

Northeastern University

From the Selected Works of Kara W. Swanson

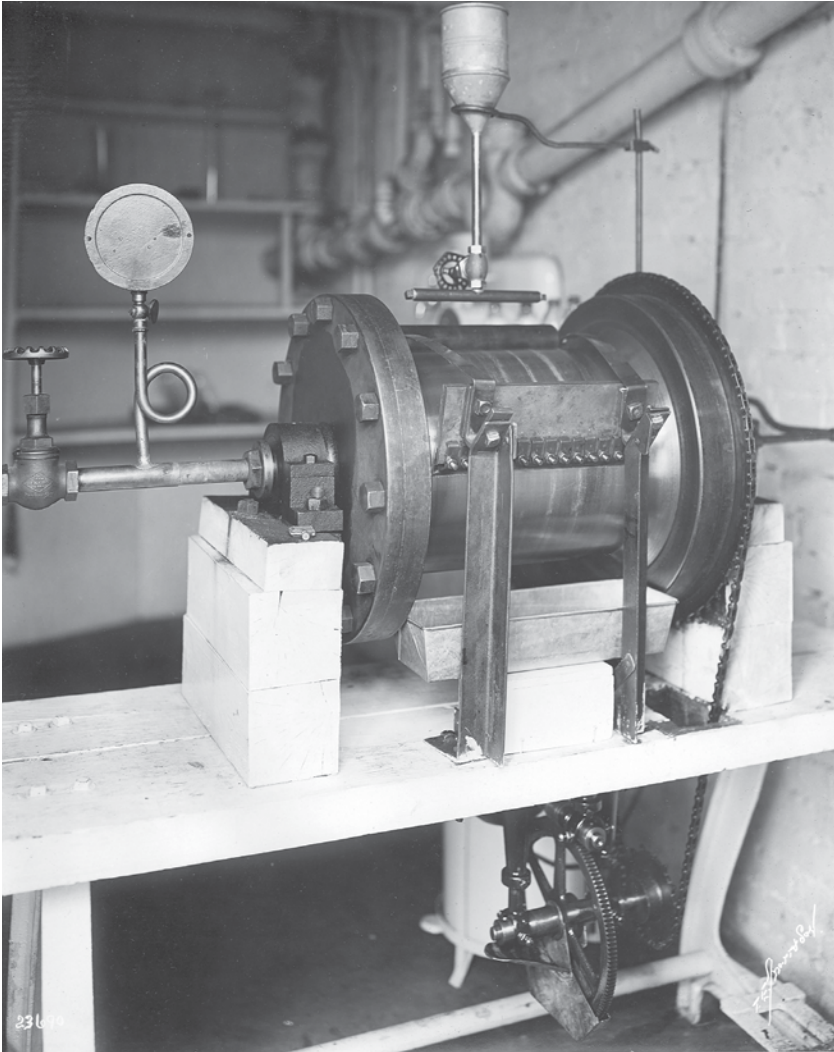
Spring 2009

Human Milk as Technology and Technologies of Human Milk: Medical Imaginings in the Early 20th Century United States

Kara W. Swanson



Available at: https://works.bepress.com/kara_swanson/2/



Human Milk Drying Machine, Boston Floating Hospital (MIT Archives)

HUMAN MILK AS TECHNOLOGY AND TECHNOLOGIES OF HUMAN MILK: MEDICAL IMAGININGS IN THE EARLY TWENTIETH-CENTURY UNITED STATES

KARA W. SWANSON

In 1922, two Massachusetts Institute of Technology (MIT) undergraduates in mechanical engineering proudly presented their senior thesis, “The Design of a Machine to Powder Milk” (Young and Sutherland 1922). While machines already existed to powder *bovine* milk (Baumgartner 1920), their machine was novel because it was designed to dry *human* milk. The aspiring engineers had been recruited by Dr. Lawrence Smith of the Boston Floating Hospital to solve what he considered to be a medical problem, the preservation of human milk. Smith, like others within the newly established specialty of pediatrics, was focused intensely on infant feeding in an effort to reduce infant mortality (Cone 1979, 151–59; Meckel 1998, 40–61). Smith and other Boston physicians collaborated with engineers and industry, enlisting technology to make human milk itself into a technology.

These male pediatricians sought to transform the feminine domestic practice of nursing into the commercial production of human milk as a raw material for their new machine.¹ They drew upon the knowledge and authority of science (Viner 2002; Apple 1987, 16–18), as well as upon engineering know-how, to promote a decoupling of the nursing dyad of mother and child. In their imaginings, human milk would be improved into a “technology,” something made and used by men, in the gendered sense in which that word was just entering popular usage in the early twentieth century (Oldenziel 1999, 14). Dried and mixed with supplements in a powdered formula, human milk would become a therapeutic tool. Disembodied, it would be available to be analyzed, manipulated, and dispensed by trained medical men, rather than by ignorant mothers and wet nurses, the nature of the breast improved by the culture of the bottle. To the extent that any discussion of breastfeeding is “a conversation about femininity,” these doctors imagined inverting the gender valence of the conversation, replacing the

femininity of the breast with the masculinity of technology (Carter 1995, 190). This move called upon binaries associated with the perceived separation between nature (biology/the body/women) and culture (technology/machines/men) (Clarke and Olesen 1999, 8). But because these binaries as organizational categories do not reflect the discursive and co-constitutive nature of the body, and did not match many women's enactments of maternity at this time, the transformation of human milk into a technology was neither smooth nor, in the long run, successful.

No matter how successfully these Progressive Era pediatricians enlisted laboratory science and engineering technologies to make better human milk for better babies, they were able only to attenuate, rather than eliminate, their reliance on the lactating breast. The imposition of medical discipline on maternal bodies that were both culturally unruly and biologically prone to leak, squirt, drip, and exhibit all manner of variability (Kukla 2005, 3) required an assertion of power that was already being resisted by those bodies. The number of women who chose to breastfeed had been dropping for the previous half century, even in the face of medical exhortations (Wolf 2001). Women had been engaged in their own search for new technologies of infant nutrition that would free them from this task. While the doctors were able to find women who were willing to supply milk as paid productive work, the control of the maternal breast through the management of lactating bodies proved difficult, as did the transformation of raw milk into a processed, standardized product. Finally, the doctors abandoned their dream, replacing their imaginings of human milk as a technology with the partially successful banishment of the maternal breast. Pediatricians and mothers alike embraced the new artificial formulas by midcentury, as professional medicine both accepted and co-opted the women-led move away from breastfeeding that had begun a century before (Wolf 2001).²

HUMAN MILK AS TECHNOLOGY

When Smith joined the Floating Hospital in 1921 (Boston Floating Hospital 1922), he joined a medical community that had been working to make non-maternal breast milk available to patients for more than a decade. His senior colleague, Dr. Fritz Talbot, was a pioneer in efforts to control the lactating breast by managing the bodies of wet nurses. The wet nurse was the time-honored solution for an infant who lacked a maternal source of milk, for centuries a near-necessity in cases of maternal death or illness, and a choice for women of certain social classes (Golden 2001; Fildes 1988).

In 1910, Talbot had established the Directory for Wet Nurses in Boston, a referral service advertised to doctors that facilitated their ability to procure a screened wet nurse. While wet nurses had long been hired by families, this organized medical involvement in their hiring reflected recent changes in infant feeding (Golden 2001, 128–155; Wolf 2001, 132–37). The rate of maternal breastfeeding had been decreasing since the mid-nineteenth century, a transition led by mothers of all classes in defiance of medical advice (Wolf 2001). Women who worked for wages weaned out of necessity. Middle- and upper-class women weaned out of a desire to continue their social and civic obligations, or because they believed themselves suffering from “agalactia,” the medical term for an insufficient milk supply, or both. Some doctors believed that about three-fourths of well-to-do mothers were afflicted with this problem because of the stresses of modern life (Davis 1913, 234; Sedgwick 1921, 455; Wolf 2000; Levenstein 1983, 88–89). Mothers turned instead to various forms of artificial feeding, including homemade mixtures of milk, cereal, and sugar; commercial infant foods; or individually prepared “formulas” mixed in commercial milk laboratories (Apple 1987; Fildes 1986, 215–350; Levenstein 1983).

By the turn of the century, doctors and better-informed mothers were increasingly aware that none of these options were as successful as breast milk. Artificially fed infants were less likely to survive, frequently succumbing to gastrointestinal illnesses in the summer months (Wolf 2001; Meckel 1998, 11–39; Preston and Haines 1991, 27–30). As more doctors focused on pediatrics, with a tenfold increase in practitioners between 1880 and 1910, they applied the science of biochemistry to infant nutrition to address infant mortality rates (Markel 2002, 48; Apple 1987, 1980). They also asserted their science-based expertise as a way of displacing the authority of laywomen in the care and feeding of infants, replicating an earlier shift in obstetrics (Leavitt 1983, 1987). The problem with artificial feeding was twofold. First, any artificial preparation was only as good as the cow’s milk from which it was made, and obtaining pure milk was a significant problem. Second, the prevalent medical opinion held that most options, except the most expensive formulas prepared in commercial laboratories, were not nutritionally equivalent to human milk. As a medical consensus developed that “a full one-third of all infant deaths [were due] to unnecessary bottle-feeding,” some doctors joined forces with Progressive women reformers to campaign for the improved purity of cow’s milk, intent on solving the first problem, and others concentrated on improving breastfeeding rates, based on their

belief that the second problem was virtually insurmountable (Davis 1913, 234; Sedgwick 1921; Wolf 2001; Meckel 1998, 62–91; Apple 1987; Levenstein 1983). For doctors such as Talbot who believed that no artificial mixture was the equivalent of human milk, the best option for their patients without a maternal supply of milk was a wet nurse.

To Progressive pediatricians, much about traditional wet nursing was unsatisfactory. These women represented the all-female world of practical expertise that the pediatricians were attempting to supplant with their scientific knowledge in order to establish themselves as a profession. Further, the new biochemical data about the variable composition of human milk brought scientific authority to age-old worries about the diet, behavior, and character of the wet nurse (Macy and Outhouse 1928; Fildes 1988; Wolf 1999). In an age of “scientific motherhood” (Apple 2006), wet nursing seemed distressingly backward to doctors and mothers alike (Golden 2001, 128–55). Talbot sought to rationalize the selection of “that necessary but often slatternly female” (Tobey 1929, 1110) and to discipline her body through his *Directory for Wet Nurses*. Talbot (1928) supplemented the *Directory* with a home where prospective wet nurses could live with their infants, maintaining their milk supply while waiting to be hired. This home served as a site of discipline where a resident registered nurse monitored the diet, dress, and behavior of the women. The residents were forbidden to drink alcohol, and were monitored for symptoms of tuberculosis and syphilis (Talbot 1911a, 1911b; Golden 2001, 184–89). *Directory* wet nurses were medically managed bodies. The mothers of Talbot’s patients welcomed such bodies because employing a wet nurse was often highly unsatisfactory for parents as well. Her presence was disruptive to the household, and her behavior a constant source of worry (Wolf 2001, 132, 141–43).

But even thus managed, the wet nurse remained problematic. Once she moved into her employer’s household, medical control over her vanished. And she was only a feasible solution for well-to-do parents. Talbot, like other urban doctors, also treated charity patients at the new children’s hospitals such as the Massachusetts Infant Asylum and the Floating Hospital (Preston and Haines 1991, 13). In these institutions, doctors struggled to help infants survive without maternal milk. At the Infant Asylum, as at a few other hospitals, Talbot developed a system of managing resident wet nurses (Talbot 1911b; Talbot 1928; Abt 1917; Wolf 2001, 149–52). As full-time residents, these women could be monitored continually. They were inspected for “any acute or chronic infectious disease or any physical defect” and kept occupied

when not nursing with light housekeeping duties. The women were subject to a schedule from 6:30 A.M. to 9:00 P.M. that included a two-hour afternoon rest, three meals and two hearty snacks, and ice cream three times a week (Talbot 1911b, 304–05). If they were “troublesome,” they were dismissed, but most stayed about six to eight months (305).

For the supervising physicians, even these disciplined wet nurses were unsatisfactory, because of their bodily resistance to scientific analysis. The suckling babe within the nurse’s arms was not amenable to data collection. Doctors therefore began to require that the nurses express their milk (Golden 2001, 189–91). Once removed from the body, the milk could be measured for volume; analyzed for fat, protein, and carbohydrate concentration; and fed to the baby in a bottle, from which the amount consumed was readily monitored. In a disembodied form, human milk became more technology-like.

The administration of disembodied breast milk relied on the near-immediate transfer of expressed milk from breast to bottle to infant, accomplished through the multiple wet nurses on duty in the hospital. In private homes where doctors cared for their middle- and upper-class patients, maintaining a supply of disembodied milk was less feasible. Even believing that “wetnurses are trouble makers,” doctors were forced to rely on them, for their bodies were ideal storage containers for breast milk (Emerson 1922, 641). To transform human milk into a controllable technology for home use would itself require technology. The realization of this dream began, not in well-to-do homes, but at the Floating Hospital.

The Floating Hospital was a boat that cruised Boston harbor daily in the summer months, taking infants and children and their mothers out into the fresh sea air and providing medical services to those on board. Without room for resident wet nurses, the Floating Hospital relied on artificial nutrition for patients. Its milk laboratory offered multiple types of artificial foods, including cow’s milk, Horlick’s malted milk, barley water, oatmeal water, rice water, albumen water, Jacobi’s mixture, peptonized milk, and dextrinized barley water (Beaven 1957, 634). In 1910, the Floating Hospital, with Talbot on staff, inaugurated a new way of providing breast milk to its patients. That summer, the hospital began to purchase milk by the ounce from lactating women on shore to be fed to infants on deck. Several physicians shared the work of inspecting the prospective “wet-nurses.” A registered nurse made daily rounds to the women’s homes, providing them with “proper instruction about cleanliness” and a daily sterile bottle, and collecting their

expressed milk for transport to the hospital, packed in ice (Talbot 1911b, 305). The doctors then dispensed the milk, choosing recipient patients and determining amounts given. Talbot reported that while there was never enough human milk for all the babies who might benefit from it, he felt “certain that the lives of most of the babies who did get it would have been lost without this means of treatment” (305–06; Boston Floating Hospital 1911).

This separation of lactating breasts and recipient babies in space was so successful that the hospital expanded its program over the following decade, collecting 225 quarts in the 1923 season (Boston Floating Hospital 1924, 27). The practice also expanded beyond the Floating Hospital as Talbot transformed his Directory into an organization devoted to the purchase and distribution of bottled breast milk, now finding that “sending wet nurses into the home was not necessary” (Macpherson 1939, 461; Talbot 1928; Golden 1988). The parents who paid for these bottles were only too happy to forego the physical presence of a wet nurse. After Talbot published details of these programs (1911b, 1928), the institution of the “mothers’ milk station” spread beyond Boston (Blankenhorn 1933; Herwick 1933). By 1929, there were stations collecting and distributing human milk in at least twenty American cities, including three affiliated stations in New York City that together collected more than twenty-five hundred quarts annually (Tobey 1929; Golden 2001, 194–200; 1988; Wolf 2001, 152–55).

These stations combined discipline of the lactating body with control over the disembodied milk, using procedures to technologize milk production as paid labor. Without the space constraints of the Floating Hospital, most stations generally bought milk from mothers who expressed on site, under the watchful eye of a nurse. Some offered a modicum of privacy in separate cubicles, but the producers remained “visible . . . to the matron who watches and advises during the process of milking” (Blankenhorn 1933, 412). To the extent possible, the lactating mother’s body was made into a medically managed production mechanism. In New York, not only did the mothers wash their hands with running water and soap, but the supervising matron, after washing her own hands, “cleanse[d] the mothers’ nipples with boiled water” (Chapin 1926, 1364). Eventually, the New York station transformed its donors from head to toe, with caps, “freshly laundered gowns,” and surgical masks over their noses and mouths (Wynne 1937, 73). In Kansas City, the milk donor underwent a six-step process to transform her body into a milk-dispensing device, including covering her entire head “with a triangular shaped cloth;” having her hands scrubbed for ten minutes with

a brush; permitting the cleansing of her breasts by the matron; and draping her body from the shoulders to the knees with a “special sheet,” exposing only the nipples (Herwick 1933, 454). At the Chicago mothers’ milk station, the women, garbed in scarves, gowns, and masks, submitted to examination by a male doctor, “[s]crubb[ed] within an inch of their lives”—including scrubbing each breast three times with “green soap”—and towel[ed] dry with sterile towels handed to them “on sterilized metal tongs” by an attending nurse (“Saving Lives” 1940, 426). Their milk was pooled “just as good dairymen mix the milk of their herds so that a slight deficiency in one donor will be compensated for by the contributions of other donors [allowing the] desired content of fat, protein, carbohydrate and mineral salts” to remain “very even” (“Preserving Human Milk” 1939, 233). As cow’s milk came to be routinely pasteurized, so too was bottled breast milk (Macpherson 1939, 466; Blankenhorn 1933, 412). The processed milk, now a “superior maternal accessory,” was dispensed only on a doctor’s order (Tobey 1929, 1110).

When Smith went to MIT in 1922 in search of a human milk drying machine, he did so as a member of a medical community committed to human milk as a medical technology. By disembodifying milk, his colleagues had removed the troublesome body of the wet nurse from newborn care and had inserted their own expertise between breast and baby through this “accessory” available only by prescription. Smith’s venture was an extension of this project. He sought to overcome the difficulty that led even the Floating Hospital to continue to use artificial foods—there simply was not enough breast milk available when needed.

TECHNOLOGIES OF HUMAN MILK

The problem was “fluctuations between demand and supply” that were “rapid and wide” (Emerson and Platt 1933, 477). Only the separation of milk from breast in time, as well as in distance, would allow the complete rationalization of supply and demand. But even pasteurized, milk could only be kept in bottles for a day or two at refrigerator temperatures. This issue was acutely annoying to the doctors on the seasonal Floating Hospital. As Smith’s colleague Dr. Paul Emerson lamented: “Each summer a source of supply is built up, and each autumn, with the closing of the hospital, it is lost” (1922, 642). The doctors were also irked by their dependence on nursing mothers, who had the power to withhold the anticipated supply: “[D]rawn breast milk must . . . be used within a very few hours’ time. . . . [T]he supply is inelastic. . . . [H]uman milk, when needed, is obtained only with difficulty

and after delay, and even then the supply is often maintained with much inconvenience. The source of supply seems always to be on the far side of the city, and any trifle, such as the state of the mother's feelings, may be enough to cause her to refuse quite suddenly to sell any more milk" (641).

The donor wet nurse was almost as much of a nuisance as that "slatternly but necessary" live-in wet nurse, resisting her place as managed production mechanism in the gendered hierarchy of doctor and donor. The trifles of "maternal feelings" interfered with the systematic collection and disbursement of human milk. More technology was needed to make human milk into a reliable technology.

When Emerson dreamed of rendering irrelevant the time between the production and consumption of human milk, with supply controlled by masculine technology rather than by feminine emotion, his knowledge of the dairy industry informed his imaginings. Emerson recruited his junior colleague, Smith, to research how dried cow's milk was made. After comparison of the two main methods for the industrial production of powdered milk, Smith and Emerson concluded that the roller method was more adaptable to smaller volumes and used less expensive machinery. The doctors arranged a meeting with engineers from The Dry Milk Company to discuss the application of the roller technology to breast milk (Smith and Emerson, 1924).

Armed with this industry expertise, Smith recruited the MIT students to construct a human milk drying machine using the roller method. The students' machine was installed and functioning at the Boston Floating Hospital by 1922 (Boston Floating Hospital 1923). Whenever the Floating Hospital collected more milk than could be used the next day, the excess was dried and stored as powder, allowing the seasonal hospital to collect and store milk year-round. By 1925, the hospital staff had successfully fed reconstituted breast milk to infants, using milk powder they had dried with their machine and stored for an average of one hundred days (Emerson 1925). Working with the Floating Hospital's chemist, Alfred Bosworth, hired to research improved artificial infant foods, the doctors created breast milk formulas, improving upon human milk by adding sugar or removing fat (Emerson and Smith 1926, 19–20). Now disembodied *and* shelf-stable, human milk was more fully a technology, amenable to medical manipulation as a raw material for superior infant foods of known qualities, dispensable in known quantities. Science and technology had improved upon the unruly and unreliable human breast as a feeding source.

Emerson, however, was not entirely satisfied. The powdered milk sometimes was a bit off-color or musty smelling, and it could be difficult to reconstitute (Smith and Emerson 1924, 939–40). Emerson kept working with the goal of “preparing a soluble product of high caloric value, the appearance of which would attain the standard of being commercially presentable” (Emerson and Platt 1933, 473). He dreamed of human milk so well preserved that it could become the basis of a commercial infant formula. This dream drew upon the recent introduction of medically derived artificial infant foods. These included Similac, a formula based on Bosworth’s research and commercialized after he left the Floating Hospital in 1922. Similac had been preceded on the market in 1912 by Dextri-Maltose, a cow’s milk supplement, and in 1921 by SMA, the first all-in-one infant formula, both also the result of physician-directed research (Apple 1987, 32–33, 38–39). Emerson’s dream of a human milk formula that had all the convenience and susceptibility to medical control of a bovine milk formula seemed within reach.

In pursuit of this human milk technology, Emerson sought still better technology. If the roller method of drying was imperfect, perhaps the alternative spray process would work better. In the 1930s, Emerson turned to the Borden Company. One of the biggest international concerns in North America, Borden combined control of the fresh milk supply in many urban areas with the manufacture, distribution, and sale of shelf-stable milk products, including condensed milk—which it had promoted as an infant food for decades—and several brands of powdered milk (Baumgartner 1920, 3; Levenstein 1983, 79). By 1930, Borden both owned The Dry Milk Company and manufactured other spray-dried milks. It agreed to conduct research into spray-drying human milk. While Emerson reported that the initial results of spray drying were “excellent” (Emerson and Platt 1933, 473), his new collaborators had ideas of their own.

Washington Platt, the Borden researcher assigned to the project, came up with the idea of preserving human milk by rapid freezing. As Emerson reported in 1933: “It soon became apparent that the freezing process was much superior to drying. . . . It was more rapid, the apparatus was much cheaper, the product was perfect in appearance, and the method could be easily learned and used by the nurses” (Emerson and Platt 1933, 474). The process used dry ice to freeze milk in small volumes (474–76). Emerson successfully conducted feeding tests with milk preserved by this method and recruited scientists to conduct laboratory analyses demonstrating the superior ability of freezing over drying to maintain vitamin content (Emerson

1933; Eddy and Morris 1934). By September 1935, Borden had patented this technique (Platt 1933). Soon Borden had licensed its patent to hospitals from Los Angeles to Montreal and to one commercial dairy (Minutes 1936). Emerson's vision of commercial breast milk products, the ultimate human milk technology, seemed on the brink of attainment.

THE END OF DREAMS

But Borden quickly concluded that it had no interest in commercializing Platt's invention. During the thirteen years since the first human milk drying machine was built, urban milk supplies had improved, the medically based artificial formulas had become more successful, and infant mortality rates had dropped. Artificial feeding came to be viewed by "physicians and mothers alike" as "one of the greatest gifts bestowed by modern science to children" (Baker and Pearson 2005, 21; Apple 1987). Emerson himself acknowledged that "[t]he science of infant feeding has progressed so rapidly that babies are no longer solely dependent on human milk and many can be reared without its use" (Emerson and Platt 1933, 472). Women had long sought safe, effective alternatives to breast milk, and intensive public campaigns had failed to slow the trend away from breastfeeding (Wolf, 2000). Pediatricians were realigning their advice to match these maternal preferences (Apple 1987, 35–36, 175–76; Wolf 2001). They could demonstrate medical expertise through scientifically guided instruction on artificial formula use and could successfully care for their patients, freed from the unquantifiable and unreliable nutrition offered by the lactating breast. Borden and other manufacturers sought to align themselves with medical recommendations (Auerbacher 1935). Prompted by a decision of the American Medical Association to withhold its seal of approval from infant foods that were advertised directly to the public, in 1932 most formula manufacturers removed all directions on use from their products, supporting organized medicine's insistence that mothers consult doctors when using artificial foods (Apple 1987, 90; 1981). The preferred technology appeared to be cow's milk formulas.

Still, human milk remained the gold standard against which all formulas were measured. SMA, for example, was marketed to doctors as having a fat content that "has the same saponification number, iodine number, Polenske number, Reichert-Meissl number, and the same melting point as the fat in woman's milk" (SMA Advertisement 1926). And Emerson continued to believe human milk to be "indispensable" for "very small premature and delicate infants" (Emerson and Platt 1933, 472). The early licenses for Borden's

patent showed some medical demand for a breast milk product. But when Borden wrote to the American Academy of Pediatrics in January 1936 to offer the Academy control of Platt's invention, the offer of the most advanced technology of human milk was rejected because of matters unrelated to Talbot and Emerson's ongoing struggle to make human milk into a technology (Report 1936).

In 1936, the Academy was the largest professional association of pediatricians, though only six years old (Pease 1952, 22–23). To consider Borden's offer, the Academy appointed a committee, chaired by Talbot. Talbot invited Borden's representative and Emerson to discuss the matter. The two doctors, no longer faced with the same life-or-death urgency in their quest to control human milk supplies, could now afford to concentrate on other issues raised by Emerson's enlistment of a commercial conglomerate. At their meeting, the doctors focused on whether the Academy would "accept and be responsible for patents," a serious problem because of "the question of patents in general, for which no settled policy has yet been arrived; that is to say, patents that are connected with the health and welfare of the public" (Minutes 1936). Talbot and his committee estimated that administering the patent would require the Academy to arrange visits to all sites seeking a license, to make periodic inspections to ensure that the method was being used correctly, and to initiate court proceedings against patent infringers. The committee recommended against Academy involvement, stating as the reason the lack of available resources to meet these requirements (Report 1936).

While the young Academy *did* have very limited resources, just a few years later, it promulgated standards for mothers' milk stations (Pease 1952, 44; Committee on Milk 1943). It was, therefore, able to find both staff and money to standardize the production and dispersal of human milk—as long as there was no patent involved. Borden's decision to obtain a patent contributed to the failure of Emerson's efforts to move from a reliance on *process* to technologize human milk production in the milk station to preserved human milk formulas as a technologized *product*. As discussed above, proprietary infant foods were becoming increasingly acceptable, as long as they were used under medical direction (Apple 1980; 1987, 47–49). But these products were patented, manufactured, and sold by independent commercial concerns. Despite the ten years of time and money the Floating Hospital had invested in Bosworth's formulations, and the two patents it acquired based on his inventions, the hospital ultimately had dedicated its patents to the public, and Bosworth instead found a for-profit company to develop his

work into the commercial product, SMA (Boston Floating Hospital 1923, 5). Organized medicine of this period distrusted proprietary technologies. By the mid-1930s, this aversion had led to much criticism within the medical community of the novel Wisconsin Alumni Research Foundation (WARF), a nonprofit corporation that collected substantial royalties from its licensed patents for Vitamin D supplementation of foods and shared them between the inventing professors and WARF's fund for scientific research at the University of Wisconsin (Committee on Investigation 1936; Apple 1989; Talbot Papers 1934–35).

In the same month that Borden had made its offer, the Academy had published its report on a yearlong intensive investigation into WARF, conducted by another committee chaired by Talbot. Stimulated by much complaining among pediatricians about the cost and advertisement of Vitamin D-supplemented foods and milk, the report criticized WARF as failing to act in the public interest and called for an articulated policy on the “patent situation” which recognized that patents related to public health should be considered in a separate category (Committee on Investigation 1936). The subsequent report on the Borden offer reflected Talbot's knowledge of WARF. Talbot believed that acceptance of Borden's offer would not only require expensive and onerous patent enforcement activities but also implicitly endorse WARF's stance that medically related patents were acceptable, and that their commercialization was also acceptable. In private correspondence related to the WARF investigation, Talbot (1935) had indicated his extreme unease with medical patents, and not even in support of their cherished dream of human milk as medical technology were he or Emerson willing to recommend that the Academy become a patent licensor.

The result was the quiet dissipation of their Progressive dreams of human milk as a medical technology. This result was aided and abetted by women's own lack of interest in producing breast milk and by their enthusiasm for scientific formulas. Pediatricians had never been able to revive significant enthusiasm among women for breastfeeding, and disciplining the breast to produce raw material for a medical technology simply became more trouble than it was worth, when most infants thrived on cow's milk-based formula. Artificial formulas allowed doctors to dispense with the resistant lactating body altogether, a process some took one step further in the postwar period by routinely prescribing lactation suppressants for newly delivered mothers (La Leche League 1963, 55). But just as the Progressive project of making human milk into a technology under masculine expert control foundered,

the midcentury banishment of the lactating breast in the name of medical science also faltered. As the female choice not to breastfeed became troublingly close to a medical dictate, middle-class women began to lead a return to breastfeeding (Weiner 1994; Blum 1999; Ward 2000; Carter 1995). The breastfeeding advocates of the 1950s and 1960s reclaimed the “conversation about femininity” by portraying breastfeeding as natural and “womanly,” in opposition to technology and commerce (La Leche League 1963, 5, 12). Despite the essentializing discourse of some breastfeeding advocates, the body continues to defy binary categorization as disembodied milk has once again become a significant feature of infant feeding. In the late twentieth century, the chief technology of human milk was woman controlled. The breast pump became “the superior maternal accessory” that enabled women to work for wages *and* to provide the form of nutrition now designated scientifically superior, the same goals sought by earlier women when they weaned (Blum 1999, 3, 53–60). Producing disembodied breast milk has become an unpaid domestic practice. And in the twenty-first century, such private production is also the source of raw material for the first human milk formula sold by a for-profit company, Prolacta Bioscience Corporation (Ensor 2006). Human milk, lactating breasts, and women continue to exist within technoscientific discourses in which power is contested and meanings are negotiated. The binary imagined by male Progressive pediatricians has been interpreted, resisted, and deployed many times since, as women, doctors, and businesspeople seek to assert their own imaginings of human milk and female bodies.

ACKNOWLEDGMENTS

For their comments and assistance, the author would like to thank fellow panelists and audiences at the American Association of the History of Medicine, Montreal, May 2007; the Society for the History of Technology, Washington, D.C., November 2007; and the Gender History Workshop at Harvard University; as well as Ellen Bales, Allan Brandt, Nancy Cott, Amber Musser, Suzanne Smith, Steven Shapin, the anonymous reviewers, and the guest editors. This work has been supported in part by a Graduate Research Fellowship from the National Science Foundation.

KARA W. SWANSON is a doctoral student in the History of Science Department at Harvard University, where she is finishing a dissertation on the history of human body fluid banks in the United States, concentrating on milk, blood,

and sperm. She earned her BS in molecular biophysics and biochemistry from Yale University and an MA in biochemistry and a JD from the University of California–Berkeley.

NOTES

1. Some of the few female physicians of this period did work in pediatrics; however, none were included within the networks that supported Smith's project (More 1999, 70–121).

2. The sociocultural position of infant feeding choices and the maternal breast is not only gendered but highly classed and racialized in ways that both preceded the Progressive Era and have persisted to the present, as only briefly touched on herein but discussed in Carter 1995; Yalom 1997; Blum 1999; Litt 2000; and Golden 2001. Additionally, women's choices have been informed by the sexualization of the breast (Yalom 1997; Carter 1995), a trend that became particularly prominent in U.S. culture after World War II (Blum 1999, 38–42).

WORKS CITED

- Abt, Isaac A. 1917. "The Technic of Wetnurse Management in Institutions." *Journal of the American Medical Association* 69:418–20.
- Apple, Rima D. 1980. "'To Be Used Only Under the Direction of a Physician': Commercial Infant Feeding and Medical Practice, 1870–1940." *Bulletin of the History of Medicine* 54:402.
- . 1987. *Mothers and Medicine: A Social History of Infant Feeding, 1890–1950*. Madison: University of Wisconsin Press.
- . 1989. "Patenting University Research: Harry Steenbock and the Wisconsin Alumni Research Foundation." *Isis* 80:374–94.
- . 2006. *Perfect Motherhood: Science and Childrearing in America*. New Brunswick: Rutgers University Press.
- Auerbacher, L. J. 1935. Letter to Fritz B. Talbot from Directory of Medical Relations, The Borden Company. October 24. Fritz B. Talbot Papers, Countway Library of Medicine, Boston.
- Baker, Jeffrey P., and Howard A. Pearson, eds. 2005. *Dedicated to the Health of All Children*. Elk Grove Village, Ill.: American Academy of Pediatrics.
- Baumgartner, F. W. 1920. *The Condensed Milk and Milk Powder Industries*. Bulletin of the Departments of History and Political and Economic Science in Queen's University, Kingston, Ontario, Canada, no. 36. Kingston, Ontario: Jackson Press.
- Beaven, Paul W. 1957. "A History of the Boston Floating Hospital." *Pediatrics* 19:629–38.
- Blankenhorn, Mary D. 1933. "A Breast Milk Dairy." *Hygeia* 11:411–12.
- Blum, Linda M. 1999. *At the Breast: Ideologies of Breastfeeding and Motherhood in the Contemporary United States*. Boston: Beacon Press.
- Boston Floating Hospital. 1911. *Seventeenth Annual Report, Season of 1910*. Countway Library of Medicine, Boston.

- . 1922. *Twenty-seventh and Twenty-eighth Annual Reports, Seasons of 1920 and 1921*. Countway Library of Medicine, Boston.
- . 1923. *Twenty-Ninth Annual Report, Season of 1922*. Countway Library of Medicine, Boston.
- . 1924. *Thirtieth Annual Report, Season of 1923*. Countway Library of Medicine, Boston.
- Carter, Pam. 1995. *Feminism, Breasts, and Breast-Feeding*. New York: St. Martin's Press.
- Chapin, Henry Dwight. 1926. "The Production and Handling of Human Milk." *Journal of the American Medical Association* 87:1364–66.
- Clarke, Adele, and Virginia L. Olesen. 1999. "Revising, Diffracting, Acting." In *Revising Women, Health, and Healing: Feminist, Cultural, and Technoscience Perspectives*, eds. A. E. Clarke and V. L. Oleson. New York: Routledge.
- Committee on Clinical Investigation and Scientific Research, American Academy of Pediatrics. 1936. "Report, 1935." *Journal of Pediatrics* 8:124–30.
- Committee on Mothers' Milk, American Academy of Pediatrics. 1943. "Recommended Standards for the Operation of Mothers' Milk Bureaus." *Journal of Pediatrics* 23:112–28.
- Cone, Thomas E., Jr. 1979. *History of American Pediatrics*. Boston: Little, Brown.
- Davis, William H. 1913. "Statistical Comparison of the Mortality of Breast-Fed and Bottle-Fed Infants." *American Journal of Diseases of Children* 5:234–47.
- Eddy, Walter H., and Steward G. Morris. 1934. "A Study of the Effect of Preserving Methods on Human Milk." *Journal of Pediatrics* 4:208–215.
- Emerson, Paul W. 1922. "The Collection and Preservation of Human Milk: Preliminary Report." *Journal of the American Medical Association* 78:641–42.
- . 1925. "Dried Human Milk. IV. Dried Human Milk as a Food for Infants." *American Journal of Diseases of Children* 30:769–73.
- . 1933. "The Preservation of Human Milk. VII. The Feeding to Premature Babies of Human Milk Preserved by Freezing." *New England Journal of Medicine* 209:893–905.
- Emerson, Paul W., and Washington Platt. 1933. "The Preservation of Human Milk. VI. A Preliminary Note on the Freezing Process." *Journal of Pediatrics* 2:472–77.
- Emerson, Paul W., and Lawrence Weld Smith. 1926. "Dried Human Milk. V. Its Use in the Feeding of Premature Infants." *American Journal of Diseases of Children* 31:1–21.
- Ensor, Deborah. 2006. "Land of Milk and Money." *San Diego Union Tribune*, February 12.
- Fildes, Valerie A. 1986. *Breasts, Bottles, and Babies: A History of Infant Feeding*. Edinburgh: Edinburgh University Press.
- . 1988. *Wet Nursing: A History from Antiquity to the Present*. New York: Basil Blackwell.
- Golden, Janet. 1988. "From Wet Nurse Directory to Milk Bank: The Delivery of Human Milk in Boston, 1909–27." *Bulletin of the History of Medicine* 62: 589–605.
- . 2001. *A Social History of Wet Nursing in America: From Breast to Bottle*. Paperbk ed. [1996] New York: Cambridge University Press.

- Herwick, Mary Katherine. 1933. "A Mother's Milk Station." *American Journal of Nursing* 33:454–456.
- Kukla, Rebecca. 2005. *Mass Hysteria: Medicine, Culture, and Mothers' Bodies*. Lanham, Md.: Rowan & Littlefield.
- La Leche League International. 1963. *The Womanly Art of Breastfeeding*. 2nd ed. Franklin Park, Ill.: La Leche League International.
- Leavitt, Judith Walzer. 1983. "'Science' Enters the Birthing Room: Obstetrics in America Since the Eighteenth Century." *Journal of American History* 70:281–304.
- . 1987. "The Growth of Medical Authority: Technology and Morals in Turn-of-the-Century Obstetrics." *Medical Anthropology Quarterly* 1:230–255.
- Levenstein, Harvey. 1983. "'Best for Babies' or 'Preventable Infanticide'? The Controversy over Artificial Feeding of Infants in America, 1820–1920." *Journal of American History* 70:75–94.
- Litt, Jacquelyn S. 2000. *Medicalized Motherhood: Perspectives from the Lives of African-American and Jewish Women*. New Brunswick: Rutgers University Press.
- Macpherson, Cornelia H. 1939. "Standards for Directories for Mother's Milk." *Journal of Pediatrics* 15:461–66.
- Macy, Icie G., and Julia Outhouse. 1928. "Breast Milk:—A Variable Food." *Journal of the American Dietetic Association* 4:9–14.
- Markel, Howard. 2002. "For the Welfare of Children: The Origins of the Relationship Between U.S. Public Health Workers and Pediatricians." In *Formative Years: Children's Health in the United States, 1880–2000*, eds. Alexandra Minna Stern and Howard Markel. Ann Arbor: University of Michigan Press.
- Meckel, Richard A. 1998. *Save the Babies: American Public Health Reform and the Prevention of Infant Mortality, 1850–1929*. Paperbk ed. [1990] Ann Arbor: University of Michigan Press.
- Minutes. 1936. "Meeting Between Dr. James A. Tobey of the Borden Company, Dr. Paul Emerson, and Dr. F. B. Talbot." May 26. Fritz B. Talbot Papers, Countway Library of Medicine, Boston.
- More, Ellen S. 1999. *Restoring the Balance: Women Physicians and the Profession of Medicine, 1850–1995*. Cambridge, Mass.: Harvard University Press.
- Oldenziel, Ruth. 1999. *Making Technology Masculine: Men, Women, and Modern Machines in America, 1870–1945*. Amsterdam: Amsterdam University Press.
- Pease, Marshall Carleton. 1952. *American Academy of Pediatrics, June 1930 to June 1951*. Evanston, Ill.: American Academy of Pediatrics.
- Platt, Washington. 1933. Infant Food. US Patent 2,015,496, filed January 3, 1933, and issued September 24, 1935.
- "Preserving Human Milk: An Interview with Helen F. Leighty, R.N." 1939. *Trained Nurse and Hospital Review*, September, 228–34.
- Preston, Samuel H., and Michael R. Haines. 1991. *Fatal Years: Child Mortality in Late Nineteenth-Century America*. Princeton: Princeton University Press.
- "Report of the Committee of Clinical Investigation and Scientific Research on the Offer of the Borden Company to Give to the American Academy of Pediatrics Directions for the Use of the Rights of the Patent of the Borden Company for

- Freezing Milk." 1936. Fritz B. Talbot Papers, Countway Library of Medicine, Boston.
- "Saving Lives with Mothers' Milk." 1940. *Hygeia* 18:424–428.
- Sedgwick, J. P. 1921. "A Preliminary Report of the Study of Breast Feeding in Minneapolis." *American Journal of Diseases of Childhood* 21:455–64.
- SMA Advertisement. 1926. *Journal of the American Medical Association* 90:51.
- Smith, Lawrence Weld, and Paul W. Emerson. 1924. "Notes on the Experimental Production of Dried Breast Milk." *Boston Medical and Surgical Journal* 191:938–40.
- Talbot, Fritz B. 1911a. "A Directory for Wet Nurses: Its Experiences for Twelve Months." *Journal of the American Medical Association* 56:1715–17.
- . 1911b. "Two Methods of Obtaining Milk for Hospital Use." *Boston Medical and Surgical Journal* 164:304–6.
- . 1928. "An Organization for Supplying Human Milk." *New England Journal of Medicine* 199:610–611.
- . 1935. Letter to L. Emmett Holt, Jr. May 17. Box 3. Fritz B. Talbot Papers, Countway Library of Medicine, Boston.
- Talbot, Fritz B., Papers of. 1934–35. "Amer. Acad. Of Pediatrics Investigation of Wisconsin Foundation." Box 3. Countway Library of Medicine, Boston.
- Tobey, James A. 1929. "A New Foster-Mother." *Hygeia* 7:1110–12.
- Viner, Russell. 2002. "Abraham Jacobi and the Origins of Scientific Pediatrics in America." In *Formative Years: Children's Health in the United States, 1880–2000*, eds. Alexandra Minna Stern and Howard Markel. Ann Arbor: University of Michigan Press.
- Ward, Julie de Jager. 2000. *La Leche League: At the Crossroads of Medicine, Feminism, and Religion*. Chapel Hill: University of North Carolina Press.
- Weiner, Lynne Y. 1994. "Reconstructing Motherhood: The La Leche League in Postwar America." *Journal of American History* 80:1357–1381.
- Wolf, Jacqueline H. 1999. "'Mercenary Hirelings' or 'a Great Blessing'? Doctors' and Mothers' Conflicted Perceptions of Wet Nurses and the Ramifications for Infant Feeding in Chicago, 1871–1961." *Journal of Social History* 33:97–120.
- . 2000. "The Social and Medical Construction of Lactation Pathology." *Women and Health* 30:93–110.
- . 2001. *Don't Kill Your Baby: Public Health and the Decline of Breastfeeding in the 19th and 20th Centuries*. Columbus: Ohio State University Press.
- Wynne, Shirley W. 1937. "Preserving Mothers' Milk." *Parents' Magazine* August 25, 73.
- Yalom, Marilyn. 1997. *A History of the Breast*. New York: Ballantine Books.
- Young, William Hoyt, Jr., and Kenneth Reynold Sutherland. 1922. "The Design of a Machine to Powder Milk." BS thesis, Massachusetts Institute of Technology.