

In 1881, the paralytic Schmid hobbled, with a cane on either side, into New York only to find himself without money or employment. Destitute, Schmid slept on park benches and even sold the shirt off his own back for a single dime. Julius's luck turned when he got his first job at a sausage casing company. He carefully saved his monthly earnings ($7.00 per month), worked two jobs, and in 1883 opened his own small business. Outwardly, Schmid's business produced capping skins, which were seals to prevent evaporation of chemicals from perfume bottles; illicitly Schmid produced contraceptive skins out of surplus casings. From surplus casings, Schmid upgraded to higher quality lamb caecum. The tube of intestine was "washed, defatted, and fitted with a spring mechanism to hold the condom on the penis, then carefully packaged—all by hand labor, making them expensive" to produce and to purchase.[41] With his base of operation in New York's Tenderloin district, Schmid could not have picked a more

[40] Loadman, *Tears of the Tree*, 189, 214, 289, 295.

[41] Murphy, *The Condom Industry*, 10.

appropriate part of town in which to open his business; the Tenderloin district was known for its bordellos and was frequently raided by Comstock's society for the suppression of vice. Schmid did not escape the attention of the vice squad, and was arrested in 1890 by Comstock himself. While Schmid started his business by manufacturing skins, it was his pioneering of rubber condoms that built his empire. By 1937, Schmid was pulling in $900,000 per year.[42]

It is possible that Schmid first experimented with rubber using the hand cut methods described by Buckingham. However, by 1915 he had perfected the cold-cure cement method and cornered a large share of the U.S. condom market. Schmid's seamless cement process, which was adopted by his major competitors, entailed several major steps. First, the raw product, crepe rubber, was acquired. There are several types of crepe, or crude, rubber. These included pale, smoked, amber, and roll brown crepe, each containing varying amounts of insoluble resin, moisture, dirt, and oxidation and solubility levels. Condoms could be made from any of these types of rubber, though each would produce a different quality and color product. Crepe rubber was inexpensive and

[42] "An Accident of Birth," 108; "Report of Persons Arrested under the auspices of the New York Society for the Suppression of Vice for the Year 1889," microfilm, Library of Congress; and Murphy, *The Condom Industry*, 10. The original spelling of Julius' last name was Schmidt, he dropped the *t* in order to mask his Jewish ethnicity. He married an American woman in 1892 who had two sons; Julius and Elizabeth had two more sons together. Tone, *Devices and Desires*, 50–51; and Collier, *The Humble Little Condom*, 155. On New York's sex industry, see, Timothy Gilfoyle, *City of Eros: New York City, Prostitution, and the Commercialization of Sex, 1790–1920* (New York: W.W. Norton, 1992); George Chauncey, Gay New York: Gender, Urban Culture, and the Makings of the Gay Male World, 1890–1940 (New York : Basic Books, 1994).

easily procured; Buckingham speculated that small manufactures likely acquired it "from some large firm ostensibly for 'dress-shield' work." [43]

The next step was to compound the raw rubber. The crepe was milled or masticated into a powder, after which compounding ingredients, such as zinc oxide were added to aid the process of vulcanization. The compounded rubber powder was then dissolved in a solvent, typically acetone, benzene, naphtha, or gasoline.

Workers hand dipped glass cylindrical forms into the liquefied rubber solution. Care had to be taken to pull out the forms very slowly, so that, as one condom manufacturer described, "there was very little rubber left on the forms," and as the dripping rubber "neared the closed end, to the point where when it just dripped a little, we would pull it out and reverse them [the forms], and what surplus there was on the end would gradually run back down the form."[44] This process was repeated until the desired thickness of rubber was achieved.

Next, the forms, coated with the still wet rubber solution were subjected to heat to complete vulcanization. The process of vulcanization, at its most basic takes the stickiness out of natural rubber and stabilizes its form against temperature variations—unvulcanized rubber melts under heat and becomes brittle when cold. The heat applied

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[43] Buckingham, "The Trade in Questionable Rubber Goods," 164. For a detailed description of crepe types from the early twentieth century (during the height of the cold-cure cement method), see John B. Tuttle, *The Analysis of Rubber*, American Chemical Society Monograph Series (New York: printed for The Chemical Catalog Co., Inc., by J.J. Little and Ives Co., 1922), 20–21.

[44] Testimony of Merle L. Youngs, April 4 1949, p. 69, *Frank B. Killian and Company vs. Allied Latex Corporation*, Civil case #43–404, Records of the United States District Court for the Southern District of New York, National Archives, Northeast Regional Office, New York.

for vulcanization also aided in drying the rubber, which was completed in the drying room where the solvents were allowed to evaporate from the rubber leaving the dried rubber condom on the glass form. Finally, the condoms were removed from the forms by hand, hand rolled, and packaged.[45]

By the time Schmid and other condom producers had perfected the cold-cure method, erected condom plants, and had begun to distribute beyond local networks, the journey that raw rubber took from harvest to the manufacturing plant had changed considerably.[46] No longer was the harvester of wild Amazonian rubber who we followed at the beginning of the chapter typical, but more often rubber was harvested by tappers on plantations and by slaves in the Belgian Congo.[47] In the early twentieth century, small amounts of domesticated rubber grown on plantations entered the market. These plantations were primarily located in Ceylon (Sri Lanka), Malaysia, and across Southern

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[45] The cold-cure cement process is described in the following sources: Transcript of Record, pp. 12, 68–72, and 90–93, *Frank B. Killian and Company vs. Allied Latex Corporation*, Civil case #43–404, Records of the United States District Court for the Southern District of New York, National Archives, Northeast Regional Office, New York; Philip Schidrowitz and T. R. Dawson, eds., *History of the Rubber Industry* (Cambridge: Published for The Institution of the Rubber Industry by W. Heffer and Sons, 1952), 304–05; Vern L. Bullough, "A Brief Note on Rubber Technology and Contraception: The Diaphragm and the Condom," *Technology and Culture* vol. 22, no. 1 (January, 1981): 108–09; and Tone, *Devices and Desires*, 185–86. For a detailed explanation of the chemical process of vulcanization that results in the creation of polymer chains, see Loadman, *Tears of the Tree*, 210–11.

[46] Besides Julius Schmid, Youngs Rubber Co., Killian Manufacturing Company, Dean Rubber Manufacturing Co., and other smaller manufacturers of rubber condoms, used the cold-cure cement process until the late 1920s or early 1930s. See discussions of Youngs and Killian in the following pages.

[47] On the history of the struggle to cultivate rubber trees, and on the labor forces used to harvest the rubber, see Loadman, *Tears of the Tree*; Stanfield, *Red Rubber, Bleeding Tree*; Schidrowitz, ed., *History of the Rubber Industry*; and Austin Coates, *The Commerce in Rubber: The First 250 Years* (Oxford: Oxford University Press, 1987).

Asia. An ever-increasing demand for rubber in new technologies, like automobiles, quickly tipped the balance between wild and plantation rubber consumption. In 1905, the world still exported most of its rubber from wild Amazonian sources. That year, 26,000 tons (47 percent of total exports) of natural rubber were exported from Brazil compared to only 2,500 tons (4 percent) of rubber from Malaysia and Ceylon. In less than ten short years, plantation rubber exports outstripped that of wild rubber harvested.[48]

The shift in where the majority of the world's rubber was grown changed products and marketing strategies, and even slid into condom advertisements. Many condom manufacturers, especially the larger ones, created several product lines. Schmid, for example, produced at least four lines of condoms of various thickness and quality. The top-of-the-line, most expensive, and most famous of Schmid's labels was his Ramses line (Figure 1). Ramses advertisements typically employed elaborate descriptions of its superiority. The insert in the singly packaged Ramses described the condom thus: "In a rubber prophylactic exceptional thinness, transparency, and glossy finish are desirable qualities. RAMSES meet these specifications. Those desiring the ultimate in prophylactic rubber goods unhesitatingly choose RAMSES!"[49]

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[48] Loadman, *Tears of the Tree*, 302, 305; and Dean, *Brazil and the Struggle for Rubber*, 4 and "Exports of Natural Rubbers, Brazil, 1827–1934," 169. The rise of the automobile industry drove rubber demand and technology forward at incredible speeds. In 1908 when the Model T first came onto the market, the worldwide production of rubber was approximately 66,500 tons; this figure rose to 2 million tons in the years just before WWII. Stanfield, *Red Rubber, Bleeding Trees*, 164.

[49] Circular enclosed in paper Ramses condom package, folder 6, box 1, subject series "Sex," Warshaw Collection of Business Americana 1724–1977, National Museum of American History Archives Center [hereafter NMAH], Washington, DC.

Figure 1. Ramses condom package, folder 6, box 1, subject series "Sex," Warshaw Collection of Business Americana 1724–1977, National Museum of American History Archives Center, Washington, D.C.

Such touting of product materials is to be expected, but by the late 1920s, advertisements for both big name manufacturers like Schmid and much smaller operations began to include the type of rubber used to make each product line—more specifically, these advertisements and circulars mentioned the *origin* of their rubber. For example, in its letters to doctors and circulars to druggists, Blair & Curtis, Inc., a New York physician's medical supply distributor, described and priced condoms by the type of rubber used. Ramses condoms were, according to a letter to doctors, made of the finest, transparent *Ceylon* rubber "strong, elastic, durable, easy to fit, convenient." Blair & Curtis's

druggists' circular added to its description of the Ramses transparent that it was "unsurpassed in finish" due to its "fine Ceylon rubber."[50]

Both types of promotional literature listed the lower priced condoms and diaphragms as the Para lines, made of amber colored wild Amazonian rubber (Para rubber). These lower quality and less expensive products were described more modestly as "made of the finest Brazilian rubber," and were "noted for durability." At the lowest price points, Blair & Curtis offered condoms with no indication of the origin of rubber and without flourish, other than to simply note these condoms were "widely used." Similarly, order forms sent to druggists and doctors frequently listed condoms and prices according to the material out of which they were made rather than by brand. The least expensive were the Brazilian Para rubber condoms, the "highest quality" rubber condoms were made of Ceylon rubber, and the most expensive condom offered were the fish skin protectors whose high cost was related directly to the hand labor required to produce them.[51]

The Blair & Curtis literature is typical of such sales and promotional material, and reflects the changes in the rubber market. The grade of rubber was a crucial element in the overall quality of the finished condom, but manufacturers could obtain high- or low-grade rubber from *either* wild rubber Amazonian sources or plantations in Southern Asia.

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[50] Blair & Curtis, Inc. Physicians Specialists to Doctor, June 1930, folder 5, box 85, Birth Control Collection, American Medical Association Health Fraud Archives [hereafter AMAHFA], Chicago, Illinois; and Blair & Curtis, Inc. Circular to Druggists, March 1930, folder 5, box 85, Birth Control Collection, AMAHFA.

[51] Ibid. The Brazilian rubber condoms priced at $2.00 per dozen, the high quality Ceylon rubbers at $3.00 per dozen, and the fish skins at $5.00 per dozen, see Condom order form, no date, folder 5, box 85, Birth Control Collection, AMAHFA.

In fact rubber from both sources originated from the *Hevea brasiliensis*, which was native to Brazil but had been imported and cultivated in Ceylon starting in the 1870s. However, improved tapping methods, the development of coagulation to replace the labor intensive smoking process, and other technological advances developed on the plantations, making it possible to produce plantation rubber at only a fraction of the cost of collecting wild rubber in Brazil. On the heels of a rubber shortage scare and a series of price hikes from Brazil in the early 1900s, plantation rubber flooded the market, and rather quickly, Brazilian rubber was out priced. That condom advertisements acknowledged Ceylon as their rubber source and marketed it as superior, was forced by changes in supply and demand, one which distributors and manufacturers cleverly marketed.[52]

Regardless of the source of condom manufacturer's raw materials, the production process remained the same, and the cold-cure method was dangerous work. By 1915, when Schmid and others had perfected the cold-cure cement process to make rubber condoms, the effects of industrial work on the body and the urban environment were part of public discourse. For example, the appropriation by Congress in 1907 of $150,000 for the study of the conditions of women and children engaged in industry led to a nineteen-volume report, the findings of which revealed the extent of horrible workplace conditions.[53]

In the condom industry, women did the menial work for menial wages. This is not at all surprising; the condom industry's coming of age coincided with the peak of

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[52] Dean, *Brazil and the Struggle for Rubber,* 28–31; Coates, *The Commerce in Rubber*, 135–46.

[53] Senate, *Report on Condition of Woman and Child Wage-Earners in the U.S.*, 61st Cong., 2nd sess., 1910, S. Doc. 645, serial 5685-5703.

women's work in manual and manufacturing jobs. Cheaper, and thought to be more dexterous, women were the preferred laborers for dipping, rolling, and packaging rubbers. Rubber manufacturer's sought the unique benefit that women's bodies provided to these tasks: their smaller hands. For their tedious work, the average wage of female condom workers in the 1920s was thirty to thirty-five cents an hour.[54]

Like women working in many other industries during the late nineteenth and early twentieth centuries, the nature of the physical labor and poor factory conditions put women's bodies in physical danger. Women condom workers suffered injuries from repetitive motions, and spent long hours in poorly ventilated spaces inhaling fumes from solvents. They also faced the danger of social stigma. Middle-class reformers were concerned with the health and safety of young, single, working women; social reformers feared that working-class women were also at increased risk of loosened morals. Working women lived without parental supervision, in large cities, had income of their own (as meager as it may have been), and had access to such places of "moral corruption" as dance halls—all of which, reformers felt, put working women at risk of becoming "fallen" women. To this tenuous social position was added the condom's association with prostitution and illicit sexual activities, and the legal grey area of condom manufacture. The female condom worker, at least in the eyes of the middle and upper classes, held a reputation only slightly more respectable than the prostitute herself.[55]

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[54] Testimony of Youngs, p. 77, *Frank B. Killian and Company vs. Allied Latex Corporation.*

[55] Ibid.; Carroll D. Wright, *Fourth Annual Report of the Commissioner of Labor 1888, Working Women in Large Cities*, 50th Cong., 2nd sess. H. Ex. Doc. 1/40, serial

Condoms could ignite moral controversy, but their manufacture, literally, could be incendiary. The cold-cure method's use of flammable gases as solvents presented the constant danger of fire, a danger that was by no means unique to Schmid's production plant. Before the late 1920s, all the major condom manufacturers used the cold-cure method. The largest of these manufacturers were Schmid and his competitor Youngs Rubber Company.

As had Schmid, Merle L. Youngs got his start in the condom trade in a small-time operation. He started as a jobber in 1905, selling condoms to New York City druggists for his uncle, Robert J. Pierce. By 1916, Youngs had entered into business for himself, jointly forming a company with two other New York businessmen. Faye, Youngs, Inc. sold its first rubber condoms, purchased from an unknown manufacturer, in January 1917. The company bought its own plant in 1918 in Barberton, Ohio (about ten miles southwest of Akron), and in 1920 changed its name to Youngs Rubber Company.[56]

2641; *Report on Condition of Woman and Child Wage-Earners in the U.S*; and Claudio Goldin, "The Work and Wages of Single Women, 1870–1920," *The Journal of Economic History* vol. 40, no. 1 (March 1980): 81–88. On working-class women's sexuality see, for example, Ruth M. Alexander, *"The Girl Problem": Female Sexual Delinquency in New York 1900–1930* (Ithaca, N.Y.: Cornell University Press, 1995); Randy McBee, *Dance Hall Days: Intimacy and Leisure among Working-Class Immigrants in the Untied States* (New York: New York University Press, 2000); Mary Odem, *Delinquent Daughters: Protecting and Policing Adolescent Female Sexuality in the Unit3ed States, 1885–1920* (Chapel Hill: University of North Carolina Press, 1995); Kathy Peiss, *Cheap Amusements: Working Class Women and Leisure in Turn-of-the-Century New York* (Philadelphia: Temple University Press, 1986); and Sharon R. Ullman, *Sex Seen: The Emergence of Modern Sexuality in America* (Berkeley: University of California Press, 1997).

[56] Condensed Statement of Testimony Merle L. Youngs, pp. 53–54, *Youngs Rubber Corporation, Inc. vs. C. I. Lee and Company, Inc. and Clarence I. Lee*, Equity #45–142, Records of the United States Circuit Court of Appeals 2nd circuit, National Archives, Northeast Regional Office, New York; and Testimony of Youngs, p. 68, *Frank B. Killian and Company vs. Allied Latex Corporation*.

Youngs Rubber cornered its share of the condom market through its high end line: Trojans. Numerous historians have documented Youngs' brilliant marketing strategy, which was to sell only to druggists, and to emphasize quality and respectability. Although in the early 1930s Youngs Rubber began to manufacture latex condoms, up until then, Youngs condoms were cold-cure condoms.[57]

Using the cold-cure cement method required a factory space divided into several distinct areas including a mixing room, dipping room, and a drying and evaporating room. Merle Youngs described the process at his factory: "After the goods were dipped, we put these racks with the forms on it in a drying room and subjected them to heat and there evaporated the benzene and gasoline."[58] As discussed above, the cold-cure method required one of several solvents to liquefy the rubber, all of which were highly flammable. As the condoms dried, the solvents evaporated into invisible clouds of potential disaster.

The drying room kept the gases relatively well contained, but also concentrated them. If the vapors exploded into flames, it was both difficult and expensive to insure that the blaze would not engulf the entire building. At the Youngs Rubber plant, the drying room was separated from the other parts of the factory by special fire walls and doors.

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[57] Condensed Statement of Testimony Youngs, pp. 53–54, *Youngs Rubber Corporation, Inc. vs. C. I. Lee and Company, Inc. and Clarence I. Lee*; and Testimony of Youngs, p. 68, *Frank B. Killian and Company vs. Allied Latex Corporation.* The most detailed histories of Youngs' Trojan marketing campaigns, are Andrea Tone, "From Naughty Goods to Nicole Miller: Medicine and the Marketing of American Contraceptives," *Culture, Medicine and Psychiatry* vol. 30 (2006): 249–67; and Tone, *Devices and Desires,* "Condom Kings," 183–200.

[58] Testimony of Youngs, pp. 69–70, *Frank B. Killian and Company vs. Allied Latex Corporation.*

Despite these precautions, fire was a constant threat. “You had to be very careful of fire,” warned Youngs, “friction of any kind, or a spark from a motor or a fan or anything like that [would ignite the solvent vapors].” The hazard was not limited solely to the drying room. Escaped gases were to blame for several fires that broke out in Youngs’ mixing room, and in 1929, an inferno decimated the dipping room.[59]

In fact, fire broke out in nearly every major factory that employed the cold-cure cement process, leaving “an almost unbroken record ” of catastrophes. For example, during the 1920s the L. E. Shunk Latex Products plant fell victim to numerous blazes that necessitated major reconstruction. At the Killian Manufacturing Company building, the ultimate tragedy occurred in 1929 when two workers, one of whom was Killian’s cousin, were burned to death in a fire that left nearly the entire factory in ashes. The cost of fire insurance was, according to Youngs, “terrific and you never knew when your plant was liable to go up in smoke.” The cost of preventing and rebuilding after these fires was enormous, and was a driving force behind condom manufacturers’ search for new, less hazardous production methods.[60]

The first steps toward streamlining and making condom production safer came in the form of increased mechanization, which changed the labor requirements and the physical space of the factory. The first of several machines built specifically for condom manufacture was Fred Killian’s bead rolling machine. The Killian Manufacturing Company was comprised of Fred L. Killian, inventor extraordinaire, and later Frank B.

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[59] Testimony of Youngs, pp. 69–70, and 75, *Frank B. Killian and Company vs. Allied Latex Corporation.*

[60] Transcript of Record, pp. 11, 61–62, and 75, *Frank B. Killian and Company vs. Allied Latex Corporation.*

Killian and Adam Joseph Killian. Fred found his entrée into the condom business through his wife, Elizabeth Terrell. Elizabeth was employed in a condom plant that her brother managed, and where she hand rolled rings onto the ends of condoms. Killian realized that this cumbersome process could be mechanized, and put his inventiveness to work.[61]

Prior to the invention of Killian's bead machine, women workers rolled the rubber ring, or bead, on the open end of the condom by hand. Rolling beads by hand was slow, and employing enough women workers to keep up with production demands was a significant expense. The weather could slow production too, as rain and humidity wrecked havoc on steady manufacture. Youngs lamented that "it was difficult to dry the goods [on rainy days] and the girls were not able to roll nice rings on wet, damp days as they were on dry days."[62] Moisture in the air and on workers' hands caused the rubbers to get sticky, even after powdered with talc.

Imagine a frustrated Mrs. Killian coming home from work on a wet day, lamenting to her husband that she could not roll her quota's worth of rings for the day even though her fingers and wrists ached from the repeated motion of rolling and her feet were sore from standing ten hours a day, six days a week. Killian surely knew a market existed for a mechanized process that reduced expense, labor, and perhaps even his wife's discomfort; his solution was the bead rolling machine. It worked by securing on pins the glass forms that had been dipped into the rubber solution. After the condoms were dried, and vulcanized, and while still hugging tightly to the form, the glass molds on

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[61] For biographical details on Killian and his wife, see Tone, *Devices and Desires*, 194.

[62] Testimony of Youngs, p. 72, *Frank B. Killian and Company vs. Allied Latex Corporation*.

their pins were propelled forward by a belt that guided them through a narrowed track. On one side of the track the forms were locked in place, preventing them from lifting off the pin, while on the other side, a brush rolled the open end of the condom upward. At the same time that the brush rolled the thin rubber up into a bead, a second belt opposite the brush rotated the form on the pin. The dual rotation of the brush upward and the form clockwise on the pin created a perfectly consistent ring at the open end of the condom. After moving past the brush, the forms proceeded on the main belt to a platform where they could simply be lifted off their pins, and the condom rolled off its mold and packaged (Figure 2).[63]

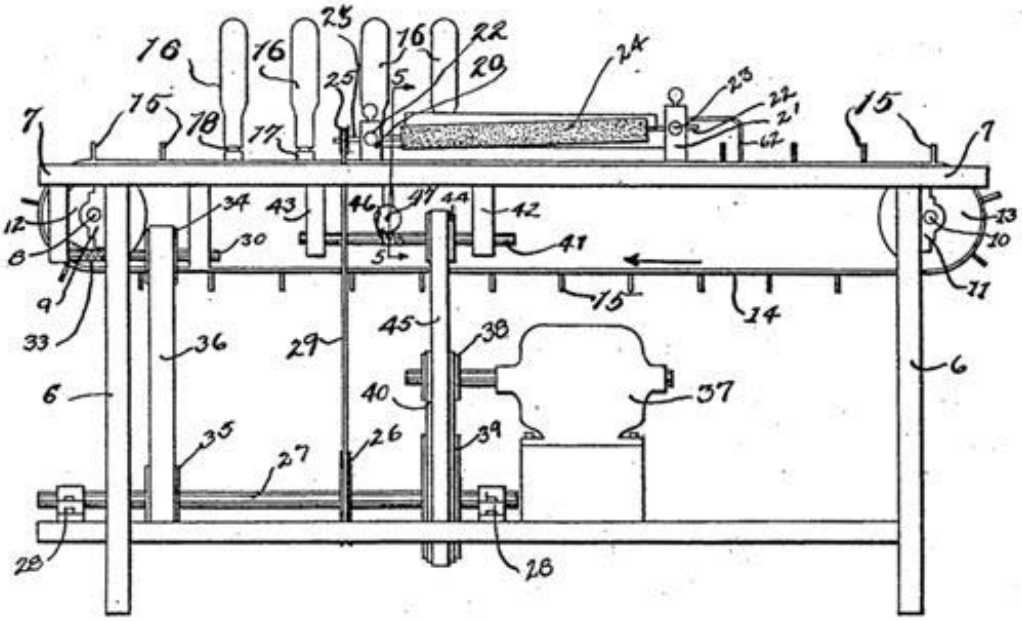

Figure 2. Fred L. Killian, Machine for manufacturing thin rubber articles, U.S. Patent 1,605,445, filed August 19, 1925 and issued November 2, 1926.

[63] Fred L. Killian, Machine for manufacturing thin rubber articles, U.S. Patent 1,605,445, filed August 19, 1925 and issued November 2, 1926.

The bead rolling machine proved so efficient that even before Killian had filed for a patent in 1925, many of the large condom manufacturers had leased licenses from him. Youngs heard of Killian's machine and was so impressed by its consistent formation of beads, even on wet days, that he started using them in his Akron plant in 1924. Killian's bead machine, and his continuous dipping machine discussed in the following pages, laid the foundation for his own empire. The Killian Manufacturing Company held the patents and licensing or royalty rights to the machinery that eventually was used by all the major condom manufacturers, Youngs and Schmid included. By 1938, Killian joined Louis Earl Shunk (who produced low end, single dip latex condoms that were much less expensive than Youngs Trojans or Schmid's Ramses) to create a joint distribution agency: Killashun.[64]

Killian's success was well earned, the advantages of the bead rolling machine were clear. Youngs described its benefits:

> Well, the machine made a very uniform, nice ring. It was a great help in selling goods. Not only that but it eliminated, I don't know how many girls, but I know a girl if she was a good operator probably could roll 20 or 25 or 30 gross of rings a day. But they would not be perfect but they would be knotty and they would be twisted rings, and of course while we [condom manufacturers] are all in the same boat they could be sold, but once this new machinery came on the market it was difficult to sell a twisted, knotty ring.[65]

Youngs paid his "girls" an hourly wage of thirty-five cents, the machine could produce a savings of $14.00 per worker per week. The real profits from the machine came in dramatically increased production numbers, due in large part to eliminating the most time

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[64] Tone, *Devices and Desire*s, 194–95; and "An Accident of Birth," 108–10.

[65] Testimony of Youngs, pp. 76–77, *Frank B. Killian and Company vs. Allied Latex Corporation.*

consuming step in condom manufacture. In return, production cost decreased and yearly sales rose by over 2 million condoms from 1921 to 1925.[66]

Shortly after the incorporation of Killian's bead rolling machine into condom production, came an advance in rubber technology that revolutionized the condom industry: latex. Latex answered condom manufacturers' search for a process that mitigated the threat of disastrous fire. Because it was already in liquid form, the use of latex in condom manufacturing eliminated the cumbersome steps of masticating and adding flammable solvents to crepe rubber. Since all rubber was initially harvested as latex, one might wonder why it was not widely used to produce condoms previous to the late 1920s and early 1930s. Latex, in its natural form, has the consistency of milk. This rather watery liquid contains much more than just tiny rubber particles—water, carbohydrates, proteins, fats, minerals, and even micro-organisms make up natural latex. Non-rubber substances, particularly the proteins and micro-organisms, cause the latex to spoil or curdle if left untreated. Bacterial action can curdle unpreserved latex in as little as several hours. In addition, transporting natural latex, which contains so little actual rubber (only 30–40 percent), was expensive and impractical.

A number of technological landmarks combined to make the transport and commercial use of latex viable for condoms and other dipped goods. The most important of these advances was the development of a new vulcanization process. Discovered by Philip Schidrowitz in 1920, the process of prevulcanization, as it came to be called, first stabilized latex by adding ammonia (this stopped the curdling effect while the latex was harvested and transferred to the processing center by protecting the proteins from

[66] Ibid., pp. 77–78.

bacterial attack).[67] The stabilized latex was then centrifuged to concentrate the rubber content by separating and then removing much of the non-rubber content. Vulcanizing agents of sulfur and zinc oxide were added to the concentrated latex. The treated latex compound was then left to sit for up to hours or days depending on the quality of latex (the process could be hastened by adding low heat or pressure, however, care was taken not to heat the latex to the point of losing moisture and compromising the liquid state). Prevulcanized latex appeared much the same as raw latex, but could easily be transported and immediately used to manufacture goods. At the manufacturing plant, a form was dipped into the treated latex, dried, and heated to a low temperature (known as postvulcanization). The finished latex good possessed all the desirable qualities of traditionally vulcanized rubber—elasticity, strength, and resistance to heat and cold.[68]

In fact, prevulcanization offered a number of benefits over traditional vulcanization. It created a finished rubber product with increased tensile strength and

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[67] Ammonia was discovered to stabilize latex by W. H. Johnson in 1853. However, since little to no demand for liquid latex existed until prevulcanization was perfected, the potential of Johnson's discovery was not realized until the 1920s. Royce J. Noble, *Latex in Industry*, 2nd ed. (New York: Published for Rubber Age by Palmerton Publishing Co., Inc., 1953), 40; Loadman, *Tears of the Tree*, 204, 291; and John Loadman, *Bouncing Balls: Everything You ever Wanted to Know about Rubber*, "Latex Processing," <http://www.bouncing-balls.com/chemistry_tech_conservation/latexprocess.htm> (accessed August, 2009).

[68] My explanation of latex compounding and vulcanization processes has been simplified and compressed. For expanded descriptions of latex composition, harvest, preservation, and processing, see Schidrowitz, and Dawson, eds., *History of the Rubber Industry*, 304–06; Loadman, *Bouncing Balls: Everything You ever Wanted to Know about Rubber*, "Latex Processing," < http://www.bouncing-balls.com/chemistry_tech_conservation/latexprocess.htm> (accessed August, 2009); Loadman, *Tears of the Tree*, 204, 214–216; Noble, *Latex in Industry*, 2nd ed., 37–41; Robert F. Mausser, "Latex and Foam Rubber," in *Rubber Technology*, ed. by Maurice Morton, 3rd ed. (New York, Van Nostrand Reinhold, 1987), 518–60; T. H. Rogers and K. C. Hecker, "Latex and Foam Rubber," in *Rubber Technology*, ed. by Maurice Morton, 2nd ed. (New York, Van Nostrand Reinhold, 1973), 459–95.

elasticity over traditionally vulcanized rubber. In addition, the low temperatures required for prevulcanization increased the range of additives that could be mixed in during the compounding of the latex. Common additives included colors and tints, and an ever-increasing array of anti-oxidants that lengthened shelf life of the final product. As rubber plantations incorporated the prevulcanization of latex into their operations, they further refined the process. In 1921, more stable and organic accelerators were discovered, and in 1923, improvements were made to the stabilization and centrifuging processes. Prevulcanized latex offered to the condom industry the advantages of a stronger material that was easier, cheaper, and safer to work with. Latex also facilitated a mechanized production process that revolutionized the condom business and solidified the place of industry giants. [69]

Although latex was commercially available as early as 1920, it took some time for condom producers to recognize its potential. In fact, when Youngs first viewed a demonstration of latex in 1928 at the American Anode Company, he left unimpressed.[70] The tremendous advantages latex presented were not immediately clear; it took a mechanical advance in the form of another of Fred Killian's inventions for Youngs and other condom manufacturers to make the switch to latex.

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[69] On organic accelerators, see Robert F. Mausser, "Latex and Foam Rubber," 519. New centrifuge machinery perfected the process so well that 60 percent rubber content could be achieved with only the stabilizing additive of ammonia (increased from the 30–40 percent rubber content of natural latex), see T. H. Rogers and K. C. Hecker, "Latex and Foam Rubber," 459; and Philip Schidrowitz and T. R. Dawson, eds., *History of the Rubber Industry*, 305.

[70] Testimony of Youngs, p. 74, *Frank B. Killian and Company vs. Allied Latex Corporation*.

Killian's invention, the continuous dipping machine, incorporated the bead rolling machine, and so much more. The continuous dipping machine automated condom production almost completely. The apparatus incorporated each of the manufacturing steps into five hundred feet of mechanized efficiency. The device was immensely complicated, containing multiple systems (Figure 3).

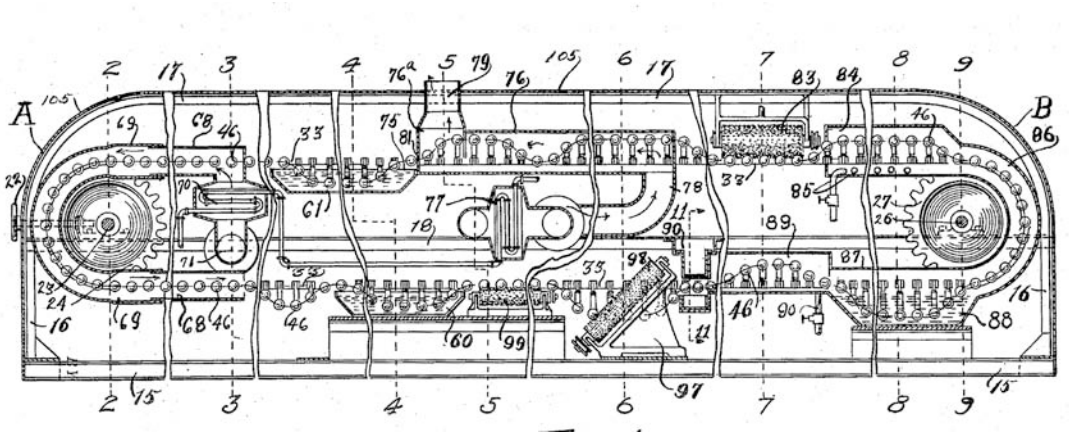

Figure 3. Fred L. Killian, Method and apparatus for manufacturing thin rubber articles, U.S. Patent 2,128,827, filed June 24, 1930 and issued August 30, 1938.

Simply described, forms moved along a conveyor belt and were dipped into latex; rotated to evenly distribute the rubber; dried; and dipped, rotated, and dried once more. The machine then rolled a bead on the open end, postvulcanization was achieved as the latex on forms moved through an overhead hot air duct and into a hot water bath, and the machine then dried them once again. A worker dusted the rubbers with talc just before Killian's machine rolled the condoms off the forms, and then advanced the glass forms through a cleaning stage before the whole process began again. The only un-mechanized part of the process was when the condoms, transported by conveyor belt to a secondary room, were unrolled and snapped by workers to remove the wrinkles induced when the

machine removed the condoms from the forms. This was a critical step, as wrinkles could cause the condom to permanently stick to itself. Although the continuous dipping machine rolled the bead ring at the open end of the machine, female workers were still employed to roll the condoms for use before they packaged them by hand.[71]

The interior of the plant no longer necessitated separate rooms for compounding, dipping, and drying. Fire walls and doors surrounding dipping rooms and careful measures to prevent fires could be eliminated. Expensive fire insurance was no longer necessary, further reducing manufacturing costs. Toxic fumes from evaporated benzene, naphtha, or gasoline no longer plagued workers health. The continuous dipping machine never got tired, sick, or injured—and oh, how it produced! The machine could run twenty-four hours a day with only minimal supervision. It made one dip per second, producing 1,800 gross (approximately 260,000) condoms per day.

All this convenience came at a price. The cost of the machine was $20,000 and manufacturers were required to pay Killian royalties of ten cents per gross of condoms manufactured on the machine. The machine may have allowed for record production and sales for big manufacturers, but small outfits could not afford Killian's prices and found themselves unable to compete. The consolidation of the industry into the hands of a few, which had begun during World War I, was solidified.[72]

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[71] Fred L. Killian, Method and apparatus for manufacturing thin rubber articles, U.S. Patent 2,128,827, filed June 24, 1930 and issued August 30, 1938; Norman Himes, *Medical History of Contraception* (Baltimore, Md.: Williams and Wilkins, Co., 1936), 203–03; and Christopher Tietze, *The Condom as a Contraceptive* (New York: National Committee on Maternal Health, Publication No. 5, 1960), 7–8.

[72] Himes, *Medical History of Contraception*, 203; and Tone, *Devices and Desires*, 195.

By 1938, five manufacturers had, according to a *Fortune* magazine profile of the industry in the same year, risen to produce "99 percent of the $38,000,000 rubber-prophylactic business, and the bulk of it at an enormous profit."[73] Among those five industry giants were Julius Schmid, Inc.; Youngs Rubber Corporation; Killian Manufacturing Company; L.E. Shunk Latex Products; and the smallest of the five, Dean Rubber Manufacturing Company. The industry giants were geographically centered in and around two cities: New York and Akron, Ohio. Schmid, Young, and others first started their businesses in the late nineteenth and early twentieth centuries in New York, and maintained offices there. However, the widespread use first of rubber and then of latex birthed a new center for condom manufacturing. Known as the rubber capitol of the world, Akron, Ohio, had been home to the rubber industry since the Goodrich Company was started there in 1869. In the early 1900s, several major tire manufacturers also established factories in Akron. For large condom manufacturers, no other city was as convenient a location for their production plants as was Akron. The city readily supplied crepe rubber or latex, solvents, vulcanizing agents, and the infrastructure to export their finished product.[74]

By the mid-1930s, condom production was conveniently geographically centered, safer, and mechanized, all of which positioned the industry to take advantage of social and political developments that would catapult condom profits higher than ever before

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[73] "An Accident of Birth," 110.

[74] Tone, *Devices and Desires*, 48; and Murphy, *The Condom Industry*, 7. On the history of Akron, Ohio, see Steve Love, David Giffels, and Debbie Van Tassel, *Wheels of Fortune: The Story of Rubber in Akron* (Akron, Ohio: University of Akron Press, 1999); and Hugh Allen, *Rubber's Home Town, the Real-life Story of Akron* (New York, Stratford House, 1949).

and usher in a golden era for condom manufacture. The Great Depression of the 1930s brought intensified effort and public attention to the work of birth control advocates. Americans' desire to limit family size in order to ease already tight budgets allowed the birth control movement to quiet significantly moral arguments against birth control. One of the most noteworthy signs of shifting attitudes toward birth control in this decade was the AMA's lift of its birth control ban in 1937. The U.S. Armed Services and the Department of Public Health also accepted and promoted the condom for both prophylactic and contraceptive purposes during the 1930s.

With the moral legitimacy and legality of the condom no longer in question, and with sales of rubbers soaring, interested parties began a closer examination of condom quality. Biochemist Cecil Vogue tested 2,000 condoms between 1934 and 1935 and found that over sixty percent were so flawed as to be useless. Oregon was the first state to address quality control when, in 1935, it limited sales of prophylactics and contraceptives to druggists, drug stores, medical supply companies, and manufacturers. The effect was to reduce the sale of poor quality, suspect goods through street vendors, solicitors, etc. The federal government followed suit. Under the Federal Food and Drug Act, the FDA claimed regulatory power over condoms. The agency conducted spot checks in every major plant in the industry in January 1938; the results were staggering. Air burst tests revealed holes, dirt, weak rubber, and other problems leading to the seizure of over 6,000 gross of condoms and forcing temporary shut-downs of many plants. In fact, the only major plants that passed initial quality testing were Youngs' and Schmid's. Later that same year, Congress passed the 1938 Food, Drug, and Cosmetic Act granting

the FDA further reach over industry regulations by demanding that products remain free "from defects that render them unsuitable for use."[75]

With federally regulated quality controls and standards in place, all the advances for condoms in rubber technology, machinery, and reduced labor requirements mattered little if manufacturers had no way to protect their product and ensure it would still be effective when the customer purchased and used the condom. Packaging became an increasingly important factor in the production of condoms. Latex condoms required special packaging consideration as they can deteriorate over time, and more quickly when exposed to ultraviolet or regular light, oxygen, ozone, humidity, friction, or extreme temperatures. Most manufacturers packaged their condoms in paper envelops, boxes, or metal tins. For example, the high-end Ramses package insert explained that "To better preserve the unique qualities of RAMSES glossy finish and transparency they are packed in unrolled form. By the simple process of placing the rubber on two fingers spread to create tension it may be rolled with ease for convenient use."[76] In keeping with its reputation for high quality products, Youngs' Trojans looked to the most effective packaging method: foil. Trojans adopted a hermetically sealed foil package, guaranteed

[75] "The Oregon Act on Contraception" *Journal of Contraception* (June–July 1937): 142–43; "The Idaho Law on Contraception" *Journal of Contraception* (November 1937): 213–15; Tone, *Devices and Desires*, 196–200; Murphy, *Condom Industry in the United States*, 9; and *Food, Drug, and Cosmetic Act, U.S. Code*, vol. 21, sec. 321 (1938).

[76] Circular enclosed in paper RAMSES package, folder 6, box 1, subject series "Sex," Warshaw Collection of Business Americana 1724–1977, NMAH.

to protect "against damage from ants and other insects, moisture, dirt, and adverse climatic conditions."[77]

Decades after Youngs had adopted the foil package, researchers, spurred by AIDS prevention efforts, focused their attention again on condom packaging. In the 1980s, researchers discovered that any translucent packaging that allowed light to penetrate and reach the condom compromised the latex, possibly causing deterioration in a matter of only hours. Opaque packaging made from foil or heavy papers was found to be the most protective. The United States Agency for International Development (USAID) sponsored studies which also revealed that plastic packaging allowed oxygen to enter, whereas foil did not. Youngs' hermetically sealed foil package was forty years ahead of the research.[78]

In the twenty-first century, latex condom production processes remain much the same as those of the 1940s. Latex still accounts for an overwhelming majority of condoms sold in the United States, manufacturers the world around use machines very similar to Killian's continuous dipping machine, FDA standards have ensured consistency in quality, and although the Ramses brand name in condoms was discontinued in 2005, the Youngs' Trojan brand remains a best seller.[79] From the 1870s

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[77] Trojan circular, ca. 1937, folder 6, box 1, subject series "Sex," Warshaw Collection of Business Americana 1724–1977, NMAH; and Christopher Tietze, *The Condoms as Contraceptive* (New York: National Committee on Maternal Health, Publication no. 5, 1960), 9.

[78] Caroline E. Gilmore, "Chapter 4: Recent Advances in the Research, Development and Manufacture of Latex Rubber Condoms," in *The Latex Condom: Recent Advances, Future Directions*, ed. Erin T. McNeill (Research Triangle Par, N.C.: Family Health International, 1998).

[79] The trademarked *Ramses* and *Trojan* brand names were sold several times between the 1930s and early 2000s. Trojan brand condoms are currently trademarked by Church and Dwight Co. Inc.

through the 1940s, advances in condom production were due both to changing social forces—key court decisions, national efforts to prevent the spread of venereal disease, gradual acceptance of the legitimacy of contraception by the medical community, and the efforts of birth control advocates—and to technological advances—vulcanization, the cold-cure method, latex and prevulcanization, and mechanized production processes.

The ancient device's original purpose and design was to prevent pregnancy. The invention of the condom is wholly predicated on human attempts to control their own bodies, to subvert biology. Nature, in the form of tiny unicellular prokaryote microorganisms (syphilis and gonorrhea), caused humans to reinvent the condom, ascribing to it the new purpose and identity of prophylactic. This identity was itself superseded when antibiotics to treat venereal diseases were discovered; soon after, the condom languished in popularity as a contraceptive as well. But that would not be the last time the condom shape-shifted; in the 1980s humans would turn to the condom again when under attack from one of nature's most mysterious agents: the Human Immunodeficiency Virus. The history of the condom, its shifting importance from contraceptive to prophylactic, is evidence of that never-ending and reciprocal dance between nature and human action, in which the actions of each influence the response of the other.

Chapter 2

BEYOND BARRIERS: FINDING TECHNOLOGY AND NATURE IN CONTRACEPTIVE DIAPHRAGMS AND CERVICAL CAPS, 1920s–1980s

"Sometimes it takes hours, but all my patients make friends with their diaphragms . . . They're mighty happy with their diaphragms and they sure don't get pregnant when I'm their coach," boasted a 1970s nurse practitioner.[80] Although her confidence may not be subtle, there is, nonetheless, a subtly in what her words tell us about the nature of the contraceptive diaphragm. To work properly, a diaphragm must be placed just so—a technique the nurse practitioner knew takes practice. To master this technique, a woman has to know herself, know her body.

Beginning in the 1970s, feminist discourse about the diaphragm transformed the way women perceived the device and its relationship to their bodies. The ways in which birth control advocates and opponents thought, wrote, and talked about the relationships between human bodies and nature often determined which contraceptives were made, how they were made, who had access to them, the manners in which they could be used, and what happened to them when humans were done with them. This chapter illustrates the interwoven, contingent, and reciprocal relationships among the production, use, and discourse of two particular barrier contraceptives: the diaphragm and the cervical cap.

[80] Anonymous nurse practitioner quoted in Barbara Seaman and Gideon Seaman, *Women and the Crisis of Sex Hormones* (New York: Bantam Books, 1977), 216.

From the 1920s until the availability of the Pill in the 1960s, the diaphragm enjoyed the status of the most effective and highly prescribed form of birth control among white middle-class women.[81] Birth control advocates used discourse about the diaphragm that emphasized, even venerated, the role of physicians in birth control, and along with manufacturers, perceived and marketed diaphragms as a sophisticated technology that took advantage of the best medical knowledge and manufacturing practices. I argue here two points. First, that feminist discourse of the 1970s and early 1980s changed the societal impact of the diaphragm, reassigning emphasis and reverence to birth control that limited the role of the physician, was non-invasive, and was "natural"—a status that feminists extended to the cervical cap as well. Second, I argue that the transformative power of the diaphragm and cervical cap was not one of discourse alone. The devices were technologies that often connected women to their own bodies in a new way. The relationship between women and their bodies was significantly altered as the effectiveness of the devices depended entirely on accurate knowledge of one's reproductive system, familiarity with the uniqueness of one's own body, and a willingness to explore exactly where and exactly how the device acted upon one's body. During its early history, the intimate relationship between a woman and her own body that was necessitated by the diaphragm's insertion was one that, for many women, was unwanted and embarrassing. Birth control advocates and diaphragm manufacturers

[81] On preferred methods see, Dorothy Bocker, *Birth Control Methods* (New York: Birth Control Clinical Research, 1924); Alan F. Guttmacher, "Conception Control and the Medical Profession: The Attitude of 3,381 Physicians toward Contraception and the Contraceptives They Prescribe," *Human Fertility* 12 (March 1947), 1–10; Ruth A. Robishaw, "A Study of 4,000 Patients Admitted for Contraceptive Advice and Treatment," *American Journal of Obstetrics and Gynecology* vol. 31 (March 1936): 426–35. See also Andrea Tone, *Devices and Desires: A History of Contraceptives in America* (New York: Hill and Wang, 2001), 136.

recognized women's anxiety about their bodies and attempted to mitigate it through the manufacture of diaphragm inserters. Inserters allowed women to take advantage of the contraceptive effectiveness of the diaphragm without having to touch themselves. The intimate self-knowledge that made women uneasy in the 1920s–1940s was, thirty years later, a selling point for the diaphragm.

Gynecologist W. P. J. Mensinga first invented the modern diaphragm in 1842. The device consisted of a hard rubber ring covered with sheet rubber. Sheet rubber was replaced with vulcanized rubber after 1860. The significance of the discovery of vulcanization in the 1850s for contraceptive technology, as discussed in Chapter 1, is immense. Prior to the discovery of vulcanization, natural rubber contraceptives suffered from the same problems as any other rubber good: heat deformed the shape, cold made the rubber brittle. Vulcanization offered many advantages that were immediately clear to inventors who sought to gain patents on newly designed contraceptives made of vulcanized rubber. Rhodes Lockwood, for example, explained the advantage in his patent application for a diaphragm-like pessary:[82]

> . . . hard rubber is very stiff and liable to be broken, is uncomfortable to the wearer, and cannot be readily fitted to any patient. . . . A pessary covered with gutta-perche [*sic*] or unvulcanized india-rubber quickly collects sediment, and emits an unpleasant odor, from which the soft vulcanized cover is perfectly free . . . it may be bent or folded in any way necessary to apply it.[83]

According to a rare first-hand account of how "questionable rubber goods" were made in the 1890s, diaphragms, caps, and condoms each followed a similar process. Rubber gum

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[82] A pessary, according to historian Andrea Tone is "a substance or device inserted into the vagina that blocks, repels, or otherwise neutralizes sperm." Tone, *Devices and Desires*, 13.

[83] U.S. Patent no 202,037, *Specifications of Patents* (April 2, 1878), 179.

was spread into thin sheets and then cut into the proper shape for the particular device by cutting-dies. The cut rubber was then molded and dipped into a sulfur vulcanizing solution.[84]

Vulcanization not only made rubber contraceptives more durable and elastic, it also made them cheaper, more reliable, and more widely available. Rubber diaphragms, cervical caps, and condoms could easily be purchased from mail-order and drug-supply houses, pharmacies, and rubber venders in every major city in the United States. During the last half of the nineteenth century, a number of diaphragm-like pessaries (mostly known as womb veils) were developed, patented, or simply made by small operations and sold to order. [85]

Diaphragms were marketed in the second quarter of the twentieth century as pieces of sophisticated technology, made from the highest quality materials, through skillful production methods. The major manufacturers—Holland-Rantos Co. selling to the medical community, and Julius Schmid selling his Ramses line through druggists as well as to physicians—emphasized the durability, coil system, and high-quality rubber of their contraceptives in their advertisements. The Ramses Transparent Vaginal Diaphragm was marketed as "thin . . . strong, durable," and made of the "finest native Ceylon rubber." The Ramses amber diaphragm was made from Brazilian rubber, amber in color, and prized for its "maximum durability." All of the informational brochures described the

[84] T. J. B. Buckingham, "The Trade in Questionable Rubber Goods," *The India Rubber World* (March 15, 1892), 164–65.

[85] Charles Goodyear, *Gum-Elastic and Its Varieties: With a Detailed Account of Its Applications and Uses, and of the Discovery of Vulcanization* (New Haven, Conn.: Published by the author, 1853); and Tone, Devices and Desires, 14, 55–56.

coil system used, most commonly "a coiled wire of the finest and strongest metal alloy."[86] (The coil provided both a base for the rubber dome and a flexible spring that allowed the diaphragm to fold for insertion.) Holland-Rantos also emphasized the careful production methods employed in diaphragm manufacturing: "Cervical Caps, like condoms, are turned out in large quantities by machines. But the vaginal diaphragm is strictly a hand-made article that requires an unusual degree of skill to fabricate."[87] In the 1930s, production methods changed when, as did major condom manufacturers, Holland-Rantos switched from using sheet rubber to latex, allowing for a more mechanized production process. The technology, quality, and skill involved in diaphragm production combined to make them a favorite choice among white middle-class Americans, contributing to what, by the mid 1930s, had become a $250 million industry in birth control.[88]

The prominence of the diaphragm in the U.S. contraceptive market by the 1930s was due in large part to the efforts of Margaret Sanger and Planned Parenthood, and to political circumstances and changing ideas about how women should relate to their bodies. Interestingly, Sanger's initial contraceptive of choice was not the diaphragm; it was the cervical cap. In Sanger's 1914 *Family Limitation*, a pamphlet distributed to about

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[86] Blair & Curtis Products, "Description, Directions and Price List for Ramses Vaginal Diaphragms," 1929, folder 5, box 85, Birth Control Collection, American Medical Association Health Fraud Archives [hereafter AMAHFA], Chicago, Illinois; Blair & Curtis letter to doctor, July 1930, folder 5, box 85, Birth Control Collection, AMAHFA; Holland-Rantos Co., Inc, "Complete Technique for the Fitting and Use of the Holland-Rantos Vaginal Diaphragms," 1929, folder 6, box 85, Birth Control Collection, AMAHFA.

[87] Holland-Rantos, *Suggestions for Contraceptive Practice* (New York: Holland-Rantos Co., 1930), 3–4 quoted in Tone, *Devices and Desires*, 135.

[88] "An Accident of Birth," *Fortune* (February 1938): 83–86.

100,000 women, she endorsed the cervical cap by writing that "it is the surest method of absolutely preventing conception." Further, Sanger implored women to learn how to insert the cap into their own bodies: "Any nurse or doctor will teach one how to adjust it; *then women can teach each other*." Sanger's initial vision for birth control in America mirrored what feminists advocating the diaphragm and cap would come back to in the 1970s and early 1980s—women-controlled birth control free from reliance on male doctors.[89]

But Sanger, upon her return from Europe in 1915, switched allegiance from the cap to the diaphragm. Adopting the birth control model she had encountered in Holland while working with Dr. Johannes Rutgers, Sanger not only looked to the diaphragm as the contraceptive of choice, she also now embraced supervision of birth control and of women's reproductive processes by physicians.[90]

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[89] Margaret Sanger, *Family Limitation (1914),* pp. 12 [emphasis added] and 14, in *The Margaret Sanger Papers Electronic Edition: Margaret Sanger and The Woman Rebel, 1914–1916,* ed. Esther Katz, Cathy Moran Hajo, and Peter Engelman (Columbia, S.C.: Model Editions Partnership, 1999). Electronic version based on the microfilm edition of *The Papers of Margaret Sanger* available from: <http://adh.sc.edu> (accessed February 2008). On Sanger's early birth control work, *Family Limitation*, and her endorsement of the cap, see David M. Kennedy, *Birth Control in America: The Career of Margaret Sanger* (New Haven, Conn.: Yale University Press, 1970), 20–27; James Reed, *From Private Vice to Public Virtue: The Birth Control Movement and American Society Since 1830* (New York: Basic Book, 1978), 97–100; and Tone, *Devices and Desires*, 117–19.

[90] Sanger was in Holland to avoid legal troubles brought on by her publication of *Family Limitation*. She had hoped to meet with the renowned doctor and birth control advocate Dr. Aletta Jacobs, who refused to see her. Jacobs believed that birth control belonged only in the realm of medicine, and Sanger's credentials did not measure up. Instead, Sanger worked with Jacobs's assistant, Dr. Rutgers, who followed Jacobs's lead in holding to the superiority of the physician-fitted Mensinga diaphragm. Tone, *Devices and Desires,* 120–22.

This dramatic shift in Sanger's position on who held authority over birth control was not just due to her experience in Holland, or to the influence of Rutgers; it was also politically necessary in order to advance the birth control movement in the United States. The AMA looked suspiciously on the contraceptive industry (which at this point operated as a black market industry due to restrictive Comstock Laws) and Sanger believed that courting the medical community and garnering its support was the best path to society-wide legitimization and legalization of birth control.[91]

Sanger's work to medicalize birth control is historical ground well-covered by scholars, but the implications for how women perceived of and experienced their own bodies through the diaphragm is not. The evidence I present in the following paragraphs suggests that women were unnerved by the bodily intimacy the diaphragm required of them. The unease women, mostly married, white and middle-class, experienced with their diaphragms, belies the tension caused by the changing attitudes toward sex and sexuality of the 1920s.[92] Sexual healthfulness in companionate marriages, increased leisure of middle-class youth, and the widespread acceptance and reading of sexual theorists such as Havelock Eillis and Sigmund Freud are often pointed to as signs of

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[91] On Sanger's courting of the medical community see: Kennedy, *Birth Control in America*; Reed, *From Private Vice to Public Virtue,* 67–142; Carole R. McCann, *Birth Control Politics in the United States, 1916–1945* (Ithaca, N.Y.: Cornell University Press, 1994); Linda Gordon, *The Moral Property of Women: A History of Birth Control Politics in America* (Chicago: University of Illinois Press, 2002; originally published as *Women's Body, Women's Right*, 1974) 125–242; and Tone, *Devices and Desires*, 117–50.

[92] Historian Andrea Tone has noted that although Sanger had envisioned birth control for the masses, the diaphragm was never used by more than a minority of mainly affluent women. Even as late as 1947, one study that identified preferred birth control methods by class showed that among the middle class, 27 percent preferred the diaphragm, while among the working class only 2.6 used the rubber dome. Tone, *Devices and Desires*, 153.

changing sexual mores in the 1920s. But seeking contraceptive advice on birth control from male physicians, figures of authority and respectability, was still for many middle-class women, prohibitively embarrassing. Even as late as 1940, only slightly more than 30 percent of middle-class families sought contraceptive advice from their physician.[93]

Sanger acknowledged the obstacles that embarrassment and prudery could cause to diaphragm use. At the heart of the problem, Sanger wrote, was that women were "afraid of their own bodies." Sanger lamented that women "are of course ignorant of their own construction. They are silly in thinking the pessary can go up too far, or that it could get lost."[94] Physician and clinical reports demonstrated that women were generally uncomfortable with the physical contact with their bodies required by the use of a diaphragm. Clinicians and doctors reported reluctance on the part of many women at first to touch themselves. In fact, "squeamishness" was a common reaction reported in evaluations of women's responses to the diaphragm and cervical cap. A questionnaire distributed to physicians in 1929 reported that the most common objections to the diaphragm were that it was "too much trouble," was messy, and that women did not like touching themselves in such "an unnatural manner."[95] Antoinette Konikow's widely circulated informational pamphlet on contraceptives, distributed to physicians and reprinted four times between 1923 and 1933, also warned physicians of women's

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[93] Ibid., 154; and John D'Emilio and Estelle B. Freedman, *Intimate Matters: A History of Sexuality in America*, 2nd ed. (Chicago: University of Chicago Press, 1997), 239–274.

[94] Sanger, *Family Limitation*, 12.

[95] Holland-Rantos, Co. Research Department, "Report on Physicians' Replies to Questionnaire Concerning their Experience with the Vaginal Diaphragm and Jelly" (New York: Holland-Rantos Co., 1929), 13–14.

discomfort with their own bodies. “Many women,” Konikow wrote, “think of their sexual organs with disgust.” Such an aversion had to be overcome for diaphragm insertion to be properly conducted.[96]

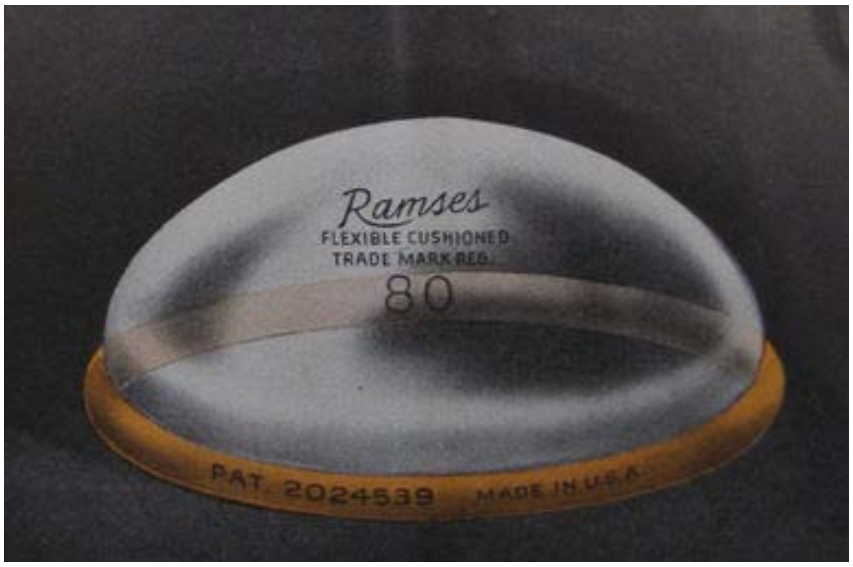

Figure 4. Ramses transparent diaphragm, image from “The Ramses Method: A Manual for Physicians Illustrating the Scientific Technique of Mechanical and Chemical Contraception,” 1937, National Museum of American History Library, Washington, D.C.

The anxiety women felt about touching themselves was compounded by the mess and inconvenience of diaphragm insertion. Despite its overall positive review of diaphragms as a contraceptive method, the Consumers Union of the United States recognized these faults, noting that the diaphragm was “far from perfect,” particularly

[96] Antoinette F. Konikow, M.D., “Voluntary Motherhood” (1923; reprint, Boston: Buchholz Publishing Co., 1933), 33–34.

because it required "foresight" and was "cumbersome."[97] A 1936 study of various contraceptive methods' effectiveness and acceptability published in the *American Journal of Obstetrics and Gynecology* revealed just how many women found diaphragm insertion and use uncomfortable. Physicians prescribed the diaphragm and spermicidal jelly to 3,514 women of the 4,000 participating in the study. The doctors instructed the women in the proper insertion technique. Of the total 4,000 women in the study, only 1,760 continued to regularly and faithfully use the method they were prescribed. Over a six-year period, 1,353 women abandoned the method voluntarily (others abandoned the prescribed method due to illness, side effects, or pregnancy), most commonly because of the "effort involved," the "mess," or discomfort.[98]

Women's complaints that the diaphragm was messy were certainly founded in the reality of its use. It was most effective when inserted one half hour prior to intercourse, and had to be used in conjunction with spermicidal jelly or cream. For the spermicide to work properly, the diaphragm had to be left in for eight hours after intercourse. Doctors reported that a common response to the mess posed by the diaphragm was that a "majority [of patients] gradually dispense with the diaphragm and use Koromex [the prescribed spermicide] alone."[99] Apparently, women found the application of spermicide

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[97] "A Report on Contraceptive Materials," Consumers Union of United States, 1941, folder 2, box 31, Florence Rose Collection, Sophia Smith Collection Women's History Archives [hereafter SSC-WHA], Northampton, Massachusetts.

[98] Ruth A. Robishaw, M.D., "A Study of 4,000 Patients Admitted for Contraceptive Advice and Treatment," *American Journal of Obstetrics and Gynecology*, vol. 31 (1936): 430–31.

[99] Holland-Rantos, Co. Research Department, "Report on Physicians' Replies to Questionnaire," 13–14.

through a metal or plastic inserter more amenable than using their fingers to insert a diaphragm, even though that meant sacrificing a great degree of protection.

The existence of inserters to place the diaphragm itself also speaks to the discomfort women had with being intimately familiar with their own bodies, and explicitly links women's ideas about their bodies, women's bodies, and contraceptive production. Between 1931 and 1949, several patents for diaphragm "introducers" were filed with the U.S. Patent Office. Each of these designs was similar, and the purpose the same: "so that the unskilled user, without assistance from a physician or nurse, incurs no danger of injury to the delicate tissues or to the diaphragm itself, and is yet assured against malpositioning of such diaphragm."[100] Surprisingly, birth control advocates and physicians welcomed the inventions.

The medicalization of birth control Sanger had worked so hard to achieve had been successful when, in 1937, the AMA lifted its ban on contraceptives. The previous year, in the landmark court case *United States v. One Package*, the Comstock Act restrictions on the prescription of contraceptives were reduced, allowing physicians to freely prescribe and distribute information about contraceptives.[101] Despite these

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[100] L. Cole, Diaphragm Introducer, U.S. Patent 2,548,755, filed March 22, 1949 and issued August 10, 1951. Other patents for introducers include, R. A. Bachmann, Gynecological instrument, U.S. Patent 2,008,380, filed December 20, 1945 and issued July 16, 1935; W. L. Schmitz, Introducer, U.S. Patent 2, 218,009, filed August 10, 1931 and issued October 15, 1940; and W. L. Schmitz, Introducer, U.S. Patent 2, 446,724, filed April 11, 1945 and issued August 10, 1948.

[101] *United States vs. One Package* arose from custom officials' seizure of Japanese pessaries sent by mail to Dr. Hannah Stone at Sanger's clinic. Under the Comstock Act, interstate commerce of "obscene matter" was illegal, the Court of Appeals ruled that medical prescription of contraceptives for the purpose of disease or patient well-being was not condemned under the act, nor was contraceptive information sent through the mail to or from physicians. McCann, *Birth Control Politics*, 75.

significant events, American women remained hesitant to visit their doctors about birth control. Even as late as 1940, one study found that 60 percent of those couples who used diaphragms had purchased them from drug stores and had never received training in their proper use. Inserters, physicians reasoned, might reduce failure rates among women who used diaphragms without physician training, and might also ease women's concerns over the embarrassing process of diaphragm placement.[102]

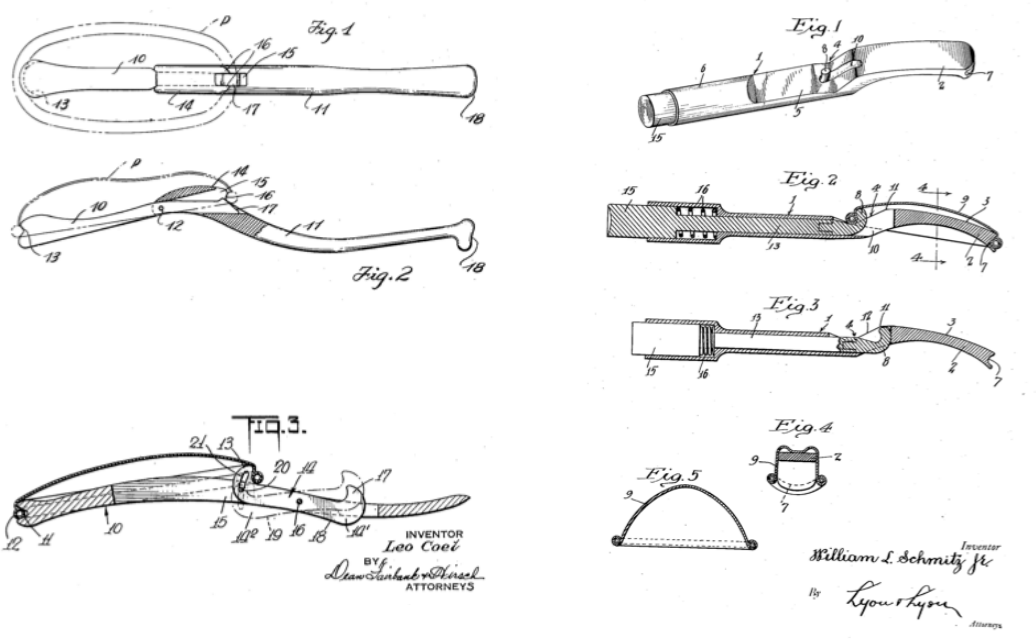

Figure 5. Drawings from inserter patents: 2,446724 (left top); 2,548,775 (left bottom); and 2,218,009 (right).

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[102] Tone, *Devices and Desires*, 154; Le Mon Clark, "Two Types of Vaginal Diaphragms and Indications for their Use," *Journal of Contraception* (November, 1938): 199–201; "Contraceptive Devices," *Human Fertility* vol. 10 (September 1945): 69–70; "Analysis of Contraceptive Materials," (New York: Consumers Union of United States, 1937), 14–15; and Holland-Rantos, Co. "Report on Physicians' Replies to Questionnaire," 15.

The "introducers" were simple devices. The diaphragm was stretched along a rod made of metal or plastic, secured at the end in a groove and fastened at the middle of the rod with a hook. A lever attached to the hook allowed a woman to easily release the diaphragm from the rod. A woman need not touch herself at all, with a gentle "thrust of the rod into the body" she could place the contraceptive properly.[103]

Physicians, inventors, and major diaphragm manufacturers continued to improve upon the designs of inserters and to sell them to women eager to buy and use them. Physicians, aware of women's embarrassment to touch themselves, continued to endorse inserter use, even knowing that sharp points or pieces had the potential to tear the diaphragm or injure the vaginal walls. Manufacturers and birth control advocates worked together to make sure that inserter designs reduced injurious risks. In 1941, Physician Robert L. Dickinson, then with the Birth Control Federation of America, warned Holland-Rantos of the potential flaws in its newest inserter.[104] Although Dickinson appreciated the "dainty and beautifully finished" swivel-tip inserter, he also had several concerns. Constructed in two pieces, the typical inserter rod was improved upon in this design by an attached swivel tip that eased the release of the diaphragm once placed. Dickinson cautioned the manufacturer against the remover section's sharp point and worried that proper disinfection between the two plastic pieces could not be achieved. Although the swivel-tip construction of the device had made it tremendously popular

[103] L. Cole, Diaphragm Introducer, U.S. Patent 2,548,755, filed March 22, 1949 and issued August 10, 1951.

[104] The Birth Control Federation of America was formed in 1939 when, out of financial necessity, the American Birth Control League and Margaret Sanger's Clinical Research Bureau merged. McCann *Birth Control Politics*, 191–93.

among patients, the hidden joint between the two pieces also provided a potential breeding ground for bacteria that could cause vaginal infection.[105]

Previous Holland-Rantos inserters had been made of metal, wartime shortages of these metals—aluminum, and chromium or nickel for plating iron or steel designs—led the company to manufacture its new inserter in plastic. Lucite, the crystal clear wonder plastic used for the device, had been introduced by DuPont only four years earlier. Lucite could not stand up to sterilization by boiling or autoclaving, and so necessitated disinfection through soaking in a strong antiseptic, an antiseptic of such great strength that if it came in contact with the vagina would be greatly irritating to sensitive tissue.[106]

Holland-Rantos addressed Dickinson's first concern about the sharp end by softening it, but they could not alter the construction of the device to retain the feature most appreciated by the women who used it (the swivel tip) *and* ensure it could easily be disinfected. Women, likely unknowingly, traded the comfort of not having to touch themselves when they inserted their diaphragms for the possible risk of infection or severe irritation from residual antiseptic. Holland-Rantos' failure to modify the device for ensured safety in order to maintain the device's ease of use, which women so enjoyed, is a powerful example of how women's ideas about their bodies—in this case, the unnaturalness of touching their own bodies—drove contraceptive production.

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[105] Robert L. Dickinson, M.D. to Holland-Rantos Co., October 29, 1941; Harry W. Hicks, Assistant General Manager, Holland-Rantos Company, Inc., to Dickinson, October 30, 1941; and Dickinson to Hicks, November 22, 1941, all in folder 1, box 90, Planned Parenthood Federation of American Collection, I [hereafter PPFAI], SSC-WHA.

[106] Ibid.; Hicks to Dickinson, November 7, 1941; and Dickinson to Hicks, November 2, 1941, folder 1, box 90, PPFAI, SSC-WHA; and Stephen Fenichell, *Plastic: The Making of a Synthetic Century* (New York: Harper Business, 1996), 145–47.

Women may have been "squeamish" about inserting diaphragms into their bodies, but the device was still the most effective method available and women continued to use it. The story of the diaphragm took a dramatic turn in 1960 when the birth control pill became available as a contraceptive. Hundreds of thousands of women turned immediately to the Pill as their contraceptive of choice. The advantages seemed obvious, not the least of which was removing the contraceptive from the sex act. No longer did women have to interrupt foreplay or anticipate sex to go insert their diaphragms.

The diaphragm, however, was far from dead. During the 1970s and early 1980s the diaphragm and cervical cap experienced a renaissance, spurred on by the women's health movement and by two feminist organizations in particular: the Boston Women's Health Book Collective (BWHBC) and the National Women's Health Network (NWHN). As feminists wrote and thought about available birth control methods, a discourse surfaced that naturalized the diaphragm and cap as these methods, feminists argued, facilitated knowledge of the natural self.

This movement toward knowledge of self and nature, accompanied by a distrust of traditional institutions of power, extended well beyond the women's health movement. During the 1970s, Americans focused increased attention on the natural world, which seemed at every turn threatened by modern technology and society. On the heels of Rachel Carson's exposé of the dangers of pesticides in *Silent Spring*, a number of environmental disasters, and an oil embargo that forced Americans to recognize the limit of natural resources, Americans began to reconsider the costs of economic expansion. The environmental movement was spurred forward by key legislation such as the National Environmental Protection Act and the creation of the Environmental Protection

Agency. Increasingly, Americans looked to more "natural" ways of living represented by the establishment of Earth Day in 1970, and through the more sustainable "appropriate technology" featured in the iconographic *Whole Earth Catalog.* In this context, the women's health movement solidified into a powerful voice for women and for the "natural."[107]

In order to establish the diaphragm as healthy and natural, these feminist authors set the diaphragm in discursive opposition to the Pill and to IUDs. They did this first by emphasizing the dangerous side effects and heavy-handed role of the physician in administrating Pills and IUDs, and then took their argument further to construct the Pill and IUD as "unnatural."

Feminists were not simply discursively constructing some devices as safer than others; there were real health dangers associated with both the Pill and the IUD. Criticism of the Pill was heightened by the publication of Barbara Seaman's *The Doctors' Case Against the Pill* (1969) and by the 1970 Senate hearings on the drug's health risks. Speculation and accusations about the Pill's harmful side effects flew wildly. Headlines accused the drug of contributing to breast cancer, cervical cancer, and even brain tumors. The medical and scientific communities, however, were slower to accuse, and generally defended the safety of the drug.[108]

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[107] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962). On the *Whole Earth Catalog*, see Andrew G. Kirk, *Counterculture Green: The Whole Earth Catalog and American Environmentalism* (Lawrence: University Press of Kansas, 2007).

[108] On the 1970s reactions against the Pill, health concerns, and informed consent, see Bernard Asbell, *The Pill: A Biography of the Drug that Changed the World* (New York: Random House, 1995), 301–12; Lara V. Marks, *Sexual Chemistry: A History of the Contraceptive Pill* (New Haven, Conn.: Yale University Press, 2001), 138–57, 237–65; and Elizabeth Seigel Watkins, *On the Pill: A Social History of Oral Contraceptives,*

The most serious of the Pill's side effects that women experienced included thrombosis, embolism, and migraines. The FDA eventually responded to public concerns by agreeing to require that a warning label listing all possible side effects be included with the drug (known as the now-familiar "patient packet insert").[109] In the case of the IUD, a legacy of infection, pelvic inflammatory disease (PID), and perforation of the uterine wall had followed the device from its early use in the late nineteenth century into the post-war era.[110]

But beyond the real health concerns new contraceptives posed, feminists opposed them on the grounds that they took control of women's bodies away from them, and that they altered women's natural bodies in unnatural ways. "To get control of your own life and your own destiny," proclaimed the BWHBS authors of *Our Bodies, Our Selves*, "is the first and most important task, but it begins with getting control of your own body . . .

1950–1970 (Baltimore, Md.: Johns Hopkins University Press, 1998), 73–131. Health scares about the Pill were intensified by the then-recent disaster of thalidomide, a drug which had caused numerous birth defects mostly in Europe, and brought the issue of drug side effects and regulation sharply to the attention of the public.

[109] At the time only one other drug was required by the FDA to include a patient warning: isoproterenol inhalators. Marks, *Sexual Chemistry*, 249.

[110] IUDs became increasingly accepted by the once skeptical medical community beginning in the 1940s with the advent of antibiotics which cured the PID problem, and the invention of new more malleable plastics in the 1950s. Tone, *Devices and Desires*, 264. Christopher Tietze, of the Committee on Maternal Health, in conjunction with the Population Council conducted widespread research on three forms of IUDs in the 1960s as well as international conferences on IUDs. This research did much to bring the IUD more solidly into the realm of science and to assuage physician's fears of complications associated with earlier forms of the devices, although IUD use in the United Sates was never as high as in developing countries where the Population Council and the International Planned Parenthood Federation promoted its use. Population Council Records, Series IV3B4.4, National Council on Maternal Health, box 82, Rockefeller Archive Center. See also Chapter 4 of this dissertation.

demand answers and explanations from the people you come in contact with for medical care." Comprised first of local groups organized by clinics or individual women, by 1973 the women's health movement boasted participation of twelve hundred all female, local self-help groups. Women met to perform cervical examinations, learn about their bodies through self exploration, and discuss childbirth and birth control without the intrusion of male medical professionals. This loose affiliation of small groups and clinics became the base of support for national organizations such as the BWHBC and NWHN, which by the late-1970s sought to do more than find liberation through self-help medicine; they sought also to influence established medical practice.[111]

National women's health advocate groups attacked the pharmaceutical industry and physicians alike for keeping women in the dark about their bodies and putting them in danger. As feminists began not simply to meet and talk about their birth control options, but to write about them as well, the Pill and the IUD became the enlightened woman's enemy as they limited a woman's control over her body and altered women's natural bodies in unnatural ways. The section on birth control in the Boston Women's Health Book Collective's *Our Bodies, Our Selves* provides an example of this discursive move. Established in 1969 with the purpose of offering women's health information by women for women (and as a reaction to women's negative, often humiliating experiences with physicians who seemed not to take their health concerns seriously), the BWHBC served as one of the most vocal feminist forces in the women's health movement. *Our*

[111] Gordon, *The Moral Property of Women*, 322–31.

Bodies, Our Selves reached a huge and hungry audience. First published in 1971, it had sold 250,000 copies by 1973.[112]

The contraceptives discussed in the earliest editions of *Our Bodies, Our Selves* were grouped into the categories of effective methods, methods that "don't work very well," and "non-methods." Each method was described, the side effects listed, and the advantages and disadvantages summarized. The rhythm method and withdrawal (those methods traditionally considered as natural birth control and the only methods condoned by the Catholic Church at the time) were listed under methods that "don't work well," leaving the Pill, IUDs, diaphragms, condoms, and spermicidal foams and jellies as the effective methods discussed. The section on the Pill emphasized its potential danger and negative effects on the natural body in the side effects section, and also in a disproportionately lengthy section entitled "Safety" (over twice as long as for any other device.)[113]

Along with outlining the real potential negative side effects of the Pill such as increased risk of heart disease, thromboembolism, etc., *Our Bodies, Our Selves* suggestively hinted that a woman who chose this method would eventually discontinue using it in favor of a different method. The segment warned: "You [the woman] see the doctor, get examined, remember to take the pill, feel the side effects, and run the risks. Hopefully, the man you sleep with understands this, is supportive, and agrees to use

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[112] Ibid., 323.

[113] For the Catholic Church's position on acceptable methods of birth control see, Pope Paul VI, *Humanae Vitae***,** Encyclical of Pope Paul VI on the Regulation of Birth, July 25, 1968. Boston Women's Health Book Collective (BWHBC), *Our Bodies, Our Selves* (Boston: New England Free Press, 1971), 119.

condoms for a while or put up with a less invisible means of birth control when you want to stop taking pills."[114] For no other contraceptive did the book editorialize on what would "hopefully" happen when a woman switched away from that method.

Likewise, in a draft of the *Our Bodies Our Selves* section on the IUD, the device was ominously decried. The author used adjectives such as "intrusive," and described the insertion as painful enough to "warrant a tranquillizer." The author wrote that some "people" object to the device, "they don't like the idea of wearing something inside them all the time, it feels *unnatural*."[115] Also of note were endorsements of the diaphragm within the segments on the IUD and the Pill. For example, listed under the advantages of the Pill, the author wrote: "when you are more comfortable with sex and more able to communicate openly with your partner, a diaphragm . . . will not seem like such an interruption." In the IUD segment, the failure rate was cited as less than 2 percent, and in the same section, the authors pointedly mentioned that when used properly, diaphragm effectiveness easily matched that of the IUD.[116]

Although the stated intent of *Our Bodies, Our Selves* was to provide women with accurate and unbiased information about each method of birth control so that women could make their own decisions, at least in these earliest editions of the book, the diaphragm emerged as the preferred device. The little dome of rubber was transformed

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[114] BWHBC, *Our Bodies, Our Selves*, 119.

[115] Draft, "IUD, or Intrauterine Device: Coil, Loop and Shield," folder 7, box 132, Boston Women's Health Book Collective Collection, MC 503 [hereafter BWHBCC], Schlesinger Library, Radcliffe Institute Harvard University. In the published version of the IUD section, these descriptors were removed and replaced with more subtle language.

[116] BWHBC, *Our Bodies, Our Selves*, 119, 121.

from a piece of technology that was embarrassing to use into the natural choice for women who sought contraceptives that worked in harmony with their natural bodies.

More than just the devices acquired natural status—so too did a woman's body. Feminists of the health movement encouraged women to explore their own bodies in order to gain knowledge and control as the most "natural" way to approach contraception. This transition was perhaps best illustrated in the cervical cap renaissance. During the late 1970s and early 1980s, the cap was rediscovered by the women's health movement and mainstream physicians alike. Feminist write-ups on the cap dramatically emphasized knowing one's own body. The BWHBC made perhaps its most striking push for women to know their bodies in Judith Brillman's write-up on the cervical cap, which was included in the 1984 edition of *Our Bodies, Our Selves*. Brillman warned readers against "highly technical, invasive, and potentially dangerous contraceptive methods." She speculated that the Pill and IUD overshadowed the cervical cap in American women's contraceptive choices because "in order to insert a cap, we need to know about the anatomy of our vagina and cervix, and we have to be comfortable about touching our genitals." [117] Yet she placed women's squeamishness firmly in the past, writing that women earlier in the century felt their genital area was reserved for only their doctors, husbands, or lovers. Brillman postulated that modern women had fewer reservations.

The cervical cap had, until the 1970s nearly disappeared from the range of Americans' contraceptive options. Cervical caps were manufactured in Europe as early as 1838. Friedrich Adolph Wilde is credited with inventing the device in the 1830s,

[117] Judith Brillman, draft, "The Cervical Cap," folder 7, box 132, BWHBCC, Schlesinger Library.

although in its earliest form, the cap came more directly from nature as women from various cultures used halves of acidic fruits or disks of beeswax molded into caps to fit over their cervixes. The first modern prototypes were made from elastic resin; the cap's shape was formed from making a wax impression of the cervix and thus was individually fitted. These early caps soon evolved as natural rubber wax replaced the elastic resin.[118] The individually shaped cap of Wilde's day soon gave way to one-size-fits-all caps and caps manufactured in two or three sizes. The Mizpah Rubber Pessary (sometimes also called the French pessary and alternatively spelled Mispah) was the most common cervical cap of the late nineteenth and early twentieth centuries.[119]

Often described as a large rubber thimble, the cap worked as a barrier method. Inserted into the vagina and placed over the cervix, the device stayed in place by suction. Like the diaphragm, it was to be used in conjunction with spermicidal jelly or cream placed in the dome. The attraction of the cap was that, unlike the diaphragm, it could be left in place for several days, or as some advocated, for up to a month. It did, however, require fitting just like a diaphragm, and one drawback was that if left in for prolonged periods it could cause unpleasant odor and vaginal dryness.

Until the 1960s, most Americans purchased their birth control over the counter rather than from a physician. Cervical caps, along with condoms, made up a large portion of those contraceptives being purchased over the counter. Caps were sold in two forms,

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[118] Friedrich Adolph Wilde, *Das weibliche Gebär-unvermögen* (Berlin, 1838) quoted in Vern L. Bullough, "A Brief Note on Rubber Technology and Contraception: The Diaphragm and the Condom," *Technology and Culture* vol. 222, no. 1 (January 1981), 105; Percy Skuy, *Tales of Contraception* (Toronto, Canada: History of Contraception Museum, Ortho-McNeil, Inc., 1995), 32; and Himes, *Medical History of Contraception*, 318 n.111.

[119] Tone, *Devices and Desires*, 118.

either in one piece or as a flexible rubber rim or ring, sometimes with a silk cord attached for removal, upon which replaceable caps fit. Advertisements from the early nineteenth century market the one-piece cap for $1.50 to $2.00; the ring ranged in price from $1.50 to $3.00 with one cap included. Additional caps cost around $0.25 . Advertisements for the cap or Mizpah emphasized the quality of the rubber and its softness. One advertisement, for example, claimed: "The Mispah is made of the purest and softest rubber, with silk cord attachment for convenient withdrawal."[120]

Although the cap and diaphragm were similar in form, function, and were manufactured in much the same way, the spaces where they were consumed differed dramatically. Whereas the cap was sold over the counter by druggists and through mail-order companies, the diaphragm had to be fitted and purchased either by a physician or at a clinic. Cervical caps were readily available from a number of U.S. manufacturers, some even producing a range of sizes, but until the 1920s diaphragms were predominantly illegally imported from Europe. Holland-Rantos Company, created by Sanger, emerged as the leading diaphragm manufacturer, selling only to physicians and clinics. The all-medical clientele separated Holland-Rantos from the over-the-counter operations and lent it a legitimacy and legal status necessary to avoid prosecution under the Comstock laws.[121] While the diaphragm increasingly gained popularity and acceptability, the

[120] Tone, *Devices and Desires*, 82; and Mail order form card, Mispah Rubber Pessary, date unknown, folder 5, box 85, Birth Control Collection, AMAHFA; *Catalog of Drug Sundries*, folder 6, box 785, Sex Collection, AMAHFA.

[121] On the history of the birth of the Holland-Rantos Company and Margaret Sanger's role in its creation, see Tone *Devices and Desires*, 127–38.

cervical cap, by the 1930s, had virtually disappeared as a contraceptive option for American women.

In fact, the reasons for the near disappearance of the cervical cap from American women's contraceptive options had everything to do with politics and economics and little to do either with the device's efficacy or how women experienced their bodies through the device. The cap's subservient position to the diaphragm can be largely attributed to Sanger's attempts to legitimize birth control by appealing to the medical community through the diaphragm as previously discussed.

The BWHBC and the NWHN were in large part responsible for the cap's rebirth. In 1978, the BWHC included information on the cap in a packet of materials sent to over four hundred women health workers. The NWHN also took up advocacy of the cap. Established in 1975 as a government agency watchdog group, the NWHN quickly became the major organizing force of women's health issues. By 1980 the NWHN publicized and listed providers for the cap, and lobbied for FDA approval of the device. A decade-long battle to gain FDA approval ended in 1988 when the Prentif cervical cap was approved. The NWHN lobbied for studies of the device, which resulted in a large-scale evaluation of cap effectiveness carried out by the National Institutes of Health. The study lasted from 1981–1986 and found the cap to be as effective as the diaphragm.[122]

[122] Gordon, *The Moral Property of Women*, 324. The cap required FDA approval due to the passage of the 1976 *Medical Device Amendments to the Food, Drug and Cosmetics Act of 1938*, which prohibited the sale of internal devices. Amy Shapiro, "Whatever Happened to the Cervical Cap?" *Harvard Women's Law Journal* vol. 10 (1987): 310–12; Rebecca Chalker, *The Complete Cervical Cap Guide* (New York: Harper & Row, 1987), 30–37; Mary-Sherman Willis, "Cervical Caps: Old and Yet Too New," *Science News* vol. 116 no. 25/26 (December 22–29, 1979): 431, 442; Michael Klitsch, "FDA Approval Ends Cervical Cap's Marathon," *Family Planning Perspectives* vol. 20 no. 3 (May–June, 1988): 137–38.

The public hunger for alternatives to the Pill, due to increased concern over the side effects, led to such great publicity for the cap, that by the mid-1980s all of the most popular women's magazines including *Ms.*, *Cosmopolitan*, and *Vogue* had featured write-ups on the device. Just one year after the cap was banned by the FDA, a 1981 article on the contraceptive in *Cosmo* asked readers, "Tired of bothersome birth-control devices, ready for something new? This remarkable barrier-type contraceptive can be left in place for weeks at a time!" Indeed, for many women the advantages of the cap over the diaphragm were striking. "I like the ease I now feel in being able to insert the cap at my leisure, well ahead of any anticipated sexual contact," declared one woman about her cervical cap, "I love the freedom to repeat intercourse if I like, or just to go off to sleep without having to deal with any kind of apparatus." As had *Our Bodies, Our Selves* in 1971, popular magazine articles emphasized the power and naturalness of knowing one's body. "It has taken American women a long time to learn about their own bodies," proclaimed a nurse practitioner prominently quoted in a *Ms.* article, "Through self-help methods, women are becoming more aware of themselves."[123]

The publicity on the cervical cap spurred women's health clinics all over the country, particularly in urban areas, to teach cap insertions in groups. In an article entitled "My Cap-fitting" in the publication *Medical Self-Care*, one women recalled: "Dispensing with modesty we took our positions, specula in hand . . . after some practice, most of us became nimble with insertion and removal. . . we were enjoying the novelty of the scene

[123] Karel J. Littman, "Contraception: The Cervical Cap, Back to Basics," *Ms.*, v. 9, October 1980, 91–2; Robert Patton, "Cervical Caps," *Cosmopolitan*, 190, June 1981, 194–96; Melva Weber, "Cervical Cap: Fit for You?" *Vogue*, 171, August 1981, 214; "New-Choice Birth Control: 'The Cap,'" *Savvy*, July 1980, 68; and Chalker, *The Complete Cervical Cap Guide*, 3.

and the satisfaction of sharing useful knowledge woman to woman. . . it all seemed perfectly natural."[124]

While feminist literature on diaphragms and caps set the devices in opposition to the dangerous and "unnatural" alternatives of the Pill and IUD, it also emphasized the importance of having the devices fitted properly by a trained physician or nurse. This may at first seem at odds with the claims to female-control over contraception. However, this part of the discourse provided a link between science and technology and natural methods.

Many contraceptive methods emerged during the 1970s and 1980s that claimed to be "natural" methods. Most of these were considered quackery, at least by the medical community.[125] Such suspect methods included semi-effective methods, such as the rhythm method and withdrawal, and more off-beat methods like Lunaception, which prescribed exposure to artificial moonlight, and conception beads, which enabled a woman to keep track of fertile times by moving colored beads along a string.[126] Although most of the natural birth control methods could easily be dismissed by the medical profession, the diaphragm, now reconceived by the women's health movement

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[124] Culverwell, "My Cap Fitting," *Medical Self-Care* (Summer, 1983), 43.

[125] Physicians' skepticism toward natural methods emerges repeatedly in memos and letters of the AMA. A standard letter of response to inquiries about the rhythm, bead, or other natural methods was that the AMA knew of "no clinical, scientific trails proving the efficacy of said method." Letters to AMA 1978–1981, all folders, box 87, Birth Control Collection, AMHFA.

[126] Louise Lacey, *Lunaception: A Feminine Odyssey into Fertility and Contraception* (New York: Coward, McCann and Geoghegan, 1974); Conception Beads, folder 38, box 2, Patricia Gold Papers, MC 430 [hereafter Gold Papers], Schlesinger Library, Radcliffe Institute, Harvard University.

as natural, could not. The diaphragm's long history of use and clinical tests, which proved it to be nearly 99 percent effective when used properly and consistently, could not be argued against by either the medical profession or the pharmaceutical industry. In fact, numerous long-term studies of the diaphragm's effectiveness had solidified its position among the top three most effective methods (the Pill, IUD, and diaphragm).[127] Regardless of how women chose to frame, discuss, and experience their relationship between the diaphragm and their own bodies, the fact that it was a legitimate, effective, and useful birth control method could not be disputed.

During the 1970s, sales of the Pill dropped by 20 percent. Thousands of women abandoned the Pill when health scares surfaced and women returned to the earlier methods of the diaphragm and cap. In fact, by the late-1980s an estimated 2.4 million women relied on one of three barrier methods: the diaphragm, cervical cap, or sponge.[128] The population of diaphragm and cap-using women was large enough to matter. Even when medical opinion favored the Pill and IUD because of their high effectiveness without the worry of user-error, many American women still turned to the barrier methods they considered to be less of a health risk.

We can learn something about women's relationships to their bodies through the diaphragm and cap simply by thinking about how the devices work. To work effectively,

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[127] These two most large-scale of these tests include Robishaw, "A Study of 4,000 patients," 426–35; and the Sanger Research Bureau Study, summarized in Barbara Seaman in *Women and the Crisis in Sex Hormones*, (New York: Bantam Books, 1977), 214–16.\

[128] Asbell, *The Pill*, 307; and J. Trussell and B. Vaughn, "Selected Results Concerning Sexual Behavior and Contraceptive Use from the 1988 National Survey of Family Growth and the 1988 National Survey of Adolescent Males," working paper no. 91–12, (Office of Population Research, Princeton University, 1991).

the diaphragm or cap required a woman to know how to properly insert it, which required that she know the inside of her body. The initial fitting and instruction—the introduction of woman to her body—was mediated by a doctor or nurse practitioner. After that, she was on her own.

One woman summed up her experience with her body vis-à-vis contraceptives in a 1982 meeting of the BWHBC. "We have been deprived of our being by the medical profession," she claimed. She reflected on her alienation from her own body as a child: she was not allowed to see her own body or look at herself in the mirror, and she believed that God would know if she looked at herself, or even if she wanted to, it was "against nature—something that was not amenable to her control, and a situation she could never get away from." Forced to look at and feel herself through use of her diaphragm, she realized, "nothing could be more natural to me now than my own body."[129]

In the 1920s and 1930s the diaphragm emerged as the contraceptive of choice for its effectiveness and it was accepted as legitimate and was controlled by the medical profession. The diaphragm had a contradictory relationship with women and their bodies. It ushered in the medicalization of birth control (which increased the power of doctors over women's bodies), but at the same time, it put women in contact with their bodies in a way few had been previously. To mitigate this uneasiness, birth control advocates and diaphragm manufacturers developed diaphragm inserters, which carried their own health risks, but at least ensured that diaphragms would be inserted and used properly. While some women in this early chapter of the diaphragm story may have been uncomfortable

[129] Minutes, BWHBC, January 15, 1982, folder 38, box 2, Gold Papers, Schlesinger Library.

with the bodily contact the device necessitated, this period of medicalization took contraception and the body out of the dark and into legitimate medical and social discourse. In the 1970s and 1980s, then, the way women thought about their bodies and contraception could go one step further. Feminists of the women's health movement generally viewed the Pill and IUD as dangerous and unnatural. They set those devices against their preferred methods of the diaphragm and cervical cap. Finally, feminists emphasized the naturalness of both the human body and women's exploration of their bodies, even naturalizing the devices themselves.

The diaphragm was transformed from a high-tech device that employed the finest materials from half-way around the world and used the latest rubber and coiled spring technology into the most natural of contraceptive choices. Feminist discourse and hands-on self-help birth control insisted on less intrusive, more natural methods. This insistence eventually forced the reemergence of the forgotten contraceptive cervical cap. The way people, in this case women involved in the women's health movement, thought about their bodies in relation to nature allowed for the existence and commercial success of these particular devices. For feminists of the 1970s and early 1980s, the diaphragm and cap brought women closer to nature through their own bodies.

Chapter 3

MACHINES IN THE BODY: OVERPOPULATION AND THE INTRAUTERINE CONTRACEPTIVE DEVICE, 1950s–1960s

"Oops, I accidentally pulled out your IUD!" Frightening words that no woman would want to hear, but they are part of the true story of one New Mexican woman's exchange with a nurse practitioner. When the unnamed women visited the Albuquerque clinic in late 2008, she intended to have the tail on her intrauterine device (IUD) shortened—it dangled too far past her cervix and she worried the device might be pulled out of place. After supposedly shortening the tail, the nurse, at first disguising her action as an accident, pulled the contraceptive out (with much pain endured by the patient) and proceeded to explain how this "accident" was a good thing—the nurse was opposed to IUDs on the basis that she believed them to be a form of abortion. The brazen nurse told her patient that she had "accidently" pulled out so many IUDs that "everyone in the office always laughs and tells me I pull these out on purpose because I am against them, but it's not true, they accidently come out when I tug." Needless to say, the patient filed a lawsuit against the device-snatching nurse.[130]

Some of the most significant themes in the history of the IUD surface in this modern story about one woman's contraceptive horrors. The nurse's claim that IUDs

[130] Tracy Clark-Flory, "Oops, I accidentally pulled out your IUD!: So Says an anti-contraception nurse in New Mexico, who is being sued by a patient," Salon.com, January 22, 2009, available at <http://www.salon.com/life/broadsheet/feature/2009/01/22/iud_abortion> (accessed January 2009).

constitute a form of abortion represent a long and confused strain within the device's history in which the exact mode of action, how the IUD actually works, has never been clearly understood, even among gynecologists and inventors of the devices. Layered into the Albuquerque woman's story are also other strands of the larger IUD story: its role as a welcomed and effective contraceptive for millions of women, and as a medical nightmare for hundreds of thousands of others. And finally, although for the New Mexican woman a female nurse took control of the device in the body of her female patient, the story suggests a larger narrative of bodily control that is literally built into the IUD. After all, the device was invented and mass manufactured largely due to the attempt of one group of humans (mostly white men involved in the population control movement) to control the bodies of another (mostly brown, third-world women). In this chapter, I turn to the examples of two IUDs, the Lippes Loop and the Margulies Spiral, to examine the ways in which the discourse of overpopulation drove the production and consumption of IUDs. I argue that during the 1960s, the male-dominated profession of gynecology supported a system of work, reward, and prestige that was one of several factors literally shaping IUDs. Furthermore, the physical shape of IUDs and the language inventors and physicians used to describe the contraceptives and the devices' mode of action were animalistic and violent. The history of the IUD in the United States is one that defies borders; it is intricately tied to people and processes that occurred on small local scales, regional and national scales, and international scales.

In the United States, the modern IUD emerged as a contraceptive option in the 1960s, but by then, the concept of the device had existed for hundreds of years. Egyptians, perhaps inspired by the effective contraceptive practice of placing stones in

uteri of camels, had attempted to inhibit human pregnancy by obstructing the uterus with stones or other foreign objects.[131] The IUD's nineteenth-century ancestors took the form of stem pessaries, also called cervical plugs or intracervical devices, which were made of stone, glass, hard rubber, or metal. These earliest iterations of intrauterine contraceptive devices were rather tortuous apparatuses, which were actually placed through the cervix, connecting the internal genital tract of the uterus with the vagina—early stem pessaries are thus better labeled as *inter*-uterine devices than intrauterine devices, for their placement was only partially in the uterus. Most commonly, they took the shape of stem plugs, collar buttons, or wishbones. Stem pessaries were widely used for prolapsed or slopped uteri, or to treat heavy or otherwise abnormal menstruation, and to prevent pregnancy in women whose health could not support it. Their insertion was painful and the risks of corrosive materials causing pelvic inflammatory disease (PID), or of the device causing damage to the cervix was great.[132]

Most historians date the birth of the modern IUD to the early 1900s. In 1909, Richard Richter, a German physician, suggested in a paper published in a German medical journal that the insertion of two or three strands of silkworm gut into the uterus was an effective contraceptive. Although Richter's findings went practically unnoticed by the U.S. medical community, the work of another German gynecologist twenty years later did rouse attention. In 1928, Ernst Gräfenberg published his findings of favorable

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[131] Percy Skuy, *Tales of Contraception* (Toronto, Canada: History of Contraception Museum, Ortho-McNeil, Inc., 1995), 24.

[132] Ibid., 21–22; Janet Farrell Brodie, *Contraception and Abortion in Nineteenth-Century America* (Ithaca, N.Y.: Cornell University Press, 1994), 209–10; and Andrea Tone, *Devices and Desires: A History of Contraceptives in America* (New York: Hill and Wang, 2001), 59–61.

results from his clinical experience with silkworm gut rolled into rings and inserted into the uterus. Shortly thereafter, Gräfenberg improved upon his rings by replacing the silkworm gut with a pliable silver coil. This silver coil, made of German silver that was actually an alloy of copper, nickel, and tin and was less corrosive than silver alone, became known as the Gräfenberg ring and experienced a short period of popularity particularly in Europe during the 1930s and 1940s.[133] Although some in the medical community urged further study of the ring, several factors combined to keep the ring from becoming available to seekers of new birth control methods in the United States. Gynecologists were highly suspicious that any foreign body placed in the uterus would cause PID, which at the time was an untreatable and potentially lethal infection. Furthermore, insertion of the ring required dilation of the cervix, which was painful enough to necessitate local anesthetic and carried with it the risk of any surgery. Removing the ring was also dangerous. It had to be retrieved by inserting a long hook into the uterus; this removal method could easily scratch or tear the uterine wall.[134]

A watershed moment for the acceptance of the IUD, both with the American medical community and among birth control advocate groups, came with the publication of two papers in the late-1950s. Published separately and halfway around the world from

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[133] Richard Richter, "Ein Mittel zur Verhutung der Konzeption," *Deutsche medizinishce Wochenschrift* vol. 35 (September 1909): 1525–27; Gräfenberg also presented the findings of his 1928 German-language paper as "An Intrauterine Contraceptive Method," in *The Practice of Contraception: An International Symposium and Survey: From the Proceedings of the Seventh International Birth Control Conference, Zurich, September 1930,* ed. Robert L. Dickinson, Hannah M Stone, and Margaret Sanger (Baltimore, Md.: Williams & Wilkins, 1931), 33–47. On the Gräfenberg ring, see also Christopher Tietze, "History of Contraceptive Methods," *The Journal of Sex Research* vol. 1, no. 2 Special Issue, Contraceptives and Abortion (July, 1965): 78; and Tone, *Devices and Desires*, 263–64.

[134] Tietze, "History of Contraceptive Methods," 78.

each other, the papers reported "very low pregnancy rates and the absence of any side effects." William Oppenheimer of Israel published his favorable results with the Gräfenberg ring in the *American Journal of Obstetrics and Gynecology*, and Atsumi Ishihama reported on the success of the Ota ring in Japan.[135] Ishihama, who reported on the work of Tenrei Ota, published the second paper in Japan. In 1934 Ota had invented and began to use his own ring, which was basically a modified Gräfenberg ring that replaced the silver coil with gold-plated silver, then gold, and finally plastic. Ota's device also contained a center disc to stabilize the device from collapse. The result was an outer "coil with a small, hollow, lentil-shaped capsule suspended in the center from three radial springs" (Figure 6).[136] Significantly, Ota was the first to use plastic (though of poor quality), and although his device was widely used in Japan, it never entered the U.S. market.

[135] W. Oppenheimer, "Prevention of Pregnancy by the Gräfenberg Ring Method," *American Journal of Obstetrics and Gynecology* vol. 78 (Aug. 1959): 446–54. Howard Taylor, Jr., the editor of *AJOG*, had personally invited Oppenheimer to present his findings—Taylor served on the medical advisory board for the Population Council. James Reed, *From Private Vice to Public Virtue: The Birth Control Movement and American Society Since 1830* (New York: Basic Books, 1978), 306.

[136] Atsumi Ishihama, "Clinical Studies on Intrauterine Rings," *Yokohama Medical Journal* vol. 10 (April 1959): 89–105; T. Ota, "A Study on Birth Control with an Intrauterine Instrument" *Japanese Journal of Obstetrics and Gynecology* vol. 17 (June 1934): 210–14; Tietze, "History of Contraceptive Methods," 79; and Jane E. Hutchings, Patti J. Benson, Gordon W. Perkin, and Richard M. Soderstrom, "The IUD After 20 Years: A Review of Worldwide Experience" *International Family Planning Perspectives* vol. 11, no. 3 (September 1985): 77–86.

Figure 6. Ota Ring.

Few American gynecologists dared use IUDs prior to the publication of these papers, but during the late 1950s and early 1960s politics, economics, and science combined to create the perfect atmosphere for the proliferation of the device. As post-war demographers documented the expansion of the world's population at alarming rates, philanthropists, birth control advocates, scientists, and others began to take notice. Historian Matthew Connelly's recent work on the population control movement identifies a "network" of private organizations and individuals who, by the early 1960s, had emerged as an international affiliation of organizations, governments, and individuals loosely united to curb population growth. The population control movement had ancestors in the eugenic and family planning movements of the previous decades. In the United States such entities as the Ford Foundation, Rockefeller Foundation, Planned Parenthood Federation of America, the Population Research Council, and the Population Council, rallied their money and intellect to diffuse what Paul R. Ehrlich would coin in 1968 as the "population bomb." Three main concerns drove their actions: issues of

national and global security, humanitarian concerns of poverty and scarce resources, and environmental protection and sustainability issues.[137]

The geographic boundaries of the IUD story stretch well beyond the borders of the United States. Although the Population Council sought to develop IUDs primarily for use outside the United States in developing countries (mostly in Asia), the majority of research and development on the device was done in the United States. The most commonly used IUDs were developed by American doctors and inventors, and the bulk of funding that went to developing countries came from population control organizations based in the United States. Furthermore, the United States, along with Britain, provided most of the financial and ideological leadership to the population control movement.[138] By the late 1950s, with population control money available for research, the risks of PID now mitigated by the availability of effective treatment in the form of penicillin, preliminary research papers on IUD effectiveness published, and restrictive laws against contraceptives no longer in place, physicians began to consider the IUD as a viable contraceptive option.

American gynecologists first began to study and experiment with IUDs using the Gräfenberg ring. One of the earliest to do so was Alan Guttmacher of the Mt. Sinai

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[137] Matthew Connelly, *Fatal Misconception: The Struggle to Control World Population* (Cambridge, Mass: Belknap Press, 2008). On the earlier Eugenics movements in the United States, see, for example, Alexandra Stern, *Eugenic Nation: Faults and Frontiers of Better Breeding in Modern America* (Berkeley: University of California Press, 2005); Harry Bruinius, *Better for All the World: The Secret History of Forced Sterilization and America's Quest for Racial Purity* (New York: Knopf, 2006); and Paul A Lombardo, *A Century of Eugenics in America: From the Indiana Experiment to the Human Genome Era* (Bloomington, Ind.: Indiana University Press, 2010).

[138] Connelly, *Fatal Misconception*, 56.

Medical Center in New York. A giant of reproductive health and contraceptive history, Guttmacher served as the president of Planned Parenthood-World Population, the vice-president of the American Eugenics Society, the head of the Population Council's medical committee, founded the Association of Reproductive Health Professionals (1963), founded the Association for the Study of Abortion (1964), and was a long-time member of the Association for Voluntary Sterilization. Ernst Gräfenberg had actually been on staff at the New York hospital, and presumably, Guttmacher learned of the ring and its proper insertion directly from the inventor. While serving as Chief of Medicine at Mt. Sinai, Guttmacher started inserting Gräfenberg rings into women who sought birth control, and with favorable results. Within a few short years, Guttmacher was overseeing a number of studies on innovative IUDs. In 1958, Guttmacher supervised clinical tests of an intra-uterine spiral, designed by gynecologist Lazar Margulies. Simultaneously, gynecologist Jack Lippes, working at Buffalo (New York) Planned Parenthood was testing his own version of a modified Gräfenberg ring, and by 1961 was testing his own loop design in collaboration with Guttmacher. Funding the continued design research of Margulies' and Lippes' devices was the organization that, by 1960, had emerged as a leader in contraceptive financial support, research, and manpower: the Population Council.[139]

John D. Rockefeller III established the Population Council in 1952. He organized a meeting in June 1952 at Williamsburg, Virginia, at which thirty-one scientists and social scientists gathered to "consider available facts and conflicting views about the

[139] Christopher Tietze and Sarah Lewit, eds., *Intra-Uterine Contraceptive Devices: Proceedings of the Conference, New York City, 30 April–1May, 1962* (Amsterdam: Excerpta Medica International Congress Series #54), 9–10, 61, and 69.

effects of population growth on human welfare." Rockefeller strongly believed, as did a growing number of demographers, social scientists, and scientists around the world that burgeoning third world populations were impeding economic development in those countries, stressing global resources, and threatening global security. After two days of discussion, the group identified five objectives and ten activities that formed the first mission statement of the Rockefeller-funded Population Council. Broadly conceived, the organization's mission was to study population problems, research solutions, and to serve as a clearinghouse for information on overpopulation. Imbedded in this original mission were extraordinary and laudable ideals that included respect for the individual, local customs, and broad educational programs. The council agreed that "solutions to questions of population involve ultimately not only matters of physical and material well-being, but also those of a cultural, moral and spiritual nature." Through the 1950s, the Population Council managed to hold close to these principles. The activities of the council during these early years centered on collecting data, assembling a demography library, surveying literature on reproductive physiology, and in the late 1950s establishing its own bio-medical laboratory.[140]

Beginning in the 1960s, the attention of the Council shifted. Those original principles of respect for individual health, custom, and education were subsumed by a sense of immediacy that led the organization to throw almost the entire weight of its operation into the research, development, study, and dissemination of contraceptives. Development and study of demography, non-reproductive public health, and agriculture, all of which were identified in the original mission and list of activities, took a less

[140] *The Population Council: A Chronicle of the First Twenty-Five Years, 1952–1977* (New York: The Population Council, 1978), 13, 15–16, 17, 21–37.

prominent role on the agenda of the council, and garnered less and less of the Council's funding. Why this shift in priorities? In part, by 1960 the social climate surrounding birth control had significantly changed. During the early 1950s it was still politically risky, even for the Population Council and a man like Rockefeller to associate too closely and publically with the birth control movement. The advent and widespread use of the birth control pill in 1960 had brought the topic of contraceptives out from under the bed sheets. Birth Control had been legitimized as both an appropriate area for scientific study and for public discussion.

The Population Council's shift in activities was also driven by an ever-increasing sense of immediacy. From the 1920s through the 1940s the annual increment of population growth (the number of people added to the global population each year) had hovered at some 20 million people. During the 1950s, the annual increment more than doubled to 50 million. Demographers projected all kinds of disastrous figures for the new millennium.[141] Frank Notestein, Population Council President, summed up the feeling of the moment as he reflected upon it almost fifteen years later, "I've never been in another situation in my life that made me feel so helpless."[142]

A third factor that contributed to the Council's increased interest in contraceptives was a change in how Americans understood health and disease, and bodies and nature. Postwar Americans' struggled to make sense of a technological world that seemed to be

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[141] World Population Growth, 1750–2050, United Nations Population Division, available at < http://www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf> (accessed June 2009).

[142] Frank Notestein, interview, August 12, 1974, quoted in Reed, *Private Virtue Public Vice*, 305.

falling apart, when around every corner lurked some unknown health danger caused by the very technological advances that made modern life possible. Fears over the effects of nuclear fallout manifested themselves in numerous ways. Contamination of milk supplies by Strontium-90, rumored to be from Russian atomic tests, contributed to a 35-million-quart decrease in the amount of milk Americans consumed in 1961.[143] The Thalidomide birth defect cases, although not wide-spread in the United States thanks to FDA refusal to approve the drug, still shook the public's faith in the ability of medical science to cure any ill. After 1962, public and scientific discourse on how human bodies, disease, and environment interacted had shifted as well. One of the catalyst's for this shift was the publication of Rachel Carson's *Silent Spring*. Carson's message reached huge audiences through its publication in condensed form in the *New Yorker* and through its airing as a prime-time CBS special. *Silent Spring* did much to popularize ecological principles of interconnectedness and the potential harm of human action on nature.[144]

Operating in this changed social and political environment of the 1960s, the Population Council could have headed in any number of directions. It could have invested in and studied programs that sought to curb population growth by reducing poverty. Or it could have thrown its energy into programs designed to increase female literacy—a course of action presented by demographer Irene Taeuber at the Council's founding conference in Williamsburg, and, which has since proven to be the *only*

[143] "The Milky Way," *Time* February 2, 1962.

[144] Linda J. Lear, "Rachel Carson's 'Silent Spring,'" *Environmental History Review* vol. 17, no. 2 (Summer 1993): 35–39.

population control measure directly correlated to decreasing fertility rates![145] Council members recognized that social reform was necessary to really diffuse the population bomb, but as council President Notestein lamented, "What can a white capitalist do in a very sensitive world?" What they did was to throw money and technology at the problem; contraceptive research and development became the priority of the organization.[146]

The Population Council's approach to overpopulation was neither like family planning programs that, at least partially, sought to give people contraceptive options and access to reproductive health services, nor was it an explicitly eugenic approach intended to improve certain races or contain undesirable ones. The primary objective of the organization was to treat the disease plaguing the earth: too many humans. The council sought to deal with the plague of humans like any invasive species, through the primary mode of biological control: interference with reproduction on a mass scale. Consequently, during this period the council's goal was to find and develop the cheapest, most reliable contraceptive that required as little education of health workers or individual users as possible.

The council took a direct and aggressive approach to the study and implementation of new contraceptives as its primary method of slowing population growth. Although intellectually, the Council recognized the problem of overpopulation as a result of cultural and social factors much more complicated than a simple fact of

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[145] "Global Decline in Female Illiteracy and Fertility," in Connelly, *Fatal Misconception*, 160, 376; and *The Population Council*, 9–17.

[146] Notestein quoted in Reed, *From Private Vice to Public Virtue*, 307.

fertility, in practice, it focused almost singularly on contraception. Between 1962 and 1963, the organization invested nearly $2 million dollars to support research on the "acceptability, effectiveness, and safety of IUDs." The total expenditures for the same period was $6 million—a full third of the entire budget went toward IUD research. [147]

In 1962, the council organized and funded an international conference on the IUD. Forty-eight participants who were either gynecologists or contraceptive experts attended. These professionals were primarily from the United States but China, England, Japan, Pakistan, Mexico, Egypt, Israel, and India were also represented. Participants shared their research and clinical experience with various IUDs, and discussed the technical, practical, and moral details of promoting the widespread use of IUDs, eventually coming to an informal conclusion that the IUD might in fact be the panacea to overpopulation. This conference laid the groundwork for the future research and development of IUDs, and the ideologies expressed there drove the way the devices were produced and consumed for the next twelve years.

One of the philosophies that informed IUD research and development was that an individual's health was expendable in the face of the global threat of overpopulation. Alan Guttmacher, still chief of the Department of Obstetrics and Gynecology at Mt. Sinai Hospital in 1962, acted as chairman of the discussion. The participants turned first to the issue of patients' medical histories and the prescription of IUDs. Guttmacher objected to making an "elaborate [medical] history a prerequisite to insertion of an intra-uterine pessary," and warned, "We dare not lose sight of our goal—to apply this method to large

[147] *Population Council,* 62 and "Annual Expenditures, 1952–1977," 210.

populations."[148] This sentiment of placing the interests of the global community first by treating large populations, even if it came at the expense of individual or even community-level health, was iterated by many of the conference participants. Dr. J. Robert Wilson, Professor and Chair of Temple University's Department of Obstetrics and Gynecology astoundingly admitted:

> "Now, obviously, if we are going to use these devices, they are occasionally going to be put in the wrong patient. . . perhaps the individual patient is expendable in the general scheme of things, particularly if the infection she acquires [from and IUD] is sterilizing but not lethal."[149]

The second driving philosophy was that above all, IUDs should be cheap, quick, and easy to insert. The fact that they might be difficult to remove, making them semi-permanent, was celebrated. Alan Guttmacher remarked in 1963 that "No contraceptive could be cheaper, and also once the damn thing is in, the patient cannot change her mind. In fact, we can hope she will forget it's there and perhaps in several months wonder why she has not conceived."[150]

Guttmacher's comment gets to the heart of what the population control movement dreamed the IUD could be: first inexpensive to produce, and second, not just an effective contraceptive, but a semi-permanent one. In stark contrast to the development of the Pill, which necessitated a sophisticated understanding about how hormones worked and could

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[148] Alan Guttmacher, "Discussion," in *Intra-Uterine Contraceptive Devices: Proceedings of the Conference*, ed. Tietze and Lewit, 122.

[149] J. Robert Wilson, "Discussion," in *Intra-Uterine Contraceptive Devices: Proceedings of the Conference*, ed. Tietze and Lewit, 124.

[150] Alan Guttmacher, "Summation," in *Intra-Uterine Contraception: Proceedings of the Second International Conference, October 2–3, 1964, International Congress Series*, ed. S. J. Segal, A. L. Southam, and K. D. Shafer (Amsterdam: Excerpta Medica, 1964), 217.

be manipulated, work on IUDs during the 1960s started with the assumption that the devices worked, how they worked was largely irrelevant to inventors and those who funded research and development. What the men, mostly white gynecologists, who developed new IUDs in the 1960s were most interested in was inventing new forms of the device that would better stay in place. This concern, as we will see, had a dramatic influence on the physical shapes of the devices. With only a limited understanding of what might increase their overall performance, researchers forged ahead with designs that did not necessarily improve effectiveness but that certainly were cheaper, more quickly manufactured, and more easily mass produced.

The pivotal 1962 conference not only articulated driving ideologies, it also produced some concrete plans. Perhaps the most lasting result of the meeting was a consensus among the forty-eight participants (only nine of whom were women) about the need for an organized program to collect data and statistics on IUDs. Operating on Population Council funding, this task fell to the National Committee on Maternal Health (NCMH) under the direction of Christopher Tietze.[151] A Jewish refugee of World War II, Tietze had emigrated from Hungary and had quickly become a leading figure in the

[151] The Committee on Maternal Health was organized in New York City in 1923 by the gynecologist Robert Latou Dickinson to study contraception. Dickinson and the CMH had a conflicted relationship with Margaret Sanger's Birth Control Clinical Research Bureau and the American Birth Control League, as the organizations vied for control and authority over contraceptive research. In 1930 the Committee on Maternal Health's name changed to the National Committee on Maternal Health and its role shifted to that of publisher and clearing-house for public information and education. By the time of Dickinson's death in 1950 the Committee was virtually inactive, and through the 1950s its association with the Population Council grew stronger. The Population Council made a "substantial" grant in 1957 to the NCMH to set up an office in New York under the leadership of Christopher Tietze with a board of directors chosen by the council; and in 1967, the NCMH was absorbed into the council's Bio-medical Division. Reed, *From Private Vice to Public* Virtue, 168–9; and *The Population Council*, 35–36.

study and promotion of birth control, and an expert on the IUD. To assess the effectiveness of the birth control method, Tietze set up the Cooperative Statistical Program (CSP) on the IUD, which evaluated clinical data on the contraceptive beginning in 1963 and continuing throughout the 1960s. Records of close to twenty-five thousand women from forty-one participating clinics, institutions, and private practitioners were accumulated. As Tietze had pointed out at the 1962 conference:

> The greatest obstacle to widespread adoption of intra-uterine contraceptive devices is the almost unanimous opposition of the medical profession. Therefore, our first objective must be to convince our colleagues outside of this room that intra-uterine contraception is a respectable medical procedure and not the devil's work.[152]

The CSP was designed to address that very problem. It worked. Over the course of the next six years, 3 million American women were fitted with IUDs. The program included investigations of four primary IUDs: the Lippes Loop, the Margulies spiral, the Brinberg Bow, and the Gräfenberg ring. Significantly, the CSP did not conduct research into the mode of action for various devices; rather it tracked the effectiveness and rates of expulsion and removal.[153]

All of the study and attention given newly developed IUDs could never have occurred without two discoveries outside the field of contraceptive research. The first of these advances was the discovery of penicillin as an antibiotic in 1939. An antibiotic

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[152] Tietze, "Discussion," *Intra-Uterine Contraceptive Device: Proceedings of the Conference, 1962*, ed. Tietze and Lewit, 123.

[153] Records of the Cooperative Statistical Program on the IUCD, folders 1771–1772, box 95, NCMH, RG IV3B4.4, Population Council I, Rockefeller Archive Center, Tarrytown, New York [hereafter RAC]; Christopher Tietze, "Intra-Uterine Contraception: Research Report," *Studies in Family Planning* vol.1, no. 7 (June 1965): 11–12; Tietze, "Intra-Uterine Contraception: Research Report," *Studies in Family Planning* vol. 1, no. 18 (April 1967): 20–24; and Tone, *Devices and Desires*, 268.

opened the opportunity for ethical testing and use of IUDs, for now, if studies found that the device increased incidents of PID, the infection could be treated. Although studies conducted outside of the United States by Gräfenberg, Ota, Ishihama, Oppenheimer and others had found low rates of PID in their clinical studies of the devices, few physicians in the United States were willing to embark upon clinical studies of IUDs for fear of increasing PID rates even after penicillin was readily available and PID could be treated. Not until IUD research received financial backing from the Population Council and the legitimacy of the NCHM Cooperative Statistical Program was the stage set to scientifically evaluate the real risk IUDs posed for PID.

The second technological advance that revolutionized birth control, just as it revolutionized much of modern culture was the advent of flexible thermo-plastics, specifically polyethylene. When first accidentally discovered in 1933, the waxy solid produced more of a nuisance than it did excitement. Twenty years later, its immense usefulness realized, and in the aftermath of an antitrust judgment against DuPont and Imperial Chemical Industries, dozens of manufacturing plants sprung up to produce the new miracle plastic, which promised limitless uses. So confident were manufacturers that polyethylene would yield fortunes, that among the eight largest of these companies, a quarter of a billion dollars had been invested in polyethylene production by 1954. Polyethylene was everywhere, from Tupperware, to Hula Hoops. In the 1960s, inventors took advantage of these new flexible “memory” plastics. Memory plastic could be molded into shapes, stretched into linear form, and would return to its original shape after being stretched. Why couldn’t the ubiquitous substance be used in the human body as well? In a saturated market, the price of polyethylene fell quickly, and created a prefect

atmosphere for any inventive gynecologist to experiment cheaply with new shapes for potential IUDs.[154]

And experiment they did! But not just because new plastics meant they *could*. During the 1960s and 1970s, designing, patenting, and especially securing funding for a new IUD became a mark of prestige within the profession of gynecology. IUD inventors were predominantly male, and gynecologists patented the bulk of devices. Even as late as 1973, one observer noted that "most of the approximately 200 IUD designs that have been or are being tried were conceived by amateur handymen and reduced to practice in little more than basement workshops. . . . Drug companies are essentially not involved."[155] The "amateur handymen" were in reality physicians, in fact, over 75 percent of IUD patents filed between 1960 and 1971 were filed by physician inventors. Furthermore, although the Population Council may have funded the clinical testing of promising new devices, neither it nor the Planned Parenthood Federation of American designed their own IUDs. In a kind of obvious feedback loop, IUD-prescribing gynecologists sought out devices designed by their peers, who they assumed possessed the specialized knowledge necessary to make the most effective, safe, and modern devices. Along with professional prestige, IUD inventors also had the potential to gain wealth. Margulies, for example, sold his patent and rights for a small fortune to Ortho

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[154] Martin Sherwood, "Polythene and Its Origins," *Chemistry and Industry* (March 21, 1983): 237; "The Polyethylene Gamble," *Fortune* 49 (February 1954): 134–37; and Jeffery L. Meikle, *American Plastic: A Cultural History* (New Brunswick, NJ: Rutgers University Press, 1995), 189.

[155] Earl L. Parr, "Contraception with Intrauterine Devices," *BioScience* vol. 23, no. 5 (May, 1973): 282.

Pharmaceutical (the major manufacturer of birth control pills).[156] The speed at which use of memory plastics created new contraceptive options is dramatically illustrated through the number of patents filed over three decades. In the 1950s, zero patents were filed for IUDs, in the 1960s there were thirty-five issued or filed. Of these thirty-five patents, thirty were for intrauterine contraceptive devices made from flexible, memory plastics. In the 1970s, the number of patents filed for IUDs or IUD-related inventions like inserters skyrocketed to over four hundred, nearly all of which were made predominately of plastic.

Without the availability of soft, flexible, "memory" plastics like polyethylene, the IUD could never have become the weapon of choice in the war on overpopulation. But for a specific IUD to become successful, it also required attention in the form of funding, study, and use. Although numerous devices were designed and used in the 1960s, the first models, those discussed at the 1962 conference and included in the NCMH's Cooperative Statistical Program, gathered the most clinical study, and became both the favorites of the population control movement and the public. As a result, until the Dalkon shield was marketed in 1971, those earliest devices—the Margulies Spiral, Lippes Loop, Brinberg bow, and Gräfenberg ring in metal and plastic form—were the most widely used and accepted by women around the world.[157]

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[156] Andrea Tone, "Violence by Design: Contraceptive Technology and the Invasion of the Female Body," in *Lethal Imagination: Violence and Brutality in American History*, ed. Michael A. Bellesiles (New York: New York University Press, 1999), 386.

[157] The Dalkon Shield was first available to women in 1971 and quickly outpaced the other IUDs in numbers of users. Between 1971 and 1974, 2.2 million women had been fitted for one in the United States alone. Tone, *Devices and Desires*, 277.

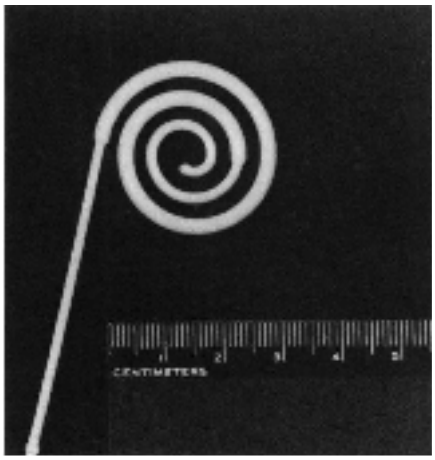

Figure 7. Margulies Spiral IUD.

Lazar Margulies's spiral was the first new IUD to emerge in the United States since Gräfenberg had introduced his coil ring. Margulies was born into a Jewish family in Poland, Graduated from the University of Vienna in 1921, and emigrated to the United States in 1941. He joined the staff at Mt. Sinai in 1954, just missing Gräfenberg's term there. In 1958, under the direction of Guttmacher, Margulies' device earned the distinction of becoming the first polyethylene IUD design to be clinically tested. Beyond the innovation of the spiral shape, Margulies contributed significantly to IUD technology by developing the first plunger inserter tube—this technique of insertion was much less painful than the older methods. The malleable plastic Margulies used to construct the spiral allowed his IUD to be placed in a thin tube by stretching it straight, once inserted the device returned to its original spiral shape.[158] Made entirely of polyethylene, the

[158] Ibid., 264.

spiral was just that: a 2-4 cm long squiggle with a protruding tail of plastic beads that was designed to allow women to feel if the IUD was in place.[159]

Taking his cues from the spiral, gynecologist Jack Lippes borrowed what worked and improved on the design. Almost immediately upon its invention, the Lippes Loop ascended to the throne as king of the contraceptive IUDs, the standard "against which all other devices were compared."[160] The loop could boast more statistical data on its effectiveness than any of the other intrauterine devices examined as part of the Cooperative Statistical Program. Perfecting the Lippes Loop was in many ways a collaborative effort between Lippes, the Population Council, and local plastic manufacturers.

[159] Margulies' first clinical studies used five sizes of the spiral ranging from just under 2 cm in diameter to just over 4 cm. The plastic bead tail was objectionable, as the hard plastic was both uncomfortable, even painful, for women and could be felt by male sexual partners during intercourse. L. C. Margulies, "Permanent reversible contraception with an intrauterine plastic spiral," in *Intrauterine Contraceptive Devices, Proceedings of the Conference 1962*, ed. Tietze and Lewit, 61–68; Lazar Margulies, 1965. Coil Spring Intra-Uterine Contraceptive Device and Method of Using, U.S. Patent 3,200,815, filed April 24, 1962 and issued August 17, 1965; and Hutchings, et al., "The IUD After 20 Years," 77–86.

[160] Hutchings, et al., "The IUD After 20 Years: A review of Worldwide Experience," 77–86.

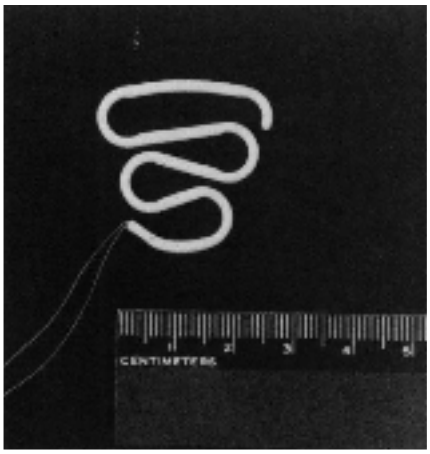

Figure 8. Lippes Loop IUD.

In 1961 the Population Council made a grant to support Lippes' research and clinical testing at the Planned Parenthood Clinic of Buffalo, New York. Financial support for the Lippes Loop development also came from Planned Parenthood of Buffalo, New York. Lippes' success with the loop was reported at the first IUD conference and the doctor filed a patent for his apparatus in 1963. The contraceptive "looped" through the uterus in a serpentine path from one side of the uterine wall to the other and back again until the cavity was filled. This shape mimicked the trapezoidal uterus, allowing the IUD to touch the endometrium in at least four places. The purpose of this design was to keep the device as securely situated in the uterus as possible, reducing the possibility of expulsion by keeping the uterine walls forced open. One of the biggest advantages of the loop was Lippes' addition of a soft nylon thread attached to the end of the plastic loop, which passed through the cervix and out the cervical os providing a "tail" that could be used to verify that the IUD was properly in place. Like the Margulies Spiral, and countless IUDs designed after the loop, Lippes' device was placed in the uterus using an inserter, which eliminated the need for cervical dilation. This narrow inserter held the

device stretched straight within; when the physician compressed the plunger, the loop spilled out and took its loop-back form in the uterus.[161]

The advantages of an inserter—namely that there was no need to dilate the cervix, it required less equipment and training, and was quicker and easier—was not lost on other gynecologists inventing IUDs and seeking Population Council funds and support for their own designs. For example, Jaroslav F. Hulka's description of his IUD claimed its objective was "to provide such a device in a form and with a tool necessary for its insertion by one having limited training."[162] Maurice Bakunin's IUD was designed to be "easily inserted without requiring special tools or the skills of trained personnel."[163] Compared to the pill or diaphragm, in which physician control and attention to individual women was emphasized as desirable, the IUD was a hands-off contraceptive. The Population Council sought a magic formula: easy, cheap and fast mass production, plus simple insertion that required little or no additional attention, equaled a decline in world population.

Beyond providing new IUD forms that could be easily inserted, polyethylene could fulfill this magic formula. The plastic, especially compared to gold or silver used in earlier pessaries, was inexpensive. Plastic also lent itself to mass production. In attempts to secure Population Council money, inventors were as savvy about addressing the magic formula in their patent descriptions and grant applications as they were about mentioning

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[161] Jack Lippes, Intra-Uterine Device, U.S. Patent 3,250,271, filed April 29, 1963 and issued May 10, 1966, 1–6.

[162] Jaroslav F. Hulka, et. al, Contraceptive Intra-Uterine Devices, U.S. Patent 3,407,806, filed August 24, 1966 and issued October 29, 1968, p. 1 lines 34–41.

[163] Maurice I. Bakunin, Intrauterine Contraceptive Device, U.S. Patent 3,405,711, filed July 22, 1966 and issued October 15, 1968, p.1 lines 26–28.

the ease of insertion. Hulka's IUD was designed "to provide such a device which is both simple and inexpensive to manufacture so that widespread distribution can be undertaken at moderate cost."[164] Bakunin, likewise claimed his device was "especially simple and economical to manufacture."[165] Marc Chaft designed an IUD for which his patent application made sure to mention that the device could be "mass-produced at relatively low cost."[166]

But no device perfected the quantity-speed-cost formula as well as the Lippes Loop. Immediately after the 1962 IUD conference, Lippes moved quickly to get his devices manufactured. Already by mid-1963 he had cemented a relationship with a local plastics plant, Hallmark Plastics, Inc., and perfected a manufacturing process. The polyethylene used for the loop was Alathon 20, supplied to Hallmark by DuPont. Pellets of polyethylene were mixed in a fibre drum with barium sulfate powder (so that the IUDs could be located by X-ray if "lost"), the mixture was then fed through a heated extruder in which the plastic was melted and the barium sulfate incorporated. The mixture was cooled and then granulated, and re-mixed with barium powder once again—this process was repeated a total of four times. The polyethylene mixture was then molded using an

[164] Jaroslav F. Hulka, et. al, Contraceptive Intra-Uterine Devices, U.S. Patent 3,407,806, filed August 24, 1966 and issued October 29, 1968, p. 1 lines 31–33.

[165] Maurice I. Bakunin, Intrauterine Contraceptive Device, U.S. Patent 3,405,711, filed July 22, 1966 and issued October 15, 1968, p.1 line 33.

[166] Marc E. Chaft, Intra-Uterine Contraceptive Device and Device for Inserting the Same, U.S. Patent 3,410,265, filed December 6, 1965 and issued November 12, 1968, p. 2 lines 36–37.

injection-molding process.[167] The "tails" made of polyethylene thread were hand-tied at a second location, Goodwill Industries, and at the rate of one hundred threaded loops per hour. The manufacture of inserters was more complicated, as it required two molds, plastic tubing that had to be purchased from an outside source, and a six-part assembly process. Lippes created four sizes of the loop to accommodate different uterus sizes. The first manufacturing set-up at Hallmark was a mold that produced one loop of each size through an injection-molding process. Eventually, these molds were replaced with molds that produced uneven numbers of sizes but numbers of each size that better correlated to the Population Council's needs (more of the smaller sizes were needed for the programs in Taiwan and Korea as these women had smaller uteri).[168]

The production process was a quick one. If machines had to be set for new molds, there was about a two-week lead time, but after set-up was complete, 100,000 loops could be produced in a month. The loops were inexpensive too. Hallmark and the Council negotiated a price of 10 cents each for the loops and $1 per inserter (four inserters to each one hundred loops made the total price 14 cents each). By establishing early on a relationship with the most important IUD funding organization, the Population Council, Lippes was able to ensure that his device was widely used. In fact, until the Dalkon Shield came on the market 1971, the Lippes Loop was the most commonly used IUD both in the United States and abroad. The Lippes Loop, Margulies Spiral, and their less

[167] Paul H. Bronnenkant, Pres. Hallmark Plastics Inc. to Clarkson Hill, Director of Administration, Population Council, February 17, 1964, folder "Lippes Loop – PC Policy," box 1, RG Administrative Files, Population Council II, RAC [unprocessed].

[168] Clarkson Hill, Notes: Buffalo Trip to Inspect Manufacture of Lippes Loops. December 20, 1963, folder 2253, box 123, RG IV3B4.6, Population Council Collection, RAC.

well-known friends the Brinberg Bow, and Gräfenberg's standard ring completely cornered the IUD market during the 1960s.

Other devices sprouted up quickly as the reports of the NCMH Cooperative Statistic Program were published and IUDs gained acceptability and use. While Margulies and Lippes had attempted to keep their devices secure in the uterus by filling as much of the cavity as possible, other inventors took a much more violent approach to the issue of preventing expulsion. Historian Andrea Tone has documented some of the language invoked by IUD inventors that, as she argues are "metaphors of violence to trumpet the power and control that masculine technologies wielded over women's uteri."

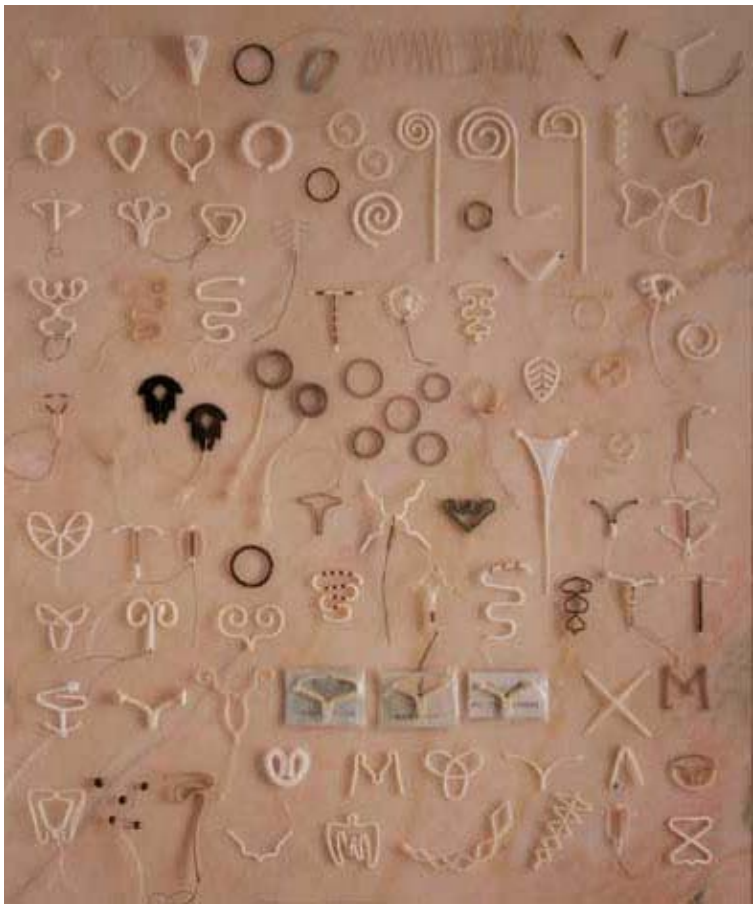

Figure 9. Plastic and metal IUDs.

Tone points to such evidence as advertisements, patents, and descriptions of devices with "barbed pieces," or a "plurality of spurs" all designed to anchor the device into the uterine wall. Aggressive IUDs did battle with ovum, sperm and female body as they "strategically disposed," "shielded," or "pieced" the uterus.[169] While as Tone shows, violence against the female body was certainly present in many of the IUD designs, they were also animalistic. Inventors portrayed the features of their devices as tails, teeth, ears, arms, and jaws. Gynecologists explained IUD insertion as "creeping," and "crawling" into the uterus. For example, in his patent description M.I. Bakunin wrote that once his device was inserted, "its arms, having bulbous extremities, slither upward into the fallopian region."[170] Whether the mechanism was violent, animalistic, or both, for IUDs the challenge was still the same: to resist expulsion. Devices that failed to stay put in the uterus, did not survive. The most successful of IUDs, those like the Lippes Loop and Margulies Spiral, flourished without massacring the female body.

In fact, the IUD success stories of the 1960s really owed their existence to how well they were able to fill the formula established by funding organizations like the Population Council. The modern IUD developed within a framework that valued low cost production, and convenience. Gynecologists earned prestige by designing new IUDs, and not just in the form of respect from their peers for working in this cutting-edge field, but

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[169] Tone, "Violence by Design: Contraceptive Technology and the Invasion of the Female Body," in *Lethal Imagination*, 373–91.

[170] Maurice I. Bakunin, Intrauterine Contraceptive Device, U.S. Patent 3,405,711, filed July 22, 1966 and issued October 15, 1968, p. 1 line 33. See also Marc E. Chaft, Intra-Uterine Contraceptive Device and Device for Inserting the Same, U.S. Patent 3,410,265, filed December 6, 1965 and issued November 12, 1968; and Jaroslav F. Hulka, et. al, Contraceptive Intra-Uterine Devices, U.S. Patent 3,407,806, filed August 24, 1966 and issued October 29, 1968.

also in the form of potential wealth. Added to these rewards was a kind of moral prestige that came with helping to solve what they perceived as the greatest threat to the planet: overpopulation. This system of work and reward, coupled with the powerful discourse of population control worked to shape modern IUDs. Weather innocent squiggles or violent and animalistic creatures, the appeal of the IUD to the population control movement that was funding the devices' development, manufacture, and widespread use, was that IUDs allowed for the relatively easy, effective, and lasting control of female reproduction. Once inserted, women could not easily or comfortably remove the IUD on their own.

Chapter 4

FLUSHED: TREATING THE WATER FOR CONTRACEPTIVES, 1990s–PRESENT

Almost everyone has a story about stumbling, unpleasantly upon a used condom in some unexpected public space. Not too long ago, I had my own series of such unfortunate encounters. Driving into Santa Cruz, California, on a long road trip, my friend and I stopped in a business complex parking lot on the outskirts of town to stretch our legs and satisfy his boredom-induced cigarette craving. As I stepped out of the rental car, there, scattered at my feet, was not just one, but three used condoms, pathetically scrawled out, bodiless against the dirty pavement (Figure 10). The first thing I did was to take notice of where I was, what was around me. I instinctively began to attempt a plausible reconstruction of the story of how those condoms got *there*, in the parking lot of what seemed to be respectable businesses—a law office, a dentist, a CPA. And only days later, craving escape into nature, we scampered down the beach cliffs to sit close to the ocean and far from other humans. I kneeled and put my face down close to a tide pool full of neon urchins, pulsating pastel anemones, and . . . used condoms? Yes, there tangled up in the craggy rock and swishing gently against velvet algae was a condom. As my companion rather inelegantly observed, "biologicals" (semen) remained visible in the reservoir tip of that device caught in the tiny cliff-side reservoir of strange little sea creatures. Again, I was forced to think about how it might have gotten there, and wondered more, what other sex trash was in that water?

Figure 10. Used condoms strewn about in a Santa Cruz, California, parking lot, 2008. Photograph by John B. Weller.

In this chapter, I trace the environmental consequences of the disposal of contraceptives, pointing out disposal myths, exploring real problems that have resulted from contraceptive trash, and examining the human reactions to contraceptive waste. I argue that although there are real environmental impacts of contraceptive disposal, Americans' reactions to used contraceptives in natural places have been disproportionate, exaggerated, and often oversimplified.

Contraceptive waste forces humans to confront private acts in public spaces. Contraceptive trash compels us to re-examine our relationships with nature through our most animal, biological, and natural function—reproduction. The histories of condoms and hormonal birth control are particularly fertile ground for exploring issues of disposal, as they represent the extremes in the visibility of contraceptive waste. Of all

contraceptives, the waste produced by used condoms is perhaps the most visible. They are cheap, effective, require little foresight or skill to use, and are normally used only once before they are disposed. At the opposite extreme are hormonal birth control methods, the disposal of which is practically invisible, and until recently has gone unnoticed. The two methods together comprise an overwhelming majority of the profits in U.S. contraceptive sales and are the top two most frequently used methods of birth control among Americans. Over the last twenty years, the issue of the disposal of these highly used contraceptives has become one of increasing concern and attention.[171]

Where and how condoms are disposed of is more than a mere question of unsightly litter in strange public places. Condom disposal has been the source of much public attention and millions of dollars spent in clean-up projects. My encounters at the parking lot and the tide pool helped me understand why the image of condoms littering lakes, oceans, beaches, and clogging up water treatment plants has captured the attention of environmentalists and the general public alike and why condom litter has spawned its own persistent myths. The most widely circulated of these stories is that of the "Great Condom Reef." Floating about somewhere in the South Pacific, as the spurious online legend goes, is a huge indestructible reef of condoms. Some iterations of the story even include references to non-existent marine biologists and pseudo-scientific explanations of

[171] W. D. Mosher et al., "Use of Contraception and Use of Family Planning Services in the United States: 1982–2002," Advance Data from Vital and Health Statistics, No. 350. , 2004; and L. J. Piccinino and W. D. Mosher, "Trends in Contraceptive Use in the United States: 1982–1995," *Family Planning Perspectives*, vol. 30, no. 1 (1998): 4–10, 46. Choice of preferred contraceptive varies greatly depending on the age, ethnicity, and class of the user. For example, women over thirty-five rely more heavily on sterilization for contraception than the Pill (as do women under thirty), and Black and Hispanic women of all ages have higher use rates for sterilization than do white women.

how the "reef" holds together. The story is, of course, absurd but the willingness of so many to believe and circulate the fable belies a truth: many people flush condoms, many know they should not, and most are not really sure what happens after the swirl of water takes the contraceptive devices down the drain and "away."[172]

There is plenty of real evidence about where used condoms end up. Britain's Marine Conservation Society has estimated that since 1998, each year in the U.K. alone anywhere from 61–100 million condoms were flushed down toilets, with many of those eventually finding their way to beaches, lakes, rivers, and the world's oceans.[173] The Ocean Conservancy's National Marine Debris Monitoring Program, which collected and monitored debris on U.S. coasts from 2001–2006, reported that condoms made up 0.5 percent of the total debris collected.[174] Half of one percent seems almost negligible, and compared to some of the debris collected such as syringes or bleach bottles, condom waste is hardly the most hazardous of items that litter beaches. Yet the presence of

[172] For the condom reef myth reproduced online, see, for example, <http://www.freewilliamsburg.com/archives/2005/05/condoms_create.html> (accessed May 2010); and http://web.ukonline.co.uk/thursday.handleigh/unusual/other/condom-reef.htm> (accessed May 2010).

[173] Marine Conservation Society, "The Evidence," Backing Paper, Beachwatch 2008, available at <http://www.mcsuk.org/downloads/pollution/beachwatch/4%20Beachwatch%202008%20Backing%20Paper.pdf> (accessed June 2009).

[174] The Ocean Conservancy, "National Marine Debris Monitoring Program Report" (Ocean Conservancy, 2007), Data Table 3, p. 49. Along the beaches monitored by the program's volunteers, only 1,296 condoms were collected.

condoms in beach litter has remained a headliner in news articles and the clean-up of the contraceptive has been a focus not only on beaches, but in lakes and rivers as well.[175]

Beginning in 2003, Lake Michigan and the city of Milwaukee were entangled in a condom controversy, the two-year resolution of which would cost the city almost $2 million. The story begins with a single fisherman, who during a spring outing discovered "a messy slick of hundreds of used condoms" floating in Milwaukee Harbor. Within weeks of the fisherman's report to city officials, the incident had made front-page news and sparked public outrage. Lake Michigan is a source of drinking water for millions, is a well-loved recreation spot revered by Milwaukeeans, and it is the ultimate receiving water of discharges from Milwaukee Metropolitan Sewerage District (MMSD) wastewater treatment plants. City officials and the media alike turned to the MMSD's Jones Island Wastewater Treatment Plant as the most likely culprit of this condom slick.[176]

Located on a narrow peninsula on Lake Michigan's shore near the port of Milwaukee, Jones Island was the city's first modern treatment facility. Late-nineteenth- and early-twentieth-century Jones Island functioned as a prosperous fishing village, settled mostly by Polish Kaszubs, emigrants from the Baltic seacoast. Although Jones Island grew to be the center of commercial fishing in Wisconsin, the inhabitants were displaced when in the 1920s the city sewerage commission chose the island for the site of

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[175] See, for example, "Sun, sea . . . and 100 million condoms—the bad news about British beaches" *Water Services (Fuel and Metallurgical Journals)* vol. 102, no. 1226 (1998): 4.

[176] Marie Rohde, "Condoms floating in Milwaukee Harbor spark angry dispute," *Milwaukee Journal Sentinel* June 16, 2003, p. 1 sec. A.

its first waste water treatment plant. At the time it was opened in 1925, Jones Island was the largest treatment center in the United States and was the first to use microorganisms to clean wastewater. The plant was expanded in 1934, again in 1952, with other major updates to the system throughout the second half of the twentieth century.[177]

Despite Jones Island's long history of effective wastewater treatment, the condom slick story would not go away. Milwaukeeans demanded to know the source of the insulting rubbers, and officials scrambled to locate the responsible parties. The MMSD blamed the private company contracted to operate the treatment plant, while the private company, United Water, blamed a faulty screening system. Complicating the condom debacle was an already damaged public image of the MMSD. Only one month before the "condom slick" was discovered, United Water had accidentally released 2 million gallons of partially treated effluent into the harbor (the sewerage district was cited by the Department of Natural Resources for the mishap).[178] This calamity, along with concern over a recent update to the screening system at a cost of $8.5 million, put both MMSD and United Water on the defensive. The condom incident pushed an already

[177] On the history of Jones Island, see Ruth Kriehn, *The Fisherfolk of Jones Island* (Milwaukee, Wis.: Milwaukee County Historical Society, 1988); and John Gurda, *Change at the River Mouth: Ethnic Succession on Milwaukee's Jones Island, 1700 to 1922* (master's thesis, University of Wisconsin-Milwaukee, 1978).

[178] Jeff Schilling, MMSD Contract Compliance, telephone conversation with author, January 19, 2010. On the May 2003 release of sewage and response by MMSD, see Marie Rohde, "Review raises concerns about sewerage upkeep, but contractor fares well overall," *Milwaukee Journal Sentinel* June 24, 2003, p. 1 sec. B

dissatisfied public upon the MMSD, which at that very point was attempting to better its public image and understanding of the water treatment process.[179]

The recent and expensive upgrades to the plant had integrated a screening system into a four-step treatment process. The first step was the screening system, which filtered out solid pollutants through screens made of metal bars placed three quarters of an inch apart. Most debris was trapped here, but smaller items or those that were flexible and thin, like condoms, could slip right through. The second stage was the primary clarification tanks where heavier debris sank to the bottom and where workers using skimmer nets manually removed "floatables" from the surface. Not all of the floatables, however, rose to the surface of the tanks: condoms were notorious for evading the skimmer nets. The contraceptives too often remained suspended in the middle of the water tanks and followed the current through to the third and fourth treatment stages of biological treatment and disinfection. Finally, with treated water, a school of fish-like condoms swam out into the harbor.[180]

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[179] For a concise review of the problems in public image and major incidents contributing to the MMSD image at the time, see Don Theiler, Division Director, King County Department of Natural Resources and Parks Wastewater Treatment Division, prepared for Brown and Caldwell, "United Water Performance Evaluation Final Report," TS-2386, June 20, 2003, p. ES-6, available at: <http://www.mmsd.com/docs/about/uws_audit_summary.pdf> (accessed August 2009). The report concluded that Jones Island compared "favorably to wastewater systems of similar size and complexity across the nation. The treatment performance levels place the system in the top rank of systems in the nation." Marie Rohde, "Condoms floating in Milwaukee Harbor spark angry dispute," *Milwaukee Journal Sentinel* June 16, 2003, p. 1 sec. A.

[180] Jeff Schilling, MMSD Contract Compliance, telephone conversation with author, January 19, 2010; and MMSD, "Treatment Process," <http://v3.mmsd.com/TreatmentProcess.aspx> (accessed December 2009).

With local newspapers reporting on the condom catastrophe almost weekly, MMSD moved quickly to capture the escapees. Temporary measures to catch condoms were instituted almost immediately. MMSD created a position for an extra worker to stand guard with a pool skimmer at the chlorine tanks (the forth and final stage of treatment) and scoop out any condoms he might observe. Over the course of 551 days, the worker skimmed out just over 14,000 condoms—that is roughly 25 condoms per day. For the condoms that did not rise to the surface and still managed to escape into the harbor with the discharge, a forty-three-foot research boat was rented to scan the lake for errant condoms. The boat collected an average of eight condoms per day.[181]

Over eighteen thousand condoms later, and almost four months after the fisherman cited the condom "slick," the issue still raged on. Prompted by threats of "aggressive" prosecution from Wisconsin Attorney General Peg Lautenschlager and the Department of Natural Resources, the MMSD moved to approve a more satisfactory fix for the wayward condoms.[182] The solution MMSD implemented was a $1.5 million system of nets to catch the condoms before they reached the harbor. Twenty-four large mesh bags were installed on the chlorine tanks at the final treatment stage of disinfection. This innovative approach, the only system of its kind designed specifically to catch condoms, was functional by mid-2004 but soon proved to have its own set of problems. In May and April 2004, Milwaukee and the surrounding areas were flooded with

[181] Steve Schultze, "MMSD, in turnabout, moves to block condoms from lake," *Milwaukee Journal Sentinel* September 23, 2003, p. 1 sec. B.

[182]Steve Schultze and Marie Rohde, "Commission votes for $2 million project after hearing warning from attorney general," *Milwaukee Journal Sentinel* September 23 2003, p. 1 sec. B.

torrential downpours of rain. The storms caused the treatment plant to be quickly inundated by massive amounts of water from storm drains, which burst through the nets and ripped the frames loose from their seals. Even after the mesh catchments were re-sealed and better secured for heavy and unexpected flows, algae constantly clogged the nets. The algae collected so quickly in the mesh that nets had to be replaced once every few weeks. Replacing the condom catchers was no small undertaking: loaded with algae, the nets weighted up to eight hundred pounds and required a "truck-mounted crane and a crew of three" to remove.[183]

The final and permanent solution to the stray condoms was an upgrade to the facility that began in mid-2005 and was almost complete in late 2009. The upgrade, part of a capital project that was not initiated solely to catch condoms, included the replacement of the screening bars at the first stage of treatment. The new screening system contains bars placed closer together in order to catch more of the small debris and came at a cost of $23 million. Any condoms coming into the system would be removed with all the other debris and transported to landfills.

The occurrence of condoms in wastewater treatment tanks and in the harbor was common enough that, even before the controversy erupted, plant workers had given the floating contraceptives a name: "silver fish." In fact, so much do condoms in the water resemble fish, that upon the fisherman's initial report, many wondered if he had seen a

[183] Jeff Schilling, MMSD Contract Compliance, telephone conversation with author, January 19, 2010; Steve Schultze, "MMSD, to set nets to catch condoms," *Milwaukee Journal Sentinel* October 21, 2003, p. 1 sec. B; and Steve Schultze, "Condom control—at a price," *Milwaukee Journal Sentinel* May 12, 2005, online post available at <www.jsonline.com/news/metro/may05/325680.asp> (accessed February 2006). The total Cost of the nets was $1.5 million, with an additional $120,000 for replacement nets.

school of alewives (a common herring found in the lake) and mistaken them for condoms. No one other than the fisherman ever reported seeing the slick of "silver fish," but the accusation alone was enough to warrant the city's $2 million dollar fishing trip. Rather than spending money on educating Milwaukeeans on proper condom disposal methods, the city spent $18.09 per condom to remove the flushed items either by skimmer, boat, or the temporary nets. Interestingly, at no time during the caper of the escaped condoms did discussions surface about the biodegradability of condoms, about their proper disposal, or about whether their use was natural or ethical. This, as we will see, has not been the case for the disposal of hormonal birth control, the presence of which in waterways has spawned not only much scientific research, but also much debate about their moral and ethical use.[184]

While flushed condoms have materialized as "silver fish" polluting waterways, the hormones from birth control pills and other hormone-based contraceptives have shown up *in* fish. Unlike condoms, sexual waste we can see, the disposal of the Pill is hidden from immediate sight. Other than the packaging, there is nothing to throw out or discard of properly, but the over 100 million women who take birth control pills do dispose of the contraceptive, even if they are unaware of it. The synthetic hormones found in birth control exit women's bodies through urine and, at least until very recently,

[184] Marie Rohde, "Condoms floating in Milwaukee Harbor spark angry dispute," *Milwaukee Journal Sentinel* June 16, 2003, p. 1 sec. A; Marie Rohde, "Review raises concerns about sewerage upkeep, but contractor fares well overall," *Milwaukee Journal Sentinel* June 24, 2003, p. 1 sec. B; Steve Schultze, "MMSD, in turnabout, moves to block condoms from lake," *Milwaukee Journal Sentinel* September 23, 2003, p. 1 sec. B; Steve Schultze, "MMSD, to set nets to catch condoms," *Milwaukee Journal Sentinel* October 21, 2003, p. 1 sec. B; and Steve Schultze, "Condom control—at a price," *Milwaukee Journal Sentinel* May 12, 2005, online post available at <www.jsonline.com/news/metro/may05/325680.asp> (accessed February 2006).

these hormones were not processed by water treatment; they were, like the flushed condoms, released with effluent into U.S. streams, lakes, and into oceans. Although American women in large numbers have used the Pill since it was first approved by the FDA for contraception in 1960, it was not until the early 1990s that researchers in the United States began to suspect birth control of causing disturbing changes in the reproductive organs of fish and amphibians.[185] From 1999–2009, the levels of birth control hormones in U.S. waterways and the effects of hormones on aquatic life were studied with increasing intensity. Likewise, the results of this scientific study became increasingly complex. Despite the intricacy of scientific findings, the media and public response has tended to dramatically simplify the cause and effects of birth control on nature.

To understand how synthetic birth control hormones end up waterways, one must understand something about how those hormones work in human bodies. Hormonal birth control inhibits ovulation by feeding the body synthetic hormones that mimic those naturally produced by the body. Four hormones comprise the chorus that regulates ovulation, each of these hormones crescendo and decrescendo on cue, singing to one another in a complex harmony. When the levels of progesterone have reached their

[185] Odd sexual abnormalities and diminishing alligator populations in Florida led researchers to connect these occurrences to similar findings in fish populations in British rivers. Researchers first suspected birth control estrogens to be the culprit, on these early suspicions see, Deborah Cadbury, *Altering Eden* (New York: St. Martin's Press, 1999), 122–30; Sheldon Krimsky, *Hormonal Chaos: The Scientific and Social Origins of the Environmental Endocrine Hypothesis* (Baltimore, Md.: Johns Hopkins University Press, 2000), 65–66; Nancy Langston, "Gender Transformed: Endocrine Disruptors in the Environment," in *Seeing Nature through Gender*, ed. Virginia J. Scharff (Lawrence: University Press of Kansas, 2003), 129–31; and Langston, *Toxic Bodies: Hormone Disruptors and the Legacy of DES* (New Haven, Conn.: Yale University Press, 2010).

lowest point, follicle stimulating hormone (FSH) rises, which stimulates the maturation of ova. Each encapsulated in its own follicle, the maturing eggs begin to produce estrogen.[186] As estrogen rises, it both encourages the full maturation of the ovum and triggers a surge in luteinizing hormone (LH), which tells the mature egg to burst from the follicle. The follicle, now empty and called the corpus luteum, releases progesterone as the egg travels to the uterus. The progesterone prevents other ova from escaping their follicles, thickens the endometrium for implantation, and makes a hospitable environment for sperm by altering the viscosity of cervical mucous. Hormonal contraception levels FSH and LH by dosing the body with synthetic progesterone and estrogen, preventing the trigger of FSH and thus of egg maturation or ovulation. Secondarily, the progestin in birth control alters the cervical mucous, inhibiting the travel of sperm through the cervix, and alters the endometrium to prevent implantation.[187] The most widely used birth control pills on the market today are combined oral contraceptive pills: they contain both synthetic estrogen (ethynylestradiol) and progestins. Depo-Provera, Norplant, mini-pills, Patches, and the NuvaRing contain only progestin.[188]

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[186] Three kinds of estrogens are produced in the female body: estradiol, which is the most abundant and is related to ovulation, sexual development, pregnancy, bone density, and mood; estriol, which is primarily associated with pregnancy; and estrone, which is produced during menopause.

[187] Synthetic progesterone, though there are several distinct chemical versions, are collectively known as *progestins*. Both natural progesterone and progestins belong to a larger classification of hormones, as do estrogens, known as *progestagens*.

[188] Progestin-only contraceptives affect the mucus around the cervix and make it harder for sperm to enter the uterus. The progestins also affect the transport of the egg through the fallopian tubes. The effectiveness of progestin-only birth control is still high at 87–99.7 percent but is slightly less reliable than combined oral contraceptives. On the history of Norplant, which was developed by the Population Council during the 1970s, see Barbara Mintzes, Anita Hardon, and Jannemieke Hanhart, eds., *Norplant: Under Her*

The developmental history of the Pill stretches back to the earliest research on hormones and endocrinology conducted in the late nineteenth century when researchers first discovered the mysterious workings of hormones, or "internal secretions" as they were then named.[189] In the 1920s and 1930s, sex hormone knowledge advanced by leaps

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Skin (Amsterdam: Women and Pharmaceuticals Project, Women's Health Action Foundation and WEMOS, 1993).

[189] Scholars across many disciplines have researched the developmental and social histories of the birth control pill. The topic has warranted a great deal of study because of the Pill's unique position as the first drug to be created and taken for purposes other than to treat an illness, and because its social impacts were so far reaching. Although an in-depth history of the development or social impacts of the Pill are not the focus of my study, unpacking the meanings and consequences behind the drug's disposal does require situating the Pill in its larger historical context. The historical sketch of the Pill's development that I provide in this study is synthesized from the following works: Elaine Tyler May, *America and the Pill: A History of Promise, Peril, and Liberation* (New York: Basic Books, 2010); Bernard Asbell, *The Pill: A Biography of the Drug that Changed the World* (New York: Random House, 1995); Lara V. Marks, *Sexual Chemistry: A History of the Contraceptive Pill* (New Haven, Conn.: Yale University Press, 2001); Vern L. Bullough, *Science in the Bedroom: A History of Sex Research* (New York: Basic Books, 1994); Elizabeth Siegel Watkins, *On the Pill: A Social History of Oral Contraceptives, 1950–1970* (Baltimore, Md.: Johns Hopkins University Press, 1998); Beth Bailey, *Sex in the Heartland* (Cambridge, Mass.: Harvard University Press, 1999); Paul Vaughan, *The Pill on Trial* (New York: Coward-McCann, Inc., 1972); Andrea Tone, *Devices and Desires: A History of Contraceptives in America* (New York: Hill and Wang, 2001); Loretta McLaughilin, *The Pill, John Rock, and the Church: The Biography of a Revolution* (Boston: Little, Brown and Co., 1982); Linda Gordon, *The Moral Property of Women: A History of Birth Control Politics in America* (1976; reprint, Chicago: University of Illinois Press, 2002); Norman E. Himes, *Medical History of Contraception*, forward by Robert Latou Dickinson, preface by Christopher Tietze (1936; reprint, New York: Schocken Books, 1970). On the history of hormone research and the development of synthetic steroids, see Carl Djerassi, *Steroids Made it Possible* (Washington, D.C.: American Chemical Society, 1990); Gabriela Soto Laveaga, *Jungle Laboratories: Mexican Peasants, National Projects, and the Making of the Pill* (Durham, N.C.: Duke University Press, 2009); Gabriela Soto Laveaga, "Uncommon Trajectories: Steroid Hormones, Mexican Peasants, and the Search for a Wild Yam," *Studies in History and Philosophy of Biological and Biomedical Science* vol. 36 (2005): 743–60; Norman Applezweig, *Steroid Drugs* (New York: McGraw-Hill, 1962); and Nelly Oudshoorn, *Beyond the Natural Body: An Archeology of Sex Hormones* (London: Routledge, 1994).

and bounds when scientists first isolated naturally occurring estrogen and progesterone. Research charged forward at amazing speed with experiments in rats and rabbits that revealed the two hormones could either induce *or* inhibit ovulation. Well before developmental research in the United States was conducted on hormonal birth control, scientists around the globe worked with natural hormones harvested from animals to develop methods of producing the hormones and acceptable modes of human ingestion. During the late 1920s and early 1930s, the Austrian physiologist Ludwig Haberlandt not only proved in experiments that progesterone could inhibit ovulation, but secured a contract with a Hungarian company that began manufacturing a natural progesterone contraceptive. Human testing was conducted in the mid-1930s, although the results were never published.

The progress of the work of Haberlandt and other pioneers, however, was slowed and lacked viability in the marketplace because of social disapproval, and the expense and difficulty of acquiring hormones for research. Similar to condoms, which were connected to the meat industry through the use of intestine casings to make sheaths, early research on hormonal contraception was linked to the meat industry, which harvested the sex organs of slaughtered pigs and cows for the extraction of natural hormones. However, the amount of natural hormone that could be extracted from animal organs was too small to be useful in the mass production of hormonal medication—80,000 sows' ovaries were needed for only a tiny fraction of estrogen.[190]

Spurred by steroidal hormone research for purposes other than birth control (for example to treat diabetes, arthritis, or menstrual problems), pharmaceutical companies

[190] Marks, *Sexual Chemistry*, 61.

sought out new and less expensive methods of producing progesterone, looking specifically for methods to create synthetic progesterone. The first breakthrough in the production of synthetic progesterone occurred when, in the late 1930s, scientists discovered they could synthesize progestin from cholesterol, which was abundant in, and easily harvested from, fish oils and animal fats, brains, and the spinal fluid of mammals.

In the next decade, the American organic chemist Russell Marker became the first to perfect a method for the production of a synthetic progesterone compound derived from a plant, the sarsaparilla root. Marker's discovery led him on a hunt for a plant that could perform even better than the sarsaparilla. He found it in Mexico, first in the *Cabeza de negro* root and later in the Mexican yam *Discore*a or *Barbasco* plant, which yielded thrice as much of the necessary chemicals to produce progestin as had the *cabeza de negro*. Realizing the potential of his discovery, Marks set up the company Syntex to harvest the yam, produce the synthetic progesterone, and sell it to major pharmaceutical companies, which by then were in need of progestin supplies for the production of cortisone, a highly effective anti-arthritic steroid. Syntex hired Carl Djerssai, a Jewish American chemist who, together with Marks and other scientists, developed the yam-based synthetic progesterone norethisterone. In the 1960s, during the height of its norethisterone production, Syntex harvested 10,000 tons of yams from the Mexican jungles weekly.[191] On the heels of norethisterone development, the American pharmaceutical company G. D. Searle created a close competitor progestin,

[191] On the Barbosca trade see, Soto Laveaga, *Jungle Laboratories*, and her article, "Uncommon Trajectories: Steroid Hormones, Mexican Peasants, and the Search for a Wild Yam."

norethynodrel. These two synthetic hormones would dominate the contraceptive pill industry for years after the Pill's development and FDA approval.

When Margaret Sanger secured the funds of Katherine McCormick, a wealthy supporter of female-controlled birth control, for the purposes of research into a contraceptive pill, she was able to hire Gregory Pincus, a sexual physiologist who had worked at Searle, to head the research. During the early 1950s, Pincus experimented with the two progestins developed by Syntex and Searle, finding them both to be effective contraceptives. Pincus, together with physician John Rock accidentally discovered that the presence of estrogen in the progestins helped to reduce break-through bleeding. From this discovery the first combined oral contraceptive, Enovid, was born. Upon its approval for contraceptive use by the FDA in 1960, millions of American women began using the Pill. Health scares that erupted during the late 1960s and early 1970s concerning the Pill's dangerous side effects such as thrombosis, migraines, and heart disease, temporarily reduced Pill usage. Pharmaceutical companies responded by reducing the dosage of hormones in the Pill, particularly of estrogen, which helped to mitigate significantly against these potential dangers. In fact, research conducted during the 1980s and beyond showed the Pill to have positive health benefits, such as reducing the risk of ovarian and uterine cancers. Because of its ease of use, its effectiveness, and because it is controlled by women, the Pill has remained the number one contraceptive choice of women in the United States.[192]

[192] On the health scares of the 1960s and 1970s see, Barbara Seaman, *The Doctor's Case Against the Pill* (New York: P.H. Wyden, 1969); and Senate, Hearings before the Subcommittee on Monopoly of the Select Committee on Small Business Competitive Problems in the Drug Industry, Part 16: Oral Contraceptives (Vol. 2), 91st Cong., 2nd sess. 2 (1970). On the health benefits of the Pill discovered in the 1980s see,

Hormonal birth control enjoyed a brief period of relatively scandal-free existence during the 1980s, until suddenly, it once again became the center of a controversy over the very nature of biological sex, and the sex of nature. Throughout the industrialized world, scientists began to discover strange things in aquatic populations: fish with ambiguous or dual reproductive organs, diminishing populations, and increased numbers of female over male animals. Scientists initially attributed this "feminization" of nature to synthetic estrogen in birth control that had entered the waterways through women's urine. When exposed to the birth control estrogen ethynylestradiol, male test fish in research studies responded by producing vitellogenin, a protein normally produced by female fish during egg maturation. Although research seemed to show that ethynylestradiol was responsible for the changes in the reproductive systems observed in aquatic wildlife, scientists could not actually measure its presence in wastewater effluent, at least not with the tools then available. Even with advances in measurement technologies, the levels of ethynylestradiol, for the most part, were very low.[193]

Scientists began to wonder if the picture were not more complicated, perhaps other substances were contributing to these sex changes. An accident in the laboratory of breast cancer researchers Ana Soto and Carlos Sonnenschein led to the discovery that dramatically complicated research into the feminization of wildlife. Soto and Sonnenschein discovered that the widely used nonylphenols, additives in plastics and smoothing agents in paints, detergents oils, toiletries, and agrochemicals among other

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for example, Lawrence K. Altman, "Health Benefits of the Pill found to Outweigh its Drawbacks," *The New York Times* July 13, 1982.

[193] Cadbury, *Altering Eden*, 128–30; Krimsky, *Hormonal Chaos*, 65–66; and Langston, "Gender Transformed," 129–30.

things, acted as estrogens when in contact with breast cancer cells. Researchers working on the feminization of fish knew that nonylphenols were present at significant levels in European and U.S. waterways, and thus tested nonylphenols on male fish. The results were similar to those of ethynylestradiol tests: upon exposure to nonylphenols, male fish developed female properties. Birth control was off the hook, but only temporarily.[194]

Over the last twenty-five years, the theory of endocrine disruption has evolved as researchers have studied an ever increasing list of substances that are dumped, leached, or otherwise find their way into water and which, once they enter the body mimic estrogen. Prompted by concern over this growing list of toxins, the White House initiated a planning framework to study the ecological effects of endocrine disruptors. Establishing a baseline for toxins already present in U.S. waterways was the primary recommendation of the framework, and thus, in 1999, the U.S. Geological Survey (USGS) initiated the first nationwide inventory of contaminants in the nation's streams.[195] Over the next year, researchers gathered water samples from 139 streams, carefully following protocols and procedures. Leaving behind their coffee, cigarettes, or other personal care items to minimize the chance for contamination, USGS staff collected stream water, filtered it when necessary, immediately chilled it and shipped it to laboratories for analysis. At the

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[194] On the early research conducted with ethynylestradiol on fish populations, the discovery of nonylphenol, and the history and evolution of the endocrine disruption theory, see Cadbury, *Altering Eden*; Krimsky, *Hormonal Chaos*; Oudshoorn, *Beyond the Natural Body*; David O. Norris, *Endocrine Disruption: Biological Basis for Health Effects in Wildlife and Humans* (New York: Oxford University Press, 2006); and Langston, "Gender Transformed: Endocrine Disruptors in the Environment."

[195] Executive Office Committee on Environment and Natural Resources National Science and Technology Council, *The Health and Ecological Effects of Endocrine Disrupting Chemicals: A Framework for Planning* (Washington DC: Office of Science and Technology Policy, November 22, 1996).

lab, the samples were tested for ninety-five organic wastewater contaminants including veterinary and human pharmaceuticals, steroids and hormones, and other chemicals used in American homes, industry, and agriculture. Most of the substances for which the streams were tested were those that posed an environmental concern, many of them are suspected or known endocrine disruptors. The results were astonishing. One or more of the contaminants were present in 80 percent of the waterways sampled, with eighty-two of the ninety-five chemicals under study detected in at least one of the sample sites.[196]

Included among the contaminants for which researchers tested were natural hormones produced in the human body and synthetic hormones used in birth control. The synthetic estrogen most commonly used in combined oral contraceptives, ethynylestradiol, as well as two hormones used in older versions of birth control pills, mestranol and 19-noethisterone were each tested for and found in the water surveyed. All three synthetic estrogens already had a half-century history of use by the time the USGS reconnaissance was conducted. The concentrations of these hormones in the majority of samples tested by the USGS were below the reporting level of .005 micrograms/liter (mg/L). However, at several test sites, concentrations of the synthetic hormones were significant. The highest concentration of ethynylestradiol recorded at the

[196] USGS, "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999–2000: A National Reconnaissance," *Environmental Science and Technology* vol. 36 (2002): 1202–1211. The impact of the study has been far-reaching, even within months of its publication it had stirred much scholarly interest. The Institute for Scientific Information named the USGS paper as one of the most frequently cited works in the field of ecology and environment for February 2003, and was named as one of the Top 100 Science Stories of the Year (2002) by *Discover Magazine*.

test sites was .831 mg/L, well above the necessary levels that later research would demonstrate have severe health effects on aquatic wildlife.[197]

Since the publication of the USGS reconnaissance, research in the field of endocrine disruptors has intensified, and inquiry into the effects of hormones, particularly of ethynylestradiol has exploded. By 2002, only sixty studies examining the presence and/or effects of ethynylestradiol on wildlife had been published; by 2008 the U.S. Environmental Protection Agency's eco-toxicology database listed 172 published peer-reviewed studies on the synthetic hormone. The studies investigated the levels and effects of ethynylestradiol on frogs, crustaceans, insects and spiders, mollusks, and fish.[198]

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[197] USGS, "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999–2000," 1205.

[198] U.S. Environmental Protection Agency Ecotoxicology Database, <http://cfpub.epa.gov/ecotox/quick_query.htm> (accessed May 2010), search parameters: Chemical Entry, Preferred Name "(17alpha)-19-Norpregna-1,3,5(10)-trien-20-yne-3,17-diol", CAS # 57636, 1915–2009, and 1915–2002. Those fish most frequently studied include minnows, zebra danios, medaka high-eyes, carp, and trout, Atlantic salmon, along with numerous others. For studies on ethynylestradiol in terrestrial wildlife see, J. M. Matter, et al., "Development and Implementation of Endocrine Biomarkers of Exposure and Effects in American Alligators (Alligator mississippiensis)" *Chemosphere* vol. 37 (September 12, 1998): 1905–14; K. C. Halldin, et al., "Sexual Behavior in Japanese Quail as a Test End Point for Endocrine Disruption: Effects of In Ovo Exposure to Ethinylestradiol and Diethylstilbestrol," *Environmental Health Perspectives* vol. 107 (November 1999): 861–66; K. I. Nishijima, et al., "Simple Assay Method for Endocrine Disrupters by In Vitro Quail Embryo Culture: Nonylphenol Acts as a Weak Estrogen in Quail Embryos," *Journal of Bioscience and Bioengineering* vol. 95 (June 2003): 612–17; N. C., Atanassova, et al., "Permanent Effects of Neonatal Estrogen Exposure in Rats on Reproductive Hormone Levels, Sertoli Cell Number, and the Efficiency of Spermatogenesis in Adulthood," *Endocrinology* vol. 140 (November 1999): 5364–73; and J. S. Fisher, et al., "Modulation of the Onset of Postnatal Development of H+-ATPase-Rich Cells by Steroid Hormones in Rat Epididymis," *Biology of Reproduction* vol. 67 (April 2002): 1106–14. Research on the effects of mestranol and norethisterone are much fewer, despite the fact that the median concentration of mestranol reported by the USGS study is higher than that of

What this abundance of research has established is that ethynylestradiol has definite effects on the reproductive systems of aquatic life. Perhaps one of the most striking and convincing studies of these effects is a multi-year study that was conducted in the Experimental Lakes Area (ELA) in northwestern Ontario, Canada, which was designed specifically to test the effects of the synthetic estrogen on wild fish populations. In this highly controlled study, researchers exposed the fathead minnow population in one lake to low levels of ethynylestradiol, in concentrations of 5–6 nanograms per litre (ng/L) of water. (The USGS study of U.S. waterways found ethynylestradiol levels to be lower than 5 ng/L at most sites, with exceptions at sites in Florida where levels measured 273 ng/L, in Massachusetts at 116 ng/L, Montana at 73 ng/L, and New York at 13 ng/L.) The results were dramatic: the population of fathead minnows almost vanished entirely, as the fish were no longer able to reproduce. Other fish in the lake also experienced significant reproductive system damage. For example, one third of male pearl dace minnows in the test lake had produced eggs within their testes. [199] While the study results are clear and useful, in the real world, women do not travel up to the experimental lakes of Canada or other remote lakes each time they need to pee: the realities of fish

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ethynylestradiol, and that the highest reported concentration of 19-norethisterone was higher than the maximum level reported for ethynylestradiol.

[199] Karen A. Kidd, et al., "Collapse of a Fish Population after Exposure to a Synthetic Estrogen," *Proceedings of the National Academy of Sciences* vol. 104, no. 21 (May 22, 2007): 889–8901; and USGS, "Water-Quality Data for Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999–2000," Open file report 02-94, Table 6 "Stream sampling sites analyzed for selected steroid and hormone compounds (Method 5) in 1999 and 2000," 2002, available at: <http://toxics.usgs.gov/pubs/OFR-02-94/table6.html> (accessed June 2009).

populations exposed to ethynylestradiol and other estrogen mimicking chemicals are much, much more complex.

In fact, research conducted with this complexity in mind has considerably complicated the potential outcomes when estrogen from birth control combines with other xenoestrogens (chemicals that mimic estrogen in animal life) in wastewater. One such study investigated the differing effects of mixtures of wastewater containing high and low levels of estrogen mimicking substances, and of the health effects to fish when ethynylestradiol was added to these wastewater samples. The findings revealed that, although when exposed to ethynylestradiol alone the fish experienced the same kind of feminizing effects observed in the Canadian and other studies, when the ethynylestradiol was combined with weak estrogen wastewater, the total concentration of estrogen in the sample water actual *decreased* and health effects, though still present, were not as prevalent as with ethynylestradiol alone. The cause, researchers suggested, was that either the ethynylestradiol bound to something in the weak estrogen effluent, which would have the effect of impeding its ability to enter hormone receptors in fish or human bodies, or that microbes in the wastewater partially digested the birth control estrogen. While the results of this study certainly do not suggest that ethynylestradiol is harmless to wildlife and humans, it does seriously complicate our understanding of the role that the synthetic hormone plays in the tangled mess of toxins that are wreaking havoc on the natural world.[200]

[200] Amy L. Filby, et al., "Health Impacts of Estrogens in the Environment, Considering Complex Mixture Effects," *Environmental Health Perspectives* vol. 115, no. 12 (December 2007): 1704–10. See also Warren G. Foster, "Environmental Estrogens and Endocrine Disruption: Importance of Comparative Endocrinology," *Endocrinology* vol. 149, no. 9 (2008): 4267–68; and Karen L. Thorpe, et al., "Relative Potencies and

Despite the complexity of this and other research, public responses to research on the environmental impact of endocrine disruptors has focused disproportionately on the role of birth control hormones, and has drastically simplified the scientific findings. One of the most potent examples of such simplification has come from the Catholic Church. Reaching a huge audience through its formal decrees, Catholic news services, and other publications, the Church has placed the blame for endocrine disruption squarely and completely upon birth control. In celebration of Pope Paul VI's 1968 encyclical, *Humanae Vitae*, which had, in the wake of the rapid acceptance of the Pill in the 1960s, declared birth control immoral and unnatural, the Catholic Church reiterated its position on birth control and chimed in on the issue of endocrine disruption. "Another essential issue that is becoming increasingly urgent is the presence of hormones in drinking water, mainly caused by the pill," declared the Church, "We have to take notice of the fact that over the last fifty years spermatozoa levels in men have dropped by 50%."[201] This sentiment was repeated in the Vatican newspaper, *L'Osservatore Romano*, in which Pedro Jose Maria Simon Castellvi, president of the Vatican's World Federation of Catholic Medical Associations, stated, "We have sufficient evidence to argue that one of

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Combination Effects of Steroidal Estrogens in Fish," *Environmental Science and Technology* vol. 37, no. 6 (2003): 142–49. Studies that show no adverse effects to ethynylestradiol exposure in some aquatic life, for example, include "Elevated Concentrations of Ethynylestradiol, 17b-Estradio, and Medroxyprogesterone have little effect on reproduction and survival of *Ceriodaphnia dubia*," *Bulletin of Environmental Contamination and Toxicology* vol. 81, no. 3 (September 2008): 230–35.

[201] Pope Paul VI, *Humanae Vitae***,** Encyclical of Pope Paul VI on the Regulation of Birth, July 25, 1968; and "Forty Years of Humanae Vitae from a Medical Perspective," World Federation of Catholic Medical Association, January 2008. The Church did also recognize the health benefits of reduced ovarian and uterine cancer rates in Pill users and stated that "we need to look at the many well known benefits of the pill to make a correct evaluation of side-effects and benefits."

the considerable factors contributing to male infertility in the West—with its ever decreasing numbers of spermatozoa in men—is environmental pollution caused by the byproducts of the pill."[202] No scientific studies exist that directly link birth control hormones to falling sperm levels. In fact, linking reproductive health issues in humans to substances known to be endocrine disruptors for wildlife remains difficult, as testing on human subjects is ethically impossible. Establishing safe levels of various endocrine-disrupting chemicals for humans is also problematic, particularly since scientists still do not understand the ways in which natural estrogens, synthetic estrogens, and xenoestrogens interact with each other. [203] Still, scientists and scholars alike have urged that we not ignore that the effects of pollutants on non-human nature signal dangers for human health as well. This approach is a prudent and wise one, but we must be careful to attribute the effects to the right causes.

Though extreme and not particularly surprising given its position on birth control, the official Catholic response to endocrine disruption points clearly to the disproportionate attention that birth control hormones receive in public discourse about endocrine disruption. This trend even permeates the scientific community. In scientific literature and public discourse alike, comparatively little attention has been paid to the levels of and effects of *naturally* produced estrogens on wildlife. While 172 published peer-reviewed studies were produced on the effects of ethynylestradiol by 2008, only 9

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[202] Carol Glatz, "Birth control pill is linked to male infertility, says Vatican paper," *Catholic News Service*, January 5, 2009.

[203] One early paper traces the rise in male reproductive health issues with the rise in reproductive abnormalities in fish populations, see Jorma Toppari, et al., "Male Reproductive Health and Environmental Xenoestrogens," *Environmental Health Perspectives* vol. 104, supplement 4 (August 1996): 741–803.

studies were published that considered the effects of natural hormones on aquatic life.[204] Although few in number, these studies present evidence that natural estrogens are at least as potent as ethynylestradiol, some suggest that natural estrogens are more easily absorbed by fish than synthetic estrogen or xenoestrogens. Despite this evidence, and regardless of the fact that when combined, the prevalence of the three naturally occurring human female estrogens in U.S. waterways is almost three times greater than that of ethynylestradiol, the majority of studies continue to focus on the synthetic hormones found in birth control and on other xenoestrogens.[205]

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[204] C. D. Metcalfe, et al., "Estrogenic potency of Chemicals Detected in Sewage Treatment Plant Effluents as Determined by in vivo assays with Japanese Medaka," *Environmental Toxicology and Chemistry* vol. 20, no. 2 (2001): 297–308; F. Tilton, W. H. Benson, and D. Schlenk, "Elevation of Serum 17-beta-Estardiol in Channel Catfish following injection of 17-beta-estradiol, ethynyl estradiol, estrone, estriol, and estradiol-17-beta-glucuronide," *Environmental Toxicology and Pharmacology* vol. 9, no. 4 (2001): 169–72; G. H. Panter, R. S. Thompson, and J. P. Sumpter, "Adverse reproductive effects in male fathead minnows exposed to environmentally relevant concentrations of natural oestrogens," *Aquatic Toxicology* vol. 42, no. 4 (1998): 243–53; T. H. Hutchinson, et al., "Impact of natural and synthetic steroids on the survival, development and reproduction of marine copepods," *Science of the Total Environment* vol. 233 (1999): 167–79; B. Allner, et al., "Electrophoretic determination of estrogen-induced protein in fish exposed to synthetic and naturally occurring chemicals," *Science of the Total Environment* vol. 233 (1999):21–31; H. R. Andersen, et al., "Development of Copepod Nauplii to Coopepodites," *Environmental Toxicology and Chemistry* vol. 20, no. 12 (2001): 2812–29; K. L. Thorpe, et al., "Relative potencies and combination effects of steroidal estrogens in fish," *Environmental Science and Technology* vol. 37, no 6 (2003): 1142–49; A. Chekiere, T. Verslycke, and C. Janssen, "Effects of Methoprene, Nonylpheno, and Estrone on the vitelogenesis of the Mysid Neomysis integer," *General and Comparative Endocrinology* vol. 147, no 2 (2006): 190–95; and R. E. Gutjahr-Gobell, et al., "Individual effects of estrogens on a marine fish, cunner (tatutogolabrus adspersus) extrapolated to the population level," *Ecotoxicology and Environmental Safety* vol. 63, no. 2 (2006): 244–52. No published studies were conducted on the effects of natural hormones on terrestrial wildlife.

[205] Median levels of natural estradiol (17 a- and 17 b-estradiol) were .03 and .16 mg/L; estriol was measured at .019 mg/L; and estrone at .027 mg/L. The median concentration of ethynylestradiol was .073 mg/L. USGS, "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants," 1205.

There are real environmental consequences to the polluting of our waterways with birth control hormones, with natural hormones, and with chemicals that act like hormones—for non-human nature and humans alike. Endocrine disruption may, in fact, be one of the biggest environmental disasters to face the planet, and this is precisely why it matters how we frame our scientific inquiry, public discourse, and where we place the blame. Like women of the interwar period who were so squeamish about touching themselves when inserting contraceptive diaphragms, we are squeamish about the presence of contraceptive trash. Twelve hundred latex condoms on beaches become a bigger disaster than ten times that many plastic bleach bottles, and synthetic estrogen used for birth control takes center stage even when the cast consists of thousands of dangerous and little-understood endocrine-disrupting pollutants. Confronting contraceptive trash in non-human nature forces us to confront our own place in nature. Contraceptive trash connects our private bodily acts and personal reproductive decisions to tide pool anemones, to fish, to the water we drink, and to each other.

Conclusion

"ECO SAFE SEX": EVERYBODY'S DOING IT

Biodegradable, fair trade condoms; minimal packaging birth control pills; all natural, non-toxic spermicides—"Eco safe sex" is the new craze and it seems that everyone wants to do it. Americans' attempts to make more sustainable, "greener" consumer and lifestyle choices have left no sheet unturned; it has seeped even into our contraceptive choices. Articles litter the internet with advice on which method of birth control is the most ecologically sound, and contraceptive manufacturers have seized the opportunity to market their products as the greenest of birth control choices. [206] But in this cacophony of contraceptive advice and instruction remain the same discourses that, over the course of the twentieth century, have shaped the way we think about our bodies and nature vis-à-vis birth control.

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[206] See, for example, Nina Shen Rastogi, "Tree-Humper, What's the Greenest Form of Birth Control?" March 3, 2009, Slate.com, available at <http://www.slate.com/id/2212648> (accessed March 2009); Barbara Fenig, "How Green Is Your Birth Control?" July 17, 2009, *Huffington Post*, available at http://www.huffingtonpost.com/2009/07/17/how-green-is-your-birth-c_n_232578.html> (accessed July 2009); Carol Bengle Gilbert, "Green in the Bedroom: Biodegradable Condom Report," available at http://www.associatedcontent.com/article/1671926/green_in_the_bedroom_biodegradable.html?cat=46 (accessed May 2010); and "Summer Lov'in—How to practice eco safe sex this summer," available at: < http://hubpages.com/hub/eco-safe-sex-this-summer-with-green--condoms > (accessed May 2010). For green marketing strategies, see for example the online marketing campaign of French Letter Condoms at http://www.frenchlettercondoms.co.uk/ (accessed May 2010). Author Stephanie Weiss has compiled her reviews of all sorts of sexual products' "green" factors, including contraceptives, in *Eco Sex: Go Green Between the Sheets and Make Your Love Life Sustainable* (Berkeley, Calif.: Ten Speed Press, 2010).

There are those voices, like the Catholic Church, that maintain birth control is unnatural and is in fact destroying nature, proclaiming for example that "The pill has created devastating ecological effects from tons of hormones being released into the environment for years."[207] And there are those who argue that any contraceptive choice is a green choice, as an overpopulated earth is still the biggest ecological challenge humans face: "When it comes to contraception: Use it. No matter what type you choose, it's guaranteed to have less of an impact on the environment than the unwitting creation of a fossil-fuel burning, diaper-wearing copy of yourself."[208] Other voices echo Margaret Sanger and early birth control advocates who sought female-controlled contraceptives; they caution against eliminating contraceptive choices, as "contraception has enabled women and families to decide when and how many children to have and this in turn has been shown to improve the health of children, women, communities and the planet."[209] And of course, there is the constant, underlying chatter of pharmaceutical companies and contraceptive manufacturers who tell us that birth control is medicine and that it does more than prevent pregnancy: it clears up skin, relieves our bloating and moodiness, and frees us from the hassle of menstruation.

How humans situate their bodies in non-human nature has immense and far-reaching meaning for the way we understand culture, nature, and the distinctions or

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[207] Carol Glatz, "Birth control pill is linked to male infertility, says Vatican paper," *Catholic News Service*, January 5, 2009.

[208] Nina Shen Rastogi, "Tree-Humper, What's the Greenest Form of Birth Control?"

[209] Jennifer Rogers, Reproductive Health Technologies Project, "The Vatican's Misleading Birth Control Story," January 12, 2009 available at <http://www.rhrealitycheck.org/blog/2009/01/08/vatican-misleads-calling-contraception-environmental-toxin> (accessed January 2009).

blurrings between the two. When we look at how we have produced, consumed, and disposed of birth control, lines between "nature" and "human" become less distinct and we see more clearly how humans and nature are both the objects *and* agents of change. This study has shown that from the late nineteenth-century to the present, the role of contraceptives in human/nature interactions has become more significant and the impact more direct. In the late nineteenth century, contraceptive production was relegated to small and local networks. Birth control was a black market and so its consumption was done in secret corners and under the cover of dark. Technological advances that allowed for safer, faster, and cheaper production of rubber condoms and diaphragms came at the cost of reshaping environments half-way around the world. Between the world wars, female factory workers in condom plants negotiated hazardous workplaces, and middle-class women negotiated the environments of their own bodies when they turned to the effective, yet uncomfortably intimate contraceptive diaphragm. In post-war America, population controllers looked directly to birth control to ease the strain on limited natural resources, yet looked to devices that fit into a capitalist scheme of cheap, easy, and fast production and which restricted women's control over their own bodies. Feminists in the 1970s took back control of their bodies and reproductive health, turning to the diaphragm and then to their own insides to find nature. In the twenty-first century, it seems we cannot escape our contraceptive choices: they litter the parking lots, beaches, water, and the cells of fish, frogs, and likely even our own bodies.

This environmental history of contraceptives in the United States has shown that the production, consumption, and disposal histories of contraceptives are not just histories of the United States. They are bound to systems big and small—from global

markets of rubber harvesting and burgeoning world populations, to invisible biochemicals and water molecules. This history tells us that environments are many things: they are the jungles from which peasants harvest yams for synthetic progesterone, they are factory spaces in which working-class women inhale benzene fumes, and they are bodies into which we must venture to control our reproductive processes and to understand the implications of contraceptive technologies.

In this study, I have shown how contraceptive histories are complex and interwoven interactions among device production, consumption, disposal; discourse; experience; and technology. For example, advances in condom production were the result of both social forces, such as national efforts to prevent the spread of venereal disease or gradual acceptance of contraception by American physicians, and of technological discoveries such as vulcanization or latex prevulcanization. The history of the condom reveals the device's shifting importance from contraceptive to prophylactic. Likewise, the contraceptive diaphragm and cap were transformed from a high-tech device into the most natural of contraceptive choices through feminist discourse and hands-on self-help birth control that insisted on less intrusive, more natural methods. During the 1960s, male gynecologists balanced work, reward, and prestige, with production costs to invent devices they could be sure would stay in women's bodies even if they harmed women's bodies. Finally, the experiences of humans and non-human nature with contraceptive trash have caused reactions that are at once exaggerated and oversimplified.

As we consider if and how to make sex "Eco safe," it matters how we think about and how we talk about human relationships with nature. Without understanding that making, selling, using, and getting rid of contraceptives are each, in essence, complex

feedback loops of choice and consequence, we cannot even come close to knowing the true ecological price of our contraceptive decisions. When we consider our bodies as environments we cannot so easily draw lines between the "natural" and that which has been altered by humans, and neither can we so easily determine who has power over our own bodies. I hope that as we ask questions about bodies, nature, and power, my work will help to clean up the messes of our contraceptive pasts and lend insight as we clean up contraceptive messes in our future.

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