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The Birth of the Sperm Bank

KARA W. SWANSON

ON APRIL 9, 1954, the *Cedar Rapids Gazette* published a scoop. The front-page banner headline screamed, "Fatherhood After Death Has Now Been Proved Possible." The story announced the birth of three "history-making" babies.[1] The babies were conceived using semen that had been frozen and stored before use, a first in human reproduction. It was a local story, because the underlying research had been conducted just 30 miles away at the University of Iowa medical school in Iowa City.[2] The article described how two university researchers, zoology graduate student Jerome Sherman and professor of urology Raymond Bunge, had developed a technique of freezing and thawing human sperm while preserving viability. At the university hospital fertility clinic, three women had been successfully inseminated with previously frozen semen. The *Gazette* was the first media outlet to announce the births resulting from this new form of assisted conception.

By 1954, the technique of artificial insemination, the use of instruments to deposit semen within the reproductive tract of the intended mother at her estimated time of ovulation, had already resulted in the birth of thousands of children in the United

1. *Cedar Rapids Gazette*, 4/9/1954.

2. The University of Iowa was then called the State University of Iowa. Stow Persons, *The University of Iowa in the Twentieth Century: An Institutional History* (Iowa City, 1990), 181. This article uses the current designation.

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States.[3] The three Iowa babies represented another step in assisted conception, transforming the sperm bank from a futuristic dream into a viable part of reproductive medicine. Despite the *Gazette*'s provocative headline, there was no indication that any of the history-making babies had been conceived posthumously. What their arrival did show, however, was that those skilled in the new technique could create large collections of frozen sperm from donors near and far and make specimens available to prospective parents and their doctors for use in conceiving a child, perhaps even after the sperm donor's death. The ability to choose a biological father for an intended child was thus expanded in ways previously impossible when only fresh sperm from a locally available donor was used for insemination. The Iowa babies opened the door not only to "fatherhood after death," but also to "genius" sperm banks and today's mail-order sperm bank industry.[4]

Less dramatically, but perhaps of more interest to the involuntarily childless, the new technology also offered a way of improving the chances of assisted conception using sperm from the intended father, avoiding the need for a donor. Artificial insemination had often been tried to treat involuntarily childless couples, but using the intended father's semen was rarely successful, often because such men had low sperm counts. Doctors had tried different approaches to obtain the most concentrated specimen possible for use in a well-timed insemination, hoping to increase the odds of conception.[5] Freezing samples offered the opportunity to collect multiple specimens over time and to choose only the best to use for insemination when the intended mother was most likely to conceive, or to combine the most concentrated portions of several samples.

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3. Abner I. Weisman, *Spermatozoa and Sterility: A Clinical Manual* (New York, 1941), 168–70; Francis I. Seymour and Alfred Koerner, "Artificial Insemination: Present Status in the United States as Shown by a Recent Survey," *Journal of the American Medical Association* 116 (6/21/1941), 2747.

4. David Plotz, *The Genius Factory: The Curious History of the Nobel Prize Sperm Bank* (New York, 2005); Lisa Jean Moore, *Sperm Counts: Overcome by Man's Most Precious Fluid* (New York, 2007), 103; Cynthia R. Daniels, *Exposing Men: The Science and Politics of Male Reproduction* (Oxford, 2006), 91.

5. Wilfred J. Finegold, *Artificial Insemination* (1964; reprint, Springfield, IL, 1976), 17–18 (reviewing methods in use in 1950s).

All of these baby-making possibilities were set before the citizens of Cedar Rapids that spring. Despite the enthusiasm and persistence of the *Gazette* reporter, who followed the story for a year, the "history-making" Iowa research was not universally acclaimed.[6] Anticipating praise and professional glory, Bunge and Sherman instead found themselves the subject of criticism in Iowa and within the national medical community. Americans remained skeptical of assisted conception, after death or otherwise, and even fertility specialists distanced themselves from the Iowa breakthrough. It would be decades before frozen sperm would be fully incorporated into the practice of reproductive medicine.

THE IOWA BABIES, renewed proof of the ability to separate sexuality and reproduction, were the mid-century version of the "test tube baby," the popular term for the result of assisted conception that had been sparking enthusiasm, anxiety, and controversy for decades. In the first English-language book on the subject, *Test Tube Babies*, published in 1934, German physician Herman Rohleder traced the artificial impregnation of humans back to the late eighteenth century.[7] Following early reports by European experimenters, scattered American doctors had attempted artificial insemination, with husband and with donor sperm, with limited success.[8] By 1920, the elite physicians of the American Gynecological Society had begun to discuss the tech-

6. Coverage in the *Gazette* had begun on December 3, 1953, and continued through December 12, 1954. Both of these stories also appeared on page 1.

7. Herman Rohleder, *Test Tube Babies: A History of the Artificial Impregnation of Human Beings* (New York, 1934) (first published as *Monographien über die Zeugung beim Menschen*, Die künstlich Zeugung [Befruchtung] im Tierreich, vol. 7 [G. Theime, 1921]). For a later history of artificial insemination, in the context of a medical treatise, see A. M. C. M. Schellen, *Artificial Insemination in the Human,* trans. M. E. Hollander (Amsterdam and New York, 1957), 9–18. A more detailed historical analysis is in F. N. L. Poynter, "Hunter, Spallanzani, and the History of Artificial Insemination," in *Medicine, Science, and Culture: Historical Essays in Honor of Owsei Temkin*, ed. Lloyd G. Stevenson and Robert P. Multhauf (Baltimore, 1968), 97–113.

8. Eliza M. Mosher, "Instrumental Impregnation," *Woman's Medical Journal* 22 (1912), 223; Margaret Marsh and Wanda Ronner, *The Empty Cradle: Infertility in America from Colonial Times to the Present* (Baltimore, 1999), 66–67, 69–70, 93–94.

nique as a useful means of treating infertility.[9] As doctors gained a more accurate understanding of the timing of ovulation, success rates for the technique increased during the twentieth century.[10] Despite this long history, the *Scientific American* described artificial insemination to its popular audience in 1934 as an "essentially new scientific practice" that offered great benefit to the "about 50,000 women [who] leave the marriage altar [annually], later to discover that they are apparently fertile but childless."[11] Just as in 1954, the test tube baby was portrayed to the lay public as a modern innovation on the cutting edge of the application of science to medicine.

In 1934 test tube babies were also in daily newspapers. Twin girls, conceived by artificial insemination using fresh semen, made headlines when their mother, Lillian Lauricella, and her doctor, Frances Seymour, were willing to discuss the artificial conception of the babies.[12] Lauricella's babies were described as resulting from artificial insemination using her husband's semen, but Dr. Seymour also talked to the press about creating "eugenic babies" using donor sperm.[13] *Scientific American* had discussed "babies by scientific selection" of sperm donors as "one of the most significant eugenic developments in the his-

9. Robert L. Dickinson, "Suggestions for a Program for American Gynecology," *Transactions of the American Gynecological Society* 45 (1920), 1, 6–7.

10. Alan F. Guttmacher, "The Role of Artificial Insemination in the Treatment of Sterility," *Journal of the American Medical Association* 120 (10/10/1942), 442, 443; Alan F. Guttmacher, John O. Haman, and John MacLeod, "The Use of Donors for Artificial Insemination: A Survey of Current Practices," *Fertility and Sterility* 1 (1950), 264, 267, 270; Abner I. Weisman, "Studies on Human Artificial Insemination," *Transactions of the Conference on Sterility and Infertility* (1946), 126–27. In 1933 Alan F. Guttmacher's *Life in the Making* (New York, 1933), 200–202, a lay guide to reproduction, presented donor and husband artificial insemination as well-established treatments for infertility.

11. John Harvey Caldwell, "Babies by Scientific Selection," *Scientific American*, March 1934, 124–25.

12. The story was reported on May 1, 1934 in, for example, the *New York Times*, the *Chicago Daily Tribune*, the *Washington Post*, the *Los Angeles Times*, and the *Billings Gazette*, and also in the May 12 issue of *Newsweek*. See also Marsh and Ronner, *The Empty Cradle*, 161–63.

13. *Los Angeles Times,* 5/1/1934. But compare Marsh and Ronner, *Empty Cradle*, 163. For a detailed discussion of eugenics and artificial insemination, see Cynthia R. Daniels and Janet Golden, "Procreative Compounds: Popular Eugenics, Artificial Insemination and the Rise of the American Sperm Banking Industry," *Journal of Social History* 38 (2004), 5, 9.

tory of man,"[14] but the newspaper articles revealed a widespread grave distrust of interfering with nature by assisted conception. After the Lauricella story broke, the New York Academy of Medicine quickly released a statement intended to quell the demand for such services, describing artificial insemination as risky, difficult, and "rarely a solution" to a barren marriage.[15] As Bunge and Sherman would later, Seymour drew criticism from those within the medical profession who found her enthusiastic embrace of donor insemination distasteful.[16]

Many public discussions, both critical and supportive, failed to distinguish between artificial insemination by husband and by donor. Gallup polls taken in the 1940s and 1950s found that more Americans disapproved than approved of the technique, but the poll questions did not specify the source of the semen.[17] Some blanket condemnations, like that of the New York Academy of Medicine, were directed at the technique in general. The Roman Catholic Church, for example, had condemned all means of artificial impregnation as early as 1897, and it reiterated its opposition, based on the separation of sexuality and reproduction, through the 1950s.[18] The medical community knew, however, that the majority of successful artificial inseminations used donor semen. In fact, donor insemination was virtually the only effective technique medicine had to offer infertile men—not exactly a cure but a solution for the involuntarily childless.[19]

It was these "babies by scientific selection" who were the source of lay and medical fascination and condemnation. Despite the promise of donor insemination, some doctors at mid-

14. Caldwell, "Babies by Scientific Selection," 124.

15. *New York Times*, 5/10/1934.

16. Kara W. Swanson, "Adultery by Doctor: Artificial Insemination, 1890–1945," *Chicago-Kent Law Review* 87 (2012), 591, 610n, 626–27; Marsh and Ronner, *The Empty Cradle*, 165–66.

17. *Los Angeles Times*, 5/24/1953 (28% approval, 30% disapproval in a nationwide Gallup poll, similar to results in 1949).

18. Glanville Williams, *The Sanctity of Life and the Criminal Law* (New York, 1966, revised and expanded from the 15th Annual James S. Carpentier Series, Columbia University School of Law, April 1956), 129; Gannon F. Ryan, "The Religious Viewpoints: Catholic," *Syracuse Law Review* 7 (1955–56), 99–101.

19. Guttmacher, Haman, and MacLeod, "The Use of Donors," 266.

century would not perform artificial insemination at all; others would do so using husband sperm, but not donor sperm, focusing their objection on the insertion of a third party into family formation.[20] In addition to moral and religious concerns, doctors and lawyers alike in the 1940s and 1950s worried that donor insemination was simply adultery by doctor, a possibly illegal practice that produced bastards.[21] Yet others, like Seymour and the author of the *Scientific American* article, found donor insemination an exciting technology that offered not only hope for the involuntarily childless but also the possibility of improving the human race through selective breeding. The Nobel Prize–winning geneticist Hermann Muller had publicly advocated planned human breeding since the 1930s.[22] The fittest men could father the next generation, not yet after death, but extramaritally, supporting eugenic goals popular among educated elites. Science could offer babies both to the desperate childless and to those who wanted a superior "eugenic" baby.

The tension between the promise and threat of artificial insemination was captured evocatively in fiction. Aldous Huxley included artificial insemination as part of his futuristic vision in *Brave New World* (1932). He imagined a technologic dystopia in which reproduction occurred entirely in factories and "scientific selection" was used to create different biological castes of humans. Artificial insemination, "artsem" in Newspeak, was also an aspect of the regime described in George Orwell's chilling critique of totalitarianism, *1984*, published in 1949.[23]

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20. Ibid.

21. Samuel A. Levinson, ed., *Symposium on Medicolegal Problems* (Philadelphia, 1948), 43–87. See also Swanson, "Adultery by Doctor," 616–32.

22. Daniels and Golden, "Procreative Compounds," 8, 9–11. Muller, in multiple venues, advocated sperm banking to advance his long-held views on planned human evolution. See, for example, H. J. Muller, *Out of the Night: A Biologist's View of the Future* (New York, 1935), 111; Elof Axel Carlson, *Genes, Radiation, and Society: The Life and Work of H. J. Muller* (Ithaca, NY, 1981), 228, 398; Daniels and Golden, "Procreative Compounds," 13. There is no evidence that Bunge met Muller or read his writings, but Sherman later visited Muller in Indiana at Muller's invitation to discuss sperm banking. Letters between Muller and Sherman, dated 1963, copies in author's possession.

23. Aldous Huxley, *Brave New World* (London, 1932); George Orwell, *1984* (London, 1949). These English novels were republished and widely read in the United States.

As evidenced by Orwell's novel, ambivalence about applying technomedicine to human reproduction persisted at midcentury. Yet the concerns of lawyers, social commentators such as Huxley and Orwell, and the many Americans who disapproved of artificial insemination were counterbalanced by the continued enthusiasm of many doctors for fertility treatments. The post–World War II period, characterized by the baby boom and a heightened emphasis on domesticity and maternity, saw an increase in the number of couples who were determined to take active steps to achieve parenthood.[24] They turned to medicine, and the medical community was increasingly willing and able to focus on their plight.

In 1944 a group of doctors had founded the first professional association focused on treating the infertile, the American Society for the Study of Sterility. One of the goals of the organization was to bring together urologists and gynecologists, whose separate training and sex-segregated patient populations limited their ability to treat and understand the infertile couple.[25] In the nineteenth century fertility treatments had focused nearly exclusively on women, under the assumption that all potent men were fertile. By the mid–twentieth century, however, as the medical profession acknowledged that men could be infertile or subfertile, many hospitals established multi-specialty fertility clinics to treat both partners in an involuntarily childless marriage.[26]

The University of Iowa opened such a clinic in early 1952. The new clinic was staffed by a gynecologist, a urologist, an anatomist to examine biopsies, and an endocrinologist to conduct hormone assays. University of Iowa doctors in the early 1950s, like doctors elsewhere at the time, practiced artificial insemination both by husband and by donor. Especially in the latter case,

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24. Elaine Tyler May, *Barren in the Promised Land: Childless Americans and the Pursuit of Happiness* (New York, 1995), 127–40, 148, 153–57; Marsh and Ronner, *The Empty Cradle*, 183–89.

25. Walter E. Duka and Alan H. DeChenery, *From the Beginning: A History of the American Fertility Society* (Birmingham, AL, 1994), 1, 16–17. The American Society for the Study of Sterility is now the American Society for Reproductive Medicine. Ibid., 99–100; www.asrm.org/about/ (last viewed 6/2/2012).

26. May, *Barren in the Promised Land*, 43-44; Margaret Marsh and Wanda Ronner, *The Fertility Doctor: John Rock and the Reproductive Revolution* (Baltimore, 2008), 162–63.

doctors and patients kept the treatment secret to avoid public condemnation and controversy.[27] Doctors anywhere who performed donor insemination struggled quietly to recruit donors and to have fresh sperm available as needed, an aspect of their practice that they considered "a heavy burden."[28] With clinicians experienced in artificial insemination by husband and by donor, a stream of patients seeking treatment, and the burden of managing sperm donors, the Iowa clinic had the combination of expertise and demand to make good use of a supply of frozen sperm, ready whenever needed.

IN 1952 a combination of such expertise and demand was not unique to the University of Iowa, yet no frozen sperm supplies existed, in Iowa City or elsewhere. Iowa City became the birthplace of the first babies conceived using frozen sperm in part because of a serendipitous interaction between two men who came from different disciplines and were of greatly differing status within the medical school.

Dr. Raymond Bunge, an associate professor, was the urologist working with the fertility clinic. Born and raised in Michigan, Bunge had come to Iowa City for a residency in 1938 after graduating from the University of Michigan medical school. He trained under the chief of urology, Dr. Nathaniel G. Alcock, a forceful personality whom Bunge continued to address affectionately as "Chief" even after Alcock's retirement to California in 1949. Aside from his military service during World War II, Bunge remained on the Iowa medical school faculty until his retirement in 1976.[29]

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27. William C. Keettel, Raymond G. Bunge, James T. Bradbury, and Warren O. Nelson, "Report of Pregnancies in Infertile Couples," *Journal of the American Medical Association* 160 (1/14/1956), 102, 104; Clintie Winfrey Kenney, "Artificial Insemination," *American Mercury* 66 (1948), 400–401. For discussion of the emphasis on secrecy, see Swanson, "Adultery by Doctor," 611–13.

28. Sophia J. Kleegman, "Therapeutic Donor Insemination," *Fertility and Sterility* 5 (1954), 7, 17.

29. "Bunge, Raymond" folder, Faculty and Staff Vertical Files Collection (RG 01.15.03), University of Iowa Archives, University of Iowa Libraries, Iowa City (hereafter cited as Bunge Faculty File); Bunge to Dr. N. Alcock, 2/14/1953, Correspondence "A," 1950–1963, box 1, Papers of Raymond Bunge (RG 99.0002), University of Iowa Archives, University of Iowa Libraries, Iowa City (hereafter

After returning from the war, Bunge had explored leaving Iowa, putting out feelers to colleagues in California and North Carolina. He may have been motivated by the state of the university hospital, which, after the Great Depression and wartime shortages of staff and money, was, in the words of one hospital administrator, "in a gloomy state of disrepair and ineffectiveness" in the early postwar years.[30] By 1952, though, Bunge had not "escaped from the department," as he described his efforts to a West Coast colleague.[31] Meanwhile, the hospital and medical school had undergone a "dramatic transformation," infused with new funds and launched on a trajectory to become a nationally recognized institution.[32]

Now 44 years old and a married father of four children, Bunge was anxious to secure a promotion to full professor at Iowa, a position he would earn in 1953.[33] His publication record would be an important part of his promotion case and perhaps could open up opportunities elsewhere. Before his involvement with frozen sperm, Bunge had published case reports about treating kidneys and prostates and was embarked on a long-term research project investigating cancer of the urinary system. As part of this latter project, he was applying tissue culture techniques to tumor cells, a way of keeping cells alive *in vivo*. By Bunge's own account, however, until he met Jerome ("Jerry") K. Sherman, he had not been thinking about freezing sperm.[34]

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cited as Bunge Papers); Persons, *The University of Iowa,* 227–34; Samuel Levey, Derek Maurer, Lee Anderson, and Matthew Schaefer, *The Rise of a University Teaching Hospital: A Leadership Perspective, The University of Iowa Hospitals and Clinics* (Chicago, 1996), 188–95.

30. Levey et al., *Rise of a University Teaching Hospital*, 209 (quote), 267; Bob Prentiss to Bunge, 5/24/1948, Correspondence "P," 1948–1962, box 2, Bunge Papers; Bunge to Dr. William N. Harness, 1/2/1952, Correspondence "H," 1948–1964, box 1, Bunge Papers.

31. Bunge to Harness, 1/2/1952.

32. Levey et al., *Rise of a University Teaching Hospital*, xxiv–xxv, 225, 228, 258–59. The medical school faculty had also won a long-running battle with the hospital administration for control of the hospital. Ibid., 224–25.

33. A fifth child had died earlier. Obituary, *Iowa Press Citizen*, 2/23/1998; Bunge Faculty File.

34. R. G. Bunge and A. P. Barer, "Hemolysis during Transurethral Prostatic Resection," *Journal of Urology* 60 (July 1948), 122; R. G. Bunge and R. J. Stein, "Cyto-dynamic Properties of Urinary Neoplasms. I. Cultivation In Vitro of

Bunge's collaborator was also a World War II veteran, but a younger man who was just beginning his career in research medicine. Sherman was a native of Brooklyn, New York, who began college at age 16, only to drop out to join the navy. He finished his B.S. in biology at Brown University in 1947, and earned a master's degree at Western Reserve University in Ohio (now Case Western Reserve University). He then came to Iowa in 1949 to pursue a doctorate in zoology, drawn in part by the offer of a research assistantship in zoology.[35]

Sherman, with expertise in electron microscopy and tissue sectioning, was soon recruited by the urology department chair, Dr. Rubin Flocks. The urology department had an expensive freeze-drying apparatus, and Flocks hired Sherman as a research assistant to freeze-dry renal tissues and perform biochemical analysis.[36] That job led Sherman to delve into the literature of freezing and freeze-drying tissues, and he became intrigued when he learned that as early as 1866 researchers had reported that human sperm could survive low temperatures. That result was even more interesting when considered alongside a newly published report by British scientists that glycerol preserved the vitality of some animal sperm during freezing and thawing.[37]

Transitional Cell Carcinoma of the Ureter," *Journal of Urology* 64 (Nov. 1950), 646–50; R. G. Bunge and W. N. Harness, "Unilateral Polycystic Kidney in an Infant," *Journal of Urology* 65 (June 1951), 972–75; R. G. Bunge and W. N. Harness, "Blastomycosis of the Prostate: Case Report," *Journal of Urology* 66 (Aug. 1951), 263–64; R. G. Bunge and R. J. Stein, "Cyto-dynamic Properties of Urinary Neoplasms. II. Maintenance of 'Hypernephroma' In Vitro," *Journal of Urology* 66 (July 1951), 103–5; R. G. Bunge, "Cyto-dynamic Properties of Urinary Neoplasms. III. Cultivation In Vitro of Carcinoma of the Kidney," *Journal of Urology* 69 (Jan. 1953), 18–20; *Daily Iowan*, 7/9/1975.

35. Jerome K. Sherman curriculum vitae, dated 2/22/1996 and updated 2005 (copy in author's possession) (hereafter cited as Sherman CV); Steve Maravetz, "Baby-Making Breakthrough," *Iowa Alumni Quarterly* 51 (Winter 1998), 29; personal communication from Jerome K. Sherman, 8/19/2011 (hereafter cited as Sherman interview).

36. Sherman interview; Handwritten notes of Jerome K. Sherman, August 2011 (in author's possession); Maravetz, "Baby-Making Breakthrough," 29.

37. P. Mantegazza, "Sullo Sperma Umano," *Rend. Real Insti. Lamb.* 3 (1866), 183, as cited in Charles Benedict Davenport, *Experimental Morphology* (New York, 1908), 244, 270; C. Polge, A. U. Smith, and A. S. Parkes, "Revival of Spermatozoa after Vitrification and Dehydration at Low Temperatures," *Nature* 164 (10/15/1949), 666.

The British scientists were working with various domesticated animals. Breeding by artificial insemination had advanced rapidly in the 1930s and 1940s. The practice first became widely used with dairy cattle in the United States in the 1930s and spread rapidly after World War II.[38] In 1945 one early American advocate declared, "No other new practice in the field of animal husbandry has been welcomed with so much approval throughout most of the world as artificial insemination."[39] By 1952, up to 75 percent of American farmers in agricultural areas such as Iowa were using artificial insemination to breed their cattle. In the 20 years after the war, the average milk yield per dairy cow in the United States jumped 65 percent, an improvement attributed to the use of artificial insemination to breed better cows.[40] Iowa City, in the middle of farm country, was surrounded by those knowledgeable about bovine insemination. Drawing on the expertise of the animal husbandry faculty at Iowa State College in Ames, farmers were using artificial insemination to improve their dairy herds.[41]

The use of artificial insemination in cattle, however, was limited by the extracorporeal lifespan of sperm. Despite the development of careful techniques to ship sperm in thermoses packed in ice, the distance from prize bull to herds of cows was a problem.[42] There was also the tantalizing prospect of using semen from a bull to inseminate cows not just during the bull's lifetime, but afterwards. The limits of space and time could be transcended if the sperm could be frozen. The British researchers had reported "dramatic results" with the use of glycerol,

38. Enos J. Perry, ed., *The Artificial Insemination of Farm Animals*, 4th rev. ed. (New Brunswick, NJ, 1968), 7. Perry edited the first edition of his book in 1945 (New Brunswick). Perry provides a brief historical survey of artificial insemination in farm animals. Ibid., 3-12. The early years of artificial insemination of dairy cattle in the United States are also discussed in J. W. Bartlett, "Artificial Insemination of Dairy Cattle," in *The Problem of Fertility: Proceedings of the Conference of Fertility, Held under the Auspices of the National Committee on Maternal Health*, ed. Earl T. Engle (Princeton, NJ, 1946), 206–27.

39. Perry, ed., *Artificial Insemination,* vii.

40. Mark Friedberger, *Farm Families and Change in Twentieth-Century America* (Lexington, KY, 1988), 20; Perry, *Artificial Insemination*, viii.

41. Bunge to Professor R. M. Melampy, 1/22/1953, Correspondence "M," 1953–1965, box 2, Bunge Papers.

42. Perry, *Artificial Insemination*, 239–44.

leading to the recovery of full motility of fowl spermatozoa after freezing and thawing, as well as "much increased" revivability of frozen human sperm. Using previously frozen sperm, the British were able to fertilize chicken eggs and successfully inseminate cattle, naming the first resulting calf "Frosty."[43] One of the British researchers told his scientific colleagues that through this work "time has lost its significance" and that "what is true of animals is also true of men." In 1951 the *New York Times* had reported that this research made "death no bar to being a father."[44]

Sherman, the young graduate student in Iowa, without any experience in artificial insemination or with sperm, undertook to test this provocative statement. Could frozen and thawed sperm fertilize a human egg? Frosty was cavorting in England, but experiments had shown time and time again that sperm varied from mammal to mammal. The British researchers had reported that the same glycerol dilutions that worked so well on fowl sperm failed on rabbit sperm.[45] What would be needed to produce a human equivalent of Frosty?

The possibility of using frozen sperm to create a human baby had remained unrealized in part because successfully reviving frozen sperm was only useful if artificial insemination of humans was a reliable technique. Despite reports of artificial insemination of humans in the late eighteenth century, throughout the nineteenth century it had remained a technique with more theoretical than actual promise. In 1866 American gynecologist J. Marion Sims reported that he was giving up after 55 attempts to artificially inseminate women with husband sperm had led to only one pregnancy.[46] When the Iowa clinic opened in 1952, however, doctors could anticipate reasonable success using fresh sperm.[47]

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43. Polge et al., "Revival of Spermatozoa," 666; C. Polge, "The Work of the Animal Research Station, Cambridge," *Studies in History and Philosophy of Biological and Biomedical Sciences* 38 (2007), 511–20, 513–14.

44. *New York Times*, 8/15/1951.

45. Polge et al., "Revival of Spermatozoa," 666.

46. J. Marion Sims, *Clinical Notes on Uterine Surgery: With Special Reference to the Management of the Sterile Condition* (New York, 1866), 369.

47. See sources in note 10, above.

Enthused by the possibilities and the challenge, Sherman began to experiment with his own sperm after hours, testing freezing protocols in search of a technique that would maximize the percentage of viable sperm after thawing. His original research plans cast aside, this work became his doctoral project, supervised by Professor Harold Beams of the zoology department. Sherman's job in the urology department not only gave him a new research direction, but also brought him into contact with Bunge. The two men had met casually, and, according to Sherman, had gotten along well. Bunge hired Sherman, an impecunious student, to paint his house. When Sherman shared his excitement about his after-hours experiments with Bunge, the senior faculty member was intrigued.[48]

Sherman felt that he was succeeding in obtaining sufficient percentages of viable sperm after freeze-thawing to make conception by insemination possible. If he were right, such a pregnancy would be a clinical first, a surefire route to professional recognition for the doctor who accomplished it. As a student and a nonphysician, however, Sherman lacked both access to patients and the status to convince the power structure within the medical school to permit such a bold experiment. Bunge could surmount these obstacles. In the fall of 1952 he went to the department chair, Flocks, and urged him to convert Sherman's research assistantship freeze-drying kidney sections into a higher-paying research associate position, in which his responsibility would be to freeze and thaw sperm for use with patients.[49]

Within a few months, Sherman's experiments made the leap from laboratory to clinic, transforming speculation about using frozen human sperm in artificial insemination into reality. Bunge, on staff at the fertility clinic, had access to couples seeking fertility treatment and to colleagues with expertise in artificial insemination. He recruited the obstetrician-gynecologist from the clinic, Dr. William Keettel, to perform the inseminations. According to Sherman, Bunge's contribution was limited to this liaison role—

48. Sherman interview; Jerome K. Sherman, "Freezing and Freeze-Drying of Human Spermatozoa" (Ph.D. diss., University of Iowa, 1954).

49. Sherman interview; Sherman CV.

Sherman had performed the freezing experiments and, in his new job, processed the sperm, and Keettel treated the patients.[50] As the staff urologist, however, Bunge may have been the doctor who examined childless husbands, and Bunge viewed himself as a full participant in the experiment. In early January 1953 he described the project as his own in correspondence with the head of the animal husbandry department at Iowa State, to whom he wrote seeking information about how bull spermatozoa were preserved.[51] When the world learned about the project, Bunge would receive full credit—and full condemnation.

FLOCKS, Keettel, Bunge, and Sherman must have been aware of the controversial status of artificial insemination by husband or by donor. Just a few years earlier, in neighboring Minnesota, a proposal to recognize donor insemination as a legal way of creating a legitimate child caused a public outcry, and the draft legislation was scuttled.[52] In 1949 a University of Iowa law student had advocated similar legislation to legitimate test tube babies in Iowa, noting that "many physicians, sociologists, psychologists and laymen" believed that couples desiring children should have access to this treatment. The author, however, also noted that social and theological objections were "still in evidence" to this means of procreation as not "normal."[53] That same year, Pope Pius XII told a meeting of Catholic physicians that artificial insemination of any kind was "entirely illicit and immoral."[54] According to a nationwide poll, only 28 percent of respondents approved of artificial insemination in 1953.[55] It was clear in the early 1950s that to announce a new type of "test tube

50. Sherman interview; R. G. Bunge, W. C. Keettel, and J. K. Sherman, "Clinical Use of Frozen Semen," *Fertility and Sterility* 5 (1954), 520–29.

51. Bunge to Phineas S. Sheaer, 1/9/1953, Correspondence "S," 1952–1963, box 2, Bunge Papers.

52. Thurston A. Shell, "Artificial Insemination—Legal and Related Problems," *University of Florida Law Review* 8 (1955), 304, 315.

53. "Legal and Social Implications of Artificial Insemination," *Iowa Law Review* 34 (1949), 658, 665–66.

54. Williams, *Sanctity of Life*, 129. The Anglican Church also condemned donor insemination and recommended that its practice be criminalized. Ibid., 131.

55. *Los Angeles Times,* 5/24/1953.

baby," conceived with frozen sperm, would be both a scientific breakthrough and highly controversial, and there was no indication that Iowans were any more receptive to the practice than Americans elsewhere.

Doctors who treated the infertile, however, were generally much more sympathetic to the use of artificial insemination than the public at large, and among the minority of Americans who found themselves involuntarily childless, demand for insemination was steadily increasing.[56] The University of Iowa clinic was already practicing artificial insemination without any public outcry. With Flocks's approval and Keettel's help, Sherman and Bunge went ahead with the experiment, seeking to be the first to use frozen sperm in assisted conception.

Sherman recalls that he was excited about the high rates of post-freezing motility he was able to achieve and anxious to test viability in humans. His hope was to bring happiness to couples who wanted children.[57] Bunge was already working with the infertile at the university clinic and was almost certainly motivated by the thought of taking part in this historic first. He also was intrigued by the eugenic implications of human sperm banks. Just as Iowa farmers had improved their dairy herds, humans could potentially improve the next generation through selection of sperm donors. Even before the first pregnancies had been announced, Bunge mused about the implications of the work in a letter to his mentor, Alcock. "Now this [research] has tremendous implications, both philosophical and clinical. . . . The spermatozoa of great men can be preserved for long periods of time and perhaps a race of superior individuals can be ultimately expected."[58]

Along with his enthusiasm about donor insemination and "fatherhood after death," however, Bunge showed caution. As a faculty member whose promotion was still winding its way through the university administration, Bunge was aware of po-

56. "Discussion and Question Period," in *Symposium on Medicolegal Problems,* ed. Samuel A. Levinson (Philadelphia, 1948), 86–87; May, *Barren in the Promised Land,* 147–48.

57. Sherman interview; Maravetz, "Baby-Making Breakthrough," 30.

58. Bunge to Dr. N. Alcock, 2/24/1953, Correspondence "A," 1950–1963, box 1, Bunge Papers.

tential pitfalls. Anxious for professional recognition, he tried to manage public and academic opinion so that he and Sherman would receive accolades for their scientific advance, rather than brickbats for their social transgression.

DRAWING ON the British animal work, Sherman had performed experiments to test optimal methods of freezing and thawing sperm, considering the speed of temperature transitions, the volume of semen used, and the use of additives.[59] According to Sherman's recollections, he drafted a series of scientific papers, detailing the results he had produced during his hours of solitary laboratory work. Bunge then included himself as a coauthor, which was a "disappointing" surprise to the young graduate student. Sherman felt that Bunge was unfairly seeking credit for Sherman's efforts. Regardless of Bunge's contributions to the research, the practice of including a sponsoring senior faculty member as an author on papers presenting work done by a junior scholar was not outside the range of academic norms, and Sherman's graduate advisor counseled him to accept the situation.[60] These publications, the first of Sherman's scientific career, would also form part of Bunge's research record.

The first two papers were accepted by the *Proceedings of the Society for Experimental Biology and Medicine*. Founded in 1903, the society and its journal were designed to foster the new scientific medicine of the twentieth century, disseminating medically relevant work done in the laboratory, as distinct from clinical reports in medical journals. *Proceedings* reached a different and broader audience than the *Journal of Urology*, the official publication of the American Urological Association, where Bunge had previously published his research.

The first report, submitted in March 1953, detailed the results from four approaches to freezing semen. It showed that slow freezing of glycerol-treated sperm on dry ice was the most successful in maintaining post-thaw motility. Even before publishing the laboratory results, Bunge and Sherman decided to

59. J. Sherman and R. Bunge, "Observations on Preservation of Human Spermatozoa at Low Temperatures," *Proceedings of the Society for Experimental Biology and Medicine* 82 (1953), 686, 688.

60. Sherman interview.

take Sherman's procedures to the clinic. The paper announced that "clinical application of practical storage banks for human spermatozoa in infertility problems is now in progress."[61] The first sperm bank was being created. Further, given the survival rate of the frozen sperm of 60–78 percent, and the unchanged "type, speed and duration of motility" before and after preservation, "artificial inseminations to test the ability of frozen human spermatozoa to fertilize and induce normal embryonic development are underway."[62] Would any patient achieve pregnancy?

In late February 1953 Bunge wrote to his former "Chief" that "the big problem here is whether the spermatozoa are capable of producing normal development, and we have several cases inseminated now and are anxiously waiting to see if any pregnancies will result."[63] Bunge knew as a urologist that motility was apparently necessary for sperm viability but not sufficient. Dr. Abner Weisman, a gynecologist and fertility specialist, had published the first manual on sperm in 1941, but by the 1950s identifying normal sperm was still an inexact art.[64] It was possible that despite the motility of a frozen-thawed sperm sample, it would fail to inseminate an egg.

The Iowa researchers were still waiting "on pins and needles" in April to find out the result of a pregnancy test for one patient.[65] At least two women had undergone one unsuccessful round of insemination using frozen-thawed sperm before they conceived the following month. By July, though, there were three confirmed pregnancies. This was the awaited result, the breakthrough.[66]

Bunge sent a brief paper to the journal *Science*, announcing that he and Sherman had proven that frozen human sperm could fertilize an egg. Publishing the findings in *Science,* the weekly journal of the largest and most general scientific organization in the United States, the American Association for the Advance-

61. Sherman and Bunge, "Observations on Preservation," 688.

62. Ibid.

63. Bunge to Dr. N. Alcock, 2/24/1953, Correspondence "A," 1950–1963, box 1, Bunge Papers.

64. Weisman, *Spermatozoa and Sterility*; Schellen, *Artificial Insemination,* 60–66.

65. Bunge to Paul Engle, 4/11/1953, Correspondence "E," 1950–1964, box 1, Bunge Papers.

66. Bunge et al., "Clinical Use," 526, 528.

ment of Science, would enable the authors to reach an even bigger audience. Time ticked by while Bunge awaited a reply from the editor. The pregnancies were advancing, and he wanted the announcement published before the babies arrived. Bunge sent a follow-up letter, asking about the fate of the manuscript. About two weeks later, the answer came: *Science* would not publish the paper. The editors found it "premature" until "the products of conception have been observed."[67]

The rejection was dated August 11; by August 19 the paper was in the mail to the editors of *Nature*.[68] *Nature* is the British equivalent of *Science*, a general science journal, the most prestigious and widely read in Britain and, like *Science*, read by scientists around the world. If Bunge and Sherman could not reach an international audience from the United States, they would do so from England. *Nature* accepted the brief article, and it appeared in the October 23 issue. The authors used scholarly understatement to announce their triumph. "The ability of glycerol-treated, frozen and thawed human spermatozoon to fertilize and actuate the human ovum has been observed." They revealed that three women had been inseminated with frozen sperm, had now missed from three to six menstrual periods, and were conclusively determined to be pregnant.[69] The news of these new test tube babies was out.

Anticipating both intense public interest and criticism, the researchers had worked to keep the pregnancies secret before their feat was published in a peer-reviewed journal. Once having achieved such a publication, however, they sought widespread acknowledgment by issuing a press release to American news outlets to coincide with the article's appearance.[70] The

67. Bunge to Editor of *Science*, 7/23/1953, and Editor of *Science* to Bunge, 8/11/1953, Correspondence "S," 1952–1963, box 2, Bunge Papers. The authors also received a rejection from the *Proceedings of the Society for Experimental Biology and Medicine*. Bunge to Paul Henshaw, 9/30/1953, Correspondence "H," 1948–1964, Bunge Papers.

68. Bunge to Editor of *Nature,* 8/19/1953, Correspondence "N," 1953–1963, box 2, Bunge Papers.

69. R. G. Bunge and J. K. Sherman, "Fertilizing Capacity of Frozen Human Spermatozoa," *Nature* 172 (10/23/1953), 767–68.

70. Science Service press release, "Women Pregnant by Frozen Human Sperm," 10/26/1953, Correspondence "S," 1952–1963, box 2, Bunge Papers.

strategy worked. The press release and the *Nature* article brought notice at the national level, including a brief mention in the *New York Times*.[71] The information released in *Nature*, that one pregnancy was six months advanced by August, seemed to indicate that a baby would be born very soon.

Inquiries and reaction streamed in from various quarters. Within days, the publisher of *Tops*, a pocket-sized magazine for adults, wrote to ask for a copy of the *Nature* article in order to describe the research to his readers. A journalist for a "national magazine" in Mexico wanted more information. Infertile couples wrote, wanting access to the new technique. Doctors across the United States, from California to New York, wrote with questions. Had the babies been safely delivered? What tips could Bunge give to those wanting to try his techniques?[72] Even the editor of *Science* wrote, expressing his "chagrin" that the researchers had chosen to publish with his transatlantic rival, and asking if they would consider publishing their update in *Science*.[73]

Bunge considered how best to provide the medical community with more details. A prominent fertility specialist on the West Coast, Dr. Edward Tyler, invited Bunge to address the local branch of the American Society for the Study of Sterility and to send a more complete clinical article to *Fertility and Sterility*.[74] *Fertility and Sterility* was the new journal of reproductive medicine the society had founded in 1950. Bunge accepted both invitations, and by November Bunge and Sherman had written their first paper for the clinical community, including Keettel as

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71. *New York Times*, 10/24/1953.

72 . William Bolton to Bunge, 10/27/1953, Correspondence "B," 1949–1964, box 1, Bunge Papers; Immanuel Kleinfeld to Bunge, 2/8/1954, Correspondence "K," 1952–1962, box 2, Bunge Papers; Herbert L. Shapiro to Bunge, undated (Bunge's reply dated 11/2/1953), Correspondence "S," 1952–1963, box 2, Bunge Papers; William Harness (CA) to Bunge, 10/1/1953, Correspondence "H," 1948–1964, box 1, Bunge Papers; Sophia Kleegman (NY) to Bunge, 12/18/1953, Correspondence "K," 1952–1962, box 2, Bunge Papers.

73. Bentley Glass to Bunge, 11/30/1953, Correspondence "S," 1952–1963, box 2, Bunge Papers. Bunge must have taken some pleasure in his reply to the editor of *Nature*, suggesting that Mr. Glass check his correspondence files in order to understand the source of his chagrin. Bunge to Glass, 12/2/1953, Correspondence "S," 1952–1963, box 2, Bunge Papers.

74. Bunge to Edward Tyler, 10/13/1953, 10/20/1953, and 11/27/1953, Correspondence "T," 1953–1965, box 2, Bunge Papers.

a coauthor. This article greatly expanded on the brief announcement in *Nature*, describing the artificial insemination treatments and the pregnancies in detail.[75] Conspicuously absent from this clinical paper, as from all previous papers and from the press announcement, was any indication whether the frozen sperm used to inseminate the women was donor sperm or husband sperm.[76] If possible, the researchers wanted to avoid the controversy surrounding donor insemination.

There was reason for such caution. The enthusiasm for the Iowa breakthrough was mingled with criticism. One of the British researchers who had developed the glycerol preservation of frozen animal semen and who had earlier claimed that their work was applicable to humans was quoted in an English newspaper caustically describing the Iowa work as "one more example of the scientist happily engaged in a fascinating line of research without worrying very much as to the ultimate desirability of his results."[77] Bunge wrote to personal friends in December that "it's pretty hot where I'm sitting right now" and remarked to another correspondent that "criticism . . . has been heaped upon my head in . . . recent months." Two decades later, Bunge recalled, "I received many letters, some of them signed, asserting that I was a scientific monster, un-Christian, and a disgrace to medicine." Sherman remembered that an Iowa state legislator wrote to the president of the university criticizing the work for treating humans like animals. Frozen sperm and artificial insemination should, many Iowans thought, be the province of

75. Bunge et al., "Clinical Use." The article was not published until 1954.

76. The surviving documents cannot resolve this question. Bunge evidently deliberately did not mention the source of semen in the frozen sperm papers, but he did say the following year that attempts to concentrate a childless husband's sperm by pooling several frozen samples were "rather disappointing." Bunge to E. Perry McCullagh, 3/4/1955, Correspondence "M," 1953–1965, box 2, Bunge Papers. Several years later, Bunge did tell a reporter that husband insemination had been successful "in a few isolated instances." Memorandum to Frank Nye, *Cedar Rapids Gazette*, 10/19/1961, Correspondence "N," 1953–1963, box 2, Bunge Papers. A 1956 review of all infertile couples treated at the Iowa clinic from 1952 to 1955 describes using frozen semen for donor insemination but only the use of fresh semen for husband insemination. Keettel et al., "Report of Pregnancies," 104. Sherman, however, recalls that all the sperm used in the first cases was husband sperm. Sherman interview.

77. Bunge et al., "Clinical Use," 525 (quoting *Manchester Guardian*, 10/29/1953).

the agricultural faculty at Iowa State College, not of the doctors at the University of Iowa medical school.[78]

These new test tube babies provided an opportunity for Bunge and Sherman, neither previously prominent in fertility medicine, to create international reputations, but the criticisms were a constant reminder of the risks of this route to fame. Bunge, as the more senior and as a state medical school professor, had more to lose. As a doctor, he faced an ongoing need to attract patients and was judged against formal and informal codes of medical professionalism by his colleagues. Although his appointment to full professor had been finalized by late 1953, he also needed to be conscious of university and state politics that might affect his future career. Having a state legislator single him out for criticism to the university president was not the kind of attention he needed. To minimize popular and professional criticism, Bunge evidently strove to publish the results in the most prestigious scientific and medical outlets possible. The publications in the peer-reviewed *Proceedings* and *Nature* demonstrated the firm scientific foundation of the work.

The publications also helped to establish Sherman's position as an up-and-coming scientist. While it was disappointing to the young biologist to have an unanticipated coauthor, a publication in the high-profile *Nature* was a coup for any scientist, particularly a graduate student. As he looked for a job in the spring and summer of 1954, after filing his dissertation in February, Sherman could use those publications to support his applications. Bunge arranged for Sherman to receive continuing financial support during his job search, negotiating a one-year research position in urology beginning in July 1954. By October 1954, however, Sherman had said a strained goodbye to Bunge and left for a position working with animal sperm in Madison, Wisconsin.[79]

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78. Bunge to Alan and Louise Duval, 12/10/1953, Correspondence "D," 1952–1964, box 1, Bunge Papers; Bunge to Charles Ernshaw, 12/21/1953, Correspondence "E," 1950–1964, box 1, Bunge Papers; *Daily Iowan*, 7/9/1975; Maravetz, "Baby-Making Breakthrough," 30. Unfortunately, none of the letters Bunge recalled receiving in opposition to the work are preserved in the Bunge Papers.

79. Bunge to Rubin [Flocks], 5/25/1954, Correspondence "S," 1952–1963, box 2, Bunge Papers; Bunge to Warren Nelson, 10/15/1954, Correspondence "N," 1953–1963, box 2, Bunge Papers; Sherman CV.

WHILE SHERMAN was finalizing his thesis and contemplating his next career move, Bunge focused intensely on the clinical outcome. The final piece of the Iowa triumph would be the delivery of the three babies. The health of the babies was a matter of intense concern to the researchers. Proof that frozen and thawed sperm could fertilize an egg was not proof that a normal baby would result. The knowledge of many successful uses of frozen-thawed sperm in animals indicated that the researchers could anticipate success, but the fact remained that the doctors could not be sure what would happen. Bunge wrote to a medical colleague in early December 1953 that "we are nervously awaiting to see what [our patients'] issue will look like."[80]

Before the clinical use of frozen-thawed sperm, Sherman had conducted multiple laboratory tests to determine whether the sperm were normal after thawing. He had performed painstaking microscopic work, using staining techniques to distinguish live and dead sperm, counting mobile sperm in samples, observing and noting the type of motion exhibited, and timing the length that thawed sperm remained active at room temperature. While the pregnancies progressed, Sherman sought additional proof of the normality of frozen-thawed sperm. He looked for changes in the nuclear proteins after glycerol treatment and after freezing and thawing.[81] The now classic paper by James Watson and Francis Crick describing the double helical structure of DNA had just been published in April 1953, and the genetic code was yet to be worked out.[82] Until 1952 the most popular hypothesis had been that proteins carried the theoretical concepts known as "genes," so nuclear proteins were an appropriate place to look for potentially significant

80. Bunge to John A. Hutch, 12/3/1953, Correspondence "H," 1948–1964 (second folder), box 2, Bunge Papers.

81. Sherman and Bunge, "Observations on Preservation," 689; J. K. Sherman and R. G. Bunge, "Effect of Glycerol and Freezing on Some Staining Reactions of Human Spermatozoa," *Proceedings of the Society for Experimental Biology and Medicine* 84 (1953), 179–80.

82. J. D. Watson and F. H. C. Crick, "A Structure for Deoxyribose Nucleic Acid," *Nature* 171 (4/25/1953), 737–38. See also J. D. Watson and F. H. C. Crick, "Genetical Implications of the Structure of Deoxyribonucleic Acid," *Nature* 171 (5/30/1953), 964–67.

changes.[83] It must have been with relief that Sherman detected no changes in nuclear proteins.[84] During the three pregnancies that had been announced in *Nature*, and a fourth that was in progress in 1954, the clinicians also attempted to ascertain the normality of each fetus. In the pre-ultrasound era, they used x-rays to examine the fetal skeleton in the third trimester, a common procedure for any pregnancy in the 1950s. The visualization of an apparently normal fetus must have reassured both patients and doctors.[85]

This same uncertainty dogged later researchers in assisted conception. In 1978, when Lesley Brown was pregnant with the first baby conceived by *in vitro* fertilization (IVF), a technique that moved insemination itself into the test tube, her doctors began to worry when she did not gain enough weight in her last trimester, and then developed toxemia. They placed her on bed rest and eventually delivered the baby by caesarian section, attempting to minimize the chances of a poor outcome. Her daughter, Louise Brown, who arrived safely in an English hospital without apparent abnormality, was widely hailed as the "first test tube baby."[86] Even some years later, when the pioneering American doctors Howard and Georgeanna Jones awaited the birth of the first IVF baby in the United States in 1981, Howard Jones was so fearful of a negative outcome that he entered the delivery room with a draft press release in his pocket, describing his grief and disappointment. The draft remained unused when Elizabeth Carr, like Louise Brown, turned out to be fine.[87]

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83. The state of scientific understanding in the early 1950s is described in Gunther S. Stent, "The DNA Double Helix and the Rise of Molecular Biology," in James D. Watson, *The Double Helix: A Personal Account of the Discovery of the Structure of DNA Together with Commentary, Reviews, and Original Papers,* ed. Gunther S. Stent (New York, 1980), xi–xxii.

84. Sherman and Bunge, "Effect of Glycerol and Freezing," 179.

85. Randi Hutter Epstein, *Get Me Out: A History of Childbirth from the Garden of Eden to the Sperm Bank* (New York, 2010), 190–91; Bunge et al., "Clinical Use," 520–29.

86. Robin Marantz Henig, *Pandora's Baby: How the First Test Tube Babies Sparked the Reproductive Revolution* (Boston, 2009), 142, 150–52, 172; "The First Test-Tube Baby," *Time Magazine*, 7/31/1978, 58–69.

87. Henig, *Pandora's Baby*, 224–25.

No such press releases were needed in Iowa City in 1953 for these earlier "test tube babies." The researchers had promised complete anonymity to the couples who had agreed to participate in their experiment. Unlike the situation 25 years later, there was to be no press conference outside the delivery room for the first frozen sperm baby. Bunge's plan was to wait until all the babies had been born, keep the births secret, and then announce the final data at one or more major professional meetings. After the pregnancies were disclosed, the researchers sought to discourage inquiries by telling the press in early December that the first baby would be born "within the next three months"; they would not reveal any further information until that time.[88] The plan was for the news of the babies' arrival, like the news of the pregnancies, to be revealed first in a forum and in language aimed at medical researchers, and only then to be picked up by the lay media.

Bunge was planning to attend the American Urological Association meeting in New York City in April 1954 to present his work to his colleagues.[89] He was also very interested in an annual prize for the best work in reproductive medicine offered by the American Society for the Study of Sterility. The Iowa breakthrough, proving that frozen-sperm banks could be used as a way of facilitating human reproduction, was surely the type of research suitable for such an honor. Bunge watched for an announcement of the competition and told friends in California that if he were awarded the prize, he would be traveling with his wife to San Francisco in the spring to attend the society's meeting. The deadline for prize submissions was March 1. While planning his talk for the New York conference (Bunge made reservations at the Waldorf-Astoria as he anticipated his triumphant visit) and writing his paper for the prize committee, Bunge refused to give out any details about the babies, telling those who inquired that the university information service had asked him to release information only through them.[90]

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88. *Cedar Rapids Gazette,* 12/3/1953.

89. Bunge to William Harness, 10/5/1953, Correspondence "H," 1948–1964, box 1, Bunge Papers.

90. Bunge to William Harness, 1/19/1954, Bunge to John O. Haman, 2/5/1954, Bunge to John Hutch, 4/23/1954, and William Harness to Bunge, 2/12/1954,

In private, Bunge could not help sharing his good news with friends and family as the babies arrived. He kept his mother, still living in Michigan, up to date. "It won't be long," he told her jokingly, "before my icicles will be in the deep freeze section of the A&P stores." Yet he cautioned her that the information was a "classified secret." Without admitting to the births directly, Bunge was also privately telling medical friends who were eager to start using frozen sperm in their practices but worried about the risk of abnormalities that he saw no reason not to proceed.[91]

Bunge's strategy required keeping the births quiet for several months while he made his professional arrangements. He was also collecting information on one of the babies remotely, because one of the pregnant women had moved away from Iowa City with her husband. The couple was keeping Bunge informed by mail about her pregnancy as her December due date approached. By a letter dated December 21, 1953, the news came from California: a girl, born December 19, mother and baby doing well.[92] The news of the safe birth confirmed the researchers' highest hopes. Now the prize paper could be written, and the talks prepared.

In February 1954, though, as the researchers were writing up their clinical notes for the prize committee, matters started slipping out of control. Bunge wrote to the father of the baby girl, asking for an update on her weight gain. The reply was devastating. The parents had learned that one of their daughter's eyes was incompletely formed and that she would be blind in that eye.[93] Was this malformation a result of the freezing and thawing of the sperm? What should the clinical report say?

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all in Correspondence "H," 1948–1964, box 1, Bunge Papers; Bunge to Waldorf-Astoria Hotel, 5/7/1954, Correspondence "W," 1952–1962, box 2, Bunge Papers. For an example of his refusal to provide details, see Bunge to Howard Gaudin, 3/2/1954, Correspondence "G," 1950–1964, box 1, Bunge Papers.

91. Bunge to Anna Bunge, 12/22/1953 and 2/23/1954, Correspondence "B," 1949–1964; and Bunge to John O. Haman, 2/5/1954, and Bunge to William Harness, 2/16/1954, Correspondence "H", 1948–1964, box 1, Bunge Papers.

92. Charles Ernshaw to Bunge, 12/21/1953, Correspondence "E," 1950–1964, box 1, Bunge Papers. The name of this correspondent has been changed to protect patient confidentiality.

93. Bunge to Charles Ernshaw, 2/10/1954, and Charles Ernshaw to Bunge, 2/15/1954, Correspondence "E," 1950–1964, box 1, Bunge Papers.

Bunge evidently consulted every eye specialist he could find. On the advice of an eye doctor at the University of Iowa, he wrote back to ask the father whether the mother had experienced any illnesses during pregnancy, because some maternal infections during the first trimester, most notably German measles, could lead to infant blindness. Bunge's Iowa colleague was disinclined to attribute the birth defect to the sperm, but Bunge was not yet convinced. He also contacted one of his old professors at the University of Michigan, seeking his opinion.[94]

While Bunge fretted, the child's condition deteriorated. She began to suffer seizures, which frightened her parents and led to her hospitalization. By March, the combination of symptoms pointed to congenital toxoplasmosis, a disease caused by a parasitic infection of the mother during pregnancy. Untreated since December, the disease was "far advanced" and there was "considerable damage," according to the father's report.[95]

The diagnosis was terrible news for the parents. Their daughter, were she to survive, might be blind and developmentally disabled. The prognosis was "doubtful."[96] But the attribution of the problems to an infection must have been a great relief to the researchers, even as Bunge grieved for the family, whom he knew personally. The baby's problems seemed to have no connection to her unusual origins. As Bunge said in a private letter to the Michigan ophthalmologist he consulted, the news "takes us off the hook a little bit." In the clinical report that was eventually published, describing the inseminations and pregnancies that resulted in two baby girls and one baby boy, all babies were described as "normal." No one was to know of the toxoplasmosis.[97]

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94. Bunge to Charles Ernshaw, 2/18/1954, Correspondence "E," 1950–1964, box 1, Bunge Papers; Bunge to Harold F. Falls, 2/18/1954, Correspondence "F," 1949–1964, box 1, Bunge Papers.

95. Charles A. Branthaver to Bunge, 3/11/1954, Correspondence "B," 1949–1964, box 1, Bunge Papers; Charles Ernshaw to Bunge, 2/24/1954, Correspondence "E," 1950–1964, box 1, Bunge Papers.

96. Charles Ernshaw to Bunge, 2/24/1954, Correspondence "E," 1950–1964, box 1, Bunge Papers.

97. Bunge to Harold F. Falls, 3/8/1954, Correspondence "F," 1949–1964, box 1, Bunge Papers; Bunge et al., "Clinical Use," 527–28. In 1962 Bunge did tell Sophia Kleegman, a fertility specialist in New York City with whom he had been corresponding since the early 1950s, that one of the 15–20 babies from

After the drama of February and March, Bunge's plans suffered a further blow in April, while the paper describing the births was still before the prize committee. The *Gazette* reporter had found someone to confirm that the awaited children had arrived. On April 9, 1954, the Sunday edition of the *Cedar Rapids Gazette* published its bold headline, referencing the news reports from 1951 predicting posthumous fatherhood. The lengthy article, covering the width of the front page, was illustrated by photographs of Bunge and Sherman. The actual news content, however, was quite limited. The reporter had gleaned that the three births announced in *Nature* "had occurred" and that the progeny were "normal." He did not know dates, sexes, or weights. Both Bunge and Sherman refused to comment for the story, although somehow the reporter learned that the results were being entered in a medical competition. Most of the article was drawn from previously published articles and Sherman's dissertation, describing the freezing experiments. The article described a "bank" at the university that held semen from childless men, which, the reporter speculated, would be used to inseminate their wives. It reiterated the notion that this meant that fatherhood after death was now possible, while quoting an earlier refusal by Bunge to comment on the "sociological aspects" of the project: "I don't want to get into the ideology of it. We are conducting the study, and that's it."[98]

The story was not the sober, scientific announcement Bunge had been planning for a national audience of doctors who specialized in urology and infertility, after a committee of his peers had reviewed his data and found them prizeworthy. It was sensationalist, emphasizing parenthood beyond the grave, and it caused a sensation. As the wire services picked up the story, Bunge heard from colleagues from California to New York who had seen press reports.[99] Bunge described himself as "down-

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frozen sperm born since 1953 had suffered toxoplasmosis. Bunge to Sophia Kleegman, 2/21/1962, Correspondence "K," 1952–1962, box 2, Bunge Papers.

98. *Cedar Rapids Gazette,* 4/9/1954.

99. Sophia Kleegman (NY) to Bunge, 4/11/1954, Correspondence "K," 1952–1962, box 2, Bunge Papers; John Hutch (CA) to Bunge, 4/19/1954, Correspondence "H," 1948–1964, box 1, Bunge Papers (describing "nice blow" in Bay Area papers).

right ashamed" when the article appeared. He told one friend who had written to congratulate him that the article was "full of crap."[100] The resulting attention was exactly what he had feared.

> Publicity and attitudes of some people toward this research has been distressing at times to me. While I believe with all my heart that it is a good project, it distresses me that at times all of the uncalled-for confusion comes tumbling down on my head. The misquotations in the newspapers and their subsequent effect on some of my colleagues produced a considerable area of misunderstanding.[101]

The American Society for the Study of Sterility wanted nothing to do with such sensationalism. As Bunge described it, "there was quite a tangle" with the society. The prize competition was cancelled for 1954—the prize committee unanimously agreed that "none of the manuscripts submitted merited the award." Bunge did not travel to the annual meeting in San Francisco to present his paper. Further, he also cancelled his long-planned appearance at the American Urological Association meeting in New York City, explaining to a colleague that the press attention had caused him to withdraw. The university information service issued a statement that the researchers would not make any public presentation of their work.[102]

The world would have to wait for the publication of the clinical article, originally written for the now-cancelled prize competition. Eventually, the article appeared in *Fertility and Sterility*. The *Gazette*, still covering the story, ran another front-page story in December, titled "Millions of Childless—A New Hope," again without any input from the researchers.[103] Even a year later, Bunge remained shy of the press, refusing to speak to reporters and declining to write a popular article about his work. He explained, "We have sort of hidden our heads on making any popular progress report on our frozen semen project. There

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100. Bunge to John O. Haman, 11/18/1954, and Bunge to John Hutch, 4/23/1954, Correspondence "H," 1948–1964, box 1, Bunge Papers.

101. Bunge to Virginia Struermer, 7/29/1954, Correspondence "S," 1952–1963, box 2, Bunge Papers.

102. Bunge to Blake Talbot, 7/1/1954, Correspondence "T," 1953–1965, box 2, Bunge Papers; Herbert H. Thomas to Bunge, 7/12/1954, Correspondence "T," 1953–1965, box 2, Bunge Papers; *Cedar Rapids Gazette*, 6/17/1954.

103. *Cedar Rapids Gazette*, 12/11/1954.

was a deplorable amount of adverse publicity connected with the scientific publications."[104]

AT MID-CAREER, on the cusp of becoming full professor, Bunge had courted fame—and found it not to his liking. The Iowa work had proven the viability of sperm banks, long considered a way of improving the human race, but Americans were not ready for sperm banks. It would be another two decades before the first commercial sperm banks would open.[105] In the interim, probably fewer than ten universities maintained frozen-sperm collections.[106] Bunge deliberately withdrew from the frontlines of reproductive medicine as too controversial, a move that allowed the history-making Iowa babies to fall into popular obscurity.[107]

Bunge's public silence did not signal the complete disappearance of the Iowa sperm bank. An unnamed doctor told the persistent *Gazette* reporter in July 1954 that research into the problem of sterility would be continuing at the medical school. By March 1955, there had been nine pregnancies from frozen donor sperm at the University of Iowa fertility clinic. Disappointingly, those nine pregnancies had resulted after 26 attempts, a rate of success lower than that of donor insemination using fresh sperm. Eight of the women who had failed to conceive using frozen donor sperm subsequently conceived using fresh donor sperm.

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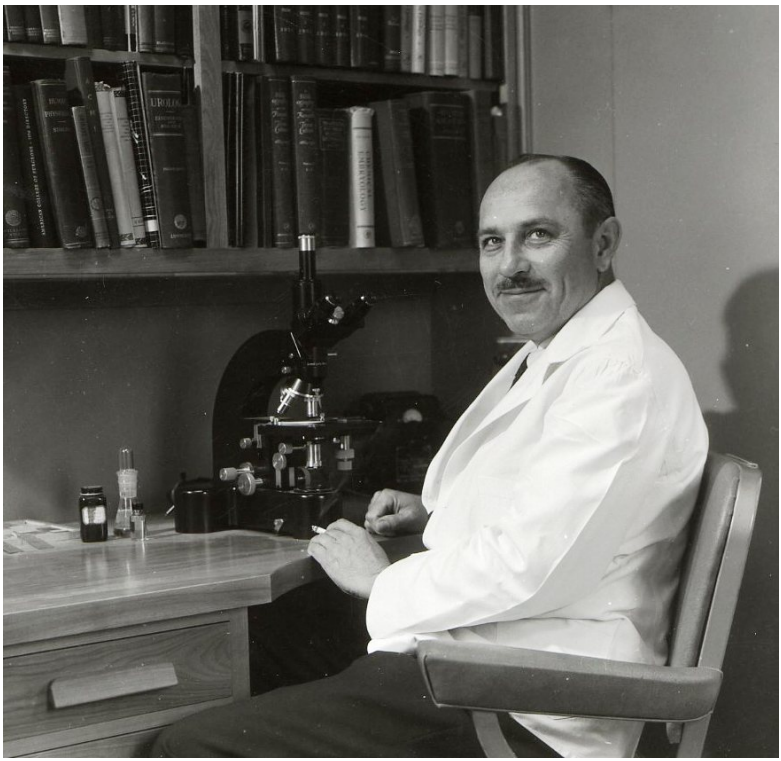
104. Bunge to A. R. Michaelis, date missing (in reply to a letter from Michaelis dated 3/7/1956), Correspondence "M," 1953–1965, box 2, Bunge Papers.

105. Daniels and Golden, "Procreative Compounds," 14–16.

106. Mark S. Frankel, "The Public Policy Dimensions of Artificial Insemination and Human-Semen Cryobanking," *Policy Studies in Science and Technology* 56 (Washington, DC, 1973), 1.

107. The Iowa research was never forgotten within the literature of reproductive medicine and has been continually cited. See, for example, Alan F. Guttmacher, "The Role of Artificial Insemination in the Treatment of Sterility," *Obstetrical and Gynecological Survey* 15 (1960), 767–85; G. W. Matheson, L. Carlborg, and C. Gemzell, "Frozen Semen for Human Artificial Insemination," *American Journal of Obstetrics and Gynecology* 104 (6/15/1969), 495–501; R. G. Polge, "Current Status of the Preservation of Semen and Embryos," *Proceedings of the Royal Society of Medicine* 69 (1976), 560–62; B. A. Keel, B. W. Webster, and D. K. Roberts, "Effects of Cryopreservation on the Motility Characteristics of Human Spermatozoa," *Journal of Reproduction and Fertility* 81 (9/1/1987), 213–20; and Ying Song, Randy Sharp, Fenghua Lu, and Maliha Hassan, "The Future Potential of Cryopreservation for Assisted Reproduction," *Cryobiology* 60 Supp. 1 (2010), S60–S65.



Dr. Raymond Bunge in 1957. From F. W. Kent Collection, University Archives, University of Iowa Libraries.

By November 1, 1954, the clinic doctors had decided that for donor insemination, fresh semen was preferable. According to Bunge's reckoning, by 1962 only about 15 to 20 babies had been born from frozen Iowa sperm since 1953, indicating that very few pregnancies were initiated with frozen sperm after 1954. Some of those babies may have been born elsewhere.[108] Although at first, in the aftermath of the controversy, Bunge declined all requests to ship frozen sperm, by 1963 he was willing to do so. He told a doctor from a small town who inquired about banked sperm as a solution to the difficulty of recruiting an anonymous

108. *Cedar Rapids Gazette*, 7/4/1954; Keettel et al., "Report of Pregnancies," 104; Bunge to Sophia Kleegman, 2/21/1962, Correspondence "K," 1952–1962, box 2, Bunge Papers.

local donor that he had in the past occasionally shipped specimens by air freight.[109] The sperm bank was quietly maintained, but was not a significant part of fertility treatment, either for husband or donor insemination.

After 1954 Bunge did not seek to capitalize on his participation in this history-making first by continuing to work in assisted conception. He returned to his research on urinary cancers, published on the biochemistry of fresh sperm, and developed a new research agenda related to intersex persons.[110] Through the 1950s Bunge occasionally mentioned in private correspondence that he continued to research concentrated frozen semen as an alternative to fresh semen for artificial insemination by husband, but he did not publish any further results, aside from one article in the *Journal of Urology* in 1960.[111]

On the other hand, Sherman, the young scientist whose experiments had initially intrigued Bunge, saw no reason to repudiate his successful dissertation research or to keep quiet about the preservation of sperm by freezing as he developed his scientific career. Instead, he devoted considerable professional energy to ensuring the eventual development of sperm banks as viable, publicly accepted institutions. Turning down opportunities to return to the East Coast, in 1958 Sherman accepted a faculty position in the Department of Anatomy at the University of Arkansas medical school, and remained there for the duration of

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109. Bunge to John Lingenfelder, 3/5/1956, and Bunge to Everett M. Laury, 5/21/1960, Correspondence "L," 1952–1962, box 2, Bunge Papers; Bunge to Harold B. Stout, 4/16/1963, Correspondence "S," 1952–1963, box 2, Bunge Papers.

110. See, for example, R. G. Bunge, "Cyto-Dynamic Properties of Urinary Neoplasms. V. Cultivation In Vitro of Transitional Cell Epithelium," *Journal of Urology* 73 (Jan. 1955), 101–2; R. G. Bunge and J. T. Bradbury, "Genetic Sex: Chromatin Test versus Gonadal Histology," *Journal of Clinical Endocrinology and Metabolism* 16 (Aug. 1956), 1117–19; R. G. Bunge and J. T. Bradbury, "Male Intersex with Ambiguous External Genitals and Well-Developed Muellerian Elements: A Case Report," *American Journal of Obstetrics and Gynecology* 80 (July 1960), 76–79; R. G. Bunge, "Two Types of Intersexuality," *Southern Medical Journal* 58 (Aug. 1965), 980–84; and K. H. Moon and R. G. Bunge, "Observations on the Biochemistry of Human Semen. I. Fructose," *Fertility and Sterility* 19 (March–Apr. 1968), 186–91.

111. Bunge to Harold Lamport, 9/21/1956, Correspondence "L," 1952–1962, box 2, Bunge Papers; R. G. Bunge, "Further Observations on Freezing Human Spermatozoa," *Journal of Urology* 83 (Feb. 1960), 192–93.

his career. He established and maintained a sperm bank at the university hospital, developed improved freezing techniques, earned accolades as a teacher, and continued his research into cryobiology. By 1967, he had received his own promotion to full professor. Sherman became a charter member of the Society for Cryobiology (founded in 1964) and the American Association of Tissue Banks (founded in 1976) and drafted the first certification standards for frozen human sperm banks.[112]

Through the 1960s, however, doctors continued to view the use of frozen-thawed sperm as experimental.[113] Despite the appearance of the first commercial sperm banks offering sperm storage services to men in the 1970s, frozen sperm would not become a significant part of reproductive medicine until the 1980s. As the AIDS epidemic began, the medical community came to understand that the HIV virus was transmitted in human semen, and that there could be a significant time lag between infection and a positive HIV test. There was now a strong medical reason to prefer frozen semen for donor insemination, as a donor could be retested for HIV some months after donation and before the semen was used, greatly reducing the risk of transmission of HIV.[114] Sherman was active in formulating and promoting a recommendation that doctors, who had been using fresh semen in 80 percent of donor inseminations, switch to frozen semen only, and from 1988 to 1992 he acted as an adviser to the Food and Drug Administration about AIDS and cryobanking.[115] He repeatedly published review articles summarizing the state of semen cryobanking for international medical and scientific audiences, and wrote some of the first histories of sperm banking.[116]

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112. Maravetz, "Baby-Making Breakthrough," 30; Sherman interview.

113. Finegold, *Artificial Insemination,* 14–15; J. K. Sherman, "Synopsis of the Use of Frozen Human Semen since 1964: State of the Art of Human Semen Banking," *Fertility and Sterility* 24 (1973), 397, 398–99.

114. Jerome K. Sherman, "Frozen Semen: Efficiency in Artificial Insemination and Advantage in Testing for Acquired Immune Deficiency Syndrome," *Fertility and Sterility* 47 (1987), 19–21.

115. Ibid., 19; Sherman CV.

116. See, for example, J. K. Sherman, "Research on Frozen Human Semen: Past, Present, and Future," *Fertility and Sterility* 15 (1964), 485–99; idem, "Synopsis," 397–412; and "Cryopreservation of Human Semen," in *Techniques of*

Dr. Jerome Sherman at work in 1971 at the University of Arkansas. Image courtesy of the UAMS Library Historical Research Center, Little Rock, Arkansas.

Despite the work that Sherman performed over a half-century to develop and promote sperm banks, decades elapsed between the Iowa babies as living proof of the concept and its acceptance. Frozen semen repositories may have been possible, but they were not desirable until assisted conception became more frequently used and accepted as a positive intervention. With each reemergence of the "test tube baby"—in the 1930s, the 1950s, and the 1970s—the medical and social landscape had changed, requiring Americans to recalculate the benefits and risks of these new conceptions. After 1953 the persistent per-

Human Andrology, ed. E. S. E. Hafez (New York, 1977), 399–420. Sherman's publications are listed in full in Sherman CV.

formance of artificial insemination with both fresh and frozen sperm supported a shift in acceptance of the practice. Even before Louise Brown made front-page news, a doctor who estimated that he performed 40 to 50 artificial inseminations per week in his New York fertility clinic in the early 1970s thought that "the repellant connotations of artificial insemination are almost nonexistent now." Sherman agreed, calling donor insemination a "widely accepted medical practice" by 1973.[117]

When Louise Brown's arrival proved the possibility of a new variant of assisted conception, even the reiteration of the threatening aspects of test tube babies in public discussions could not keep couples from clamoring for technical assistance in conception or doctors from rushing to open IVF clinics in response to this demand.[118] The first IVF conceptions were performed using fresh semen from the intended father and an egg from the intended mother, but the technique could also be used with donor gametes. As the assisted reproductive industry developed in the wake of enthusiasm for IVF and after the emergence of AIDS made fresh semen medically risky, the sperm bank found a place as part of that industry, providing frozen donor sperm to women seeking pregnancy in nontraditional ways.

IOWA, the perennial "middle land," once again proved a bellwether at mid-century.[119] The Iowa researchers exemplified the trend toward offering more medical assistance to the infertile. Bunge and Sherman, surrounded by an agricultural culture, did not hesitate to adapt animal husbandry techniques to the clinic in pursuit of a new type of test tube baby. Yet test tube babies were not acceptable to most Americans regardless of geography. Public discussions of test tube babies brought intense public interest and criticism in Iowa, as elsewhere. Criticism had followed Frances Seymour in 1934 when she went public with her

117. D. Rorvik, "The Embryo Sweepstakes," *New York Times Magazine*, 9/15/1974, 17, as quoted in Phillip Reilly, *Genetics, Law and Social Policy* (Cambridge, MA, 1977), 191; Sherman, "Synopsis," 401. For a contrary opinion, see Marsh and Ronner, *The Empty Cradle*, 227.

118. Marsh and Ronner, *The Empty Cradle*, 239–41; May, *Barren in the Promised Land*, 217.

119. The phrase is from Dorothy Schwieder, *Iowa: The Middle Land* (Ames, 1996).

artificial insemination practice, and it followed Bunge and Sherman in 1954. An Iowa legislator condemning frozen sperm as "pagan"[120] was expressing a lay person's version of the distaste expressed by the physicians of the American Society for the Study of Sterility, who found frozen-sperm babies too controversial to be prizeworthy. Despite this widespread distaste, Iowa couples who came to the university's fertility clinic for help were willing to try the new technique. As Iowans both embraced and rejected this advance, they reflected the perspectives of the nation.

For the next few decades, Iowans also used a strategy to address this ambivalence that reflected national practice, quietly keeping the sperm bank in operation at the university hospital and continuing to offer artificial insemination to patients while avoiding publicity. During the 1970s, however, Iowans once again began to discuss and celebrate frozen sperm. As Bunge neared retirement and as sperm banking became mainstream, he began to speak publicly about the Iowa test tube babies. In 1975, the year before his retirement, the university newspaper, the *Daily Iowan*, sought him out and published a full-page spread trumpeting "the urologist as superstar, trailblazing with gusto." Bunge told the student interviewer about how one of those first three patients was delayed by a blizzard on the day she was scheduled to receive frozen sperm. By 1977, the *Daily Iowan* described Bunge as a "pioneering urologist," and in 1978, the year Louise Brown was born, he was in the paper as "still ingenious" at 70.[121] Once sperm banks were well established in the 1990s, the University of Iowa also sought to advertise Sherman's work, highlighting him as an influential alumnus. The alumni magazine made him the subject of a cover story in 1998, providing an account of his "baby-making breakthrough" that explained how the "father of semen banks" did his pioneering work at the University of Iowa. In 2006 Sherman received a Distinguished Alumni Award.[122] As test tube babies are no longer

120. Maravetz, "Baby-Making Breakthrough," 30.

121. *Daily Iowan*, 7/9/1975, 10/6/1977, 7/7/1978.

122. Maravetz, "Baby-Making Breakthrough," 29; www.iowalum.com/daa/sherman.html (last viewed 8/21/2011).

specters of a dystopic future but cherished children all around us, Iowa is willing to remember and celebrate its early test tube babies and the first frozen-sperm bank.