

12

THE IMPACT OF MEDICAL HISTORY ON MEDICAL HALACHAH

Edward Reichman, M.D.

Never before has a generation been privy to such rapid and extraordinary scientific advances. However, such change invariably spawns a multitude of ethical dilemmas. For the religious Jew, in particular, history has borne out that scientific advance begets halachic challenge. The response to halachic challenge has traditionally been reflected in the *teshuvah* or responsa literature, this literature being a product or collection of responses to individual questions. Today, the changes in science are so sweeping that many of the issues, such as genetic testing, are no longer person specific, but rather affect all members of the Jewish community equally. The conference format is therefore, in essence, a communal responsum.

This conference, in particular, represents the paradigm of the modern medical halachah conference, a product of the late twentieth century. With simultaneous translation and computer driven presentations, it has addressed some halachic aspects of cutting edge medical technology. As has become the norm at such gatherings, the podium was shared by both scientists and rabbis alike, each sharing their own expertise. Appropriately, the scientific presentations reflected the most recent advances in medical research, while the rabbinic counter-

presentations responded accordingly. In a world where thousands of jargon-filled scientific articles are published weekly and where almost every molecule of the human body has its own research team, there is simply no other effective and productive way to conduct an halachic conference. In order for halachic authorities, the likes of which participated in this conference, to address modern medical issues, there must be direct dialogue with the representatives of the scientific world. Otherwise, the halachic discussions are anachronistic and purely academic. However, while this particular conference format may be a product of the recent past, the basic formula for the resolution of medical halachic dilemmas has remained intact throughout history. Rabbinic authorities at every stage of history invariably sought medical consultation, either directly or indirectly, prior to rendering decisions on *materia medica*. The accumulated literature of centuries of medical halachic discourse serves as the foundation for contemporary medical halachic analysis. As this literature spans the chronological gamut of scientific and medical discovery, it is essential to view each source in its proper historical context.

My objective in this article is to sensitize the reader to the historical dimension of medical halachic research. It is clearly essential for a modern rabbinic authority to integrate the most current medical information in order to address a particular medical issue. What is often neglected, however, is the value of an understanding of medical history as a supplement or adjunct to the study of medical halacha. Herein, I shall enumerate the ways in which a medical historical approach can be useful for the halachist, providing examples in each category. As this field of research remains largely unexplored, this exercise is an attempt to pave the path for future exploration of uncharted territory, and it is my hope that these categories and examples will be expanded, refined, restructured or replaced as research in this area evolves.

TEXTUAL INTERPRETATION

On a microcosmic level, an understanding of medical history can enhance or facilitate the interpretation of a particular text in a number of ways:

1) Identification of Personalities

Modern medical halachic responsa, despite their reliance on modern medicine and their inclusion of detailed scientific information, rarely contain references to specific physicians. In contrast, pre-modern medical halachic literature frequently contains such specific references. This is due, in large part, to the nature of medical training and tradition in the pre-modern era. Whereas today, medical students study textbooks which are a composite of multiple authors, the medical student curriculum of the Middle Ages and Renaissance consisted of selected works of a handful of authors, mostly from Greek antiquity.¹ Three of these authors, Hippocrates (ca. 460 B.C.E.-ca. 368 B.C.E.),² Galen (ca. 130 C.E.-ca. 200 C.E.)³ and Avicenna (980 C.E.-1037 C.E.)⁴, are often cited in rabbinic literature. The references may be accompanied by the title of physician,⁵ but sometimes there is no indication of the secular or medical origin of the author.⁶ Avicenna is called Ibn Sina in Hebrew and could easily be mistaken for a rabbinic source. The names of these physicians did not require identification by the rabbinic authors, as they were undoubtedly familiar to the contemporary reader. In fact, the works of all the aforementioned medical authors were frequently translated into Hebrew.⁷

1. S. D'Irsay, "Teachers and Textbooks of Medicine in the Medieval University of Paris," *Annals of Medical History* 8(1926), 234–39; S. Cooper, "The Medical School of Montpellier in the Fourteenth Century," *Annals of Medical History: New Series* 2(1930), 164–95, esp. 174; N. G. Siraisi, *Medieval and Early Renaissance Medicine* (University of Chicago Press: Chicago, 1990), 70–77.

2. *Teshuvot Maharashdam, Choshen Mishpat*, 364. Hippocrates is referred to as Avukrat in Hebrew.

3. *ibid*; *Teshuvot Maharshach* 2:160; *Tzitz Eliezer*, 10:25, chap. 4.

4. *Teshuvot Darchei No'am, Yoreh De'ah*, 26; *Noda bi-Yehudah, Mahadurah Tinyana, Yoreh De'ah*, 21; *She'eilat Ya'avetz* 1:41 and 171.

5. *Teshuvot Maharsham, C.M.* 364; *Noda bi-Yehudah, Mahadurah Tinyana, Yoreh De'ah*, 21.

6. *She'eilat Ya'avetz* 1:41 and 171.

7. E. Lieber, "Galen in Hebrew: The Transmission of Galen's Works in the Medieval Islamic World," in *Galen: Problems and Prospects* (Wellcome Institute for the History of Medicine: London, 1981), 167–186; One need only peruse the index of H.D. Isaacs, *Medical and Para-Medical Manuscripts in the Cairo Geniza Collection* (Cambridge

Knowing the nature of an author's reference can enhance the reader's interpretation. It is helpful to know that the author is citing a medical authority when discussing a medical matter. Such reliance on physicians could contribute to the general discussion on the reliance on medical knowledge in halacha (*ne'emanut harofim*). On a pragmatic note, knowing that the citation is not rabbinic in origin may also prevent fruitless searches for a reference.

2) Clarification of Concepts and Terminology

Just as medical personalities mentioned in rabbinic literature may be unfamiliar to the modern reader, the same is true for medical terminology and theories. Rabbinic literature throughout history, ranging from biblical to halachic commentaries, is replete with allusions to medical theories. These theories are variously assimilated depending on the context and are better understood in their proper medical historical milieu.

a) Innate heat—Prior to the eighteenth century, the ability of the human body to maintain temperatures higher than its environment was attributed to the existence of so-called innate heat. The source of this heat was thought to be in the heart, where a flame was thought to exist, similar in principle to the flame of a household furnace. Cardiac and respiratory function were thought to revolve around the control and maintenance of this all-important, life-preserving flame. The theory of innate heat, known in Hebrew as *chom ha-tiv'i*, finds its expression in biblical commentaries, where it is used to explain the fainting of Jacob upon hearing of his son's survival and the resuscitations performed by Elijah and Elisha,⁸ as well as in halachic discussions, where it is used

University Press: Cambridge, 1994) under Galen, Hippocrates and Avicenna to appreciate the popularity of these authors. For a list of extant Hebrew manuscripts of Avicenna's Canon, see B. Richler, "Manuscripts of Avicenna's Canon in Hebrew Translation: A Revised and Up-to-date List," *Koroth* 8:3-4(August, 1982), 145-168. Avicenna's Canon is the first Hebrew medical book to be printed and the only extant Hebrew medical incunabula (Naples, 1491). See also J.O. Leibowitz, "Ibn Sina in Hebrew," *Koroth* 8:1-2(June, 1981), 3-8; D. Wilk, "One Thousandth Anniversary of Ibn Sina: Notes from the Library," *ibid.*, 91-95.

8. For more extensive treatment of this topic, see E. Reichman, "The Incorporation

by R. Tzvi Ashkenazi in his discussion of the importance of the heart in the definition of life.⁹ It is important for the modern reader to appreciate that this doctrine is a product of science and not of rabbinic tradition, and that the contemporary scientific understanding of cardiac and respiratory physiology has supplanted the doctrine of innate heat.

b) Homunculus—In discussing the laws relating to procreation and the prohibition of wasting the male seed, R. Yechiel Epstein (1829–1908) makes the following comment: “Scientists have discovered, with the use of the microscope, that within the confines of the male seed exists a completely formed minuscule being. Therefore, one who emits seed wastefully is as if he has committed murder.”¹⁰ From whence did this notion of the preformed minuscule human being in the sperm, known as the homunculus, derive? And why is this seemingly obvious scientific support for the prohibition of wasting the male seed not cited by R. Epstein’s predecessors?

The history of embryology and reproductive physiology is as fascinating as the process of reproduction itself. How man arrived at the understanding of the process of procreation and the development of a full term fetus from the union of two cells is a prolonged tale of fantastic theories and intriguing misconceptions.¹¹ Among the misconceptions that littered the field of embryology in the 17th–19th centuries was the notion that within the human seed was contained the entire preformed human being.¹² This so-called homunculus, with proper nourishment, it was thought, would grow to the size of a full term fetus. R. Epstein co-opted the then current theory of the homunculus to but-

of Pre-Modern Scientific Theories into Rabbinic Literature: The Case of Innate Heat,” *Torah U-Madda Journal*, 8 (1998–1999) 181–199..

9. *ibid.*; See also E. Reichman, “The Halakhic Definition of Death in Light of Medical History,” *Torah U-Madda Journal* 4 (1993), 148–174.

10. *Aruch Ha-Shulchan* Even ha-Ezer 23:1.

11. See J. Needham, *A History of Embryology* (Abelard-Schuman: New York, 1959).

12. For a history of the notion of preformation see C. Pinto-Correia, *The Ovary of Eve: Egg and Sperm and Preformation* (University of Chicago Press: Chicago, 1997); J. Farley, *Gametes and Spores: Ideas About Sexual Reproduction 1750–1914* (Johns Hopkins University Press: Baltimore, 1982).

gress a pre-existing halachah. Subsequent to the theory's rejection by the scientific community in the late 19th century, it was no longer cited in rabbinic sources.

3) Prevention of Misapplication

Another dimension of textual interpretation enhanced by the study of medical history is an appreciation of the medical facts from which a halachic decision is derived. For example, in the assessment of medical risk in halachah, and the permissibility of undergoing potentially dangerous procedures, a passage from the works of R. Yaakov Emden is oft quoted.¹³ One section of this passage reads as follows: “. . . some choose to risk their lives in order to save themselves from great suffering, such as those who undergo the surgery for cutting the stone. . . . [such a surgery] is not permitted under any circumstance.” One must first identify the condition and procedure mentioned by R. Emden in order to ascertain the medical grounds for his prohibition. The condition mentioned by R. Emden is a urinary bladder stone, and the mortality rate for surgical removal of the stone at his time was anywhere from 20 to 50%, depending on the skill of the surgeon. It is essential to know the basis for R. Emden's strict ruling if one wishes to apply his principles to contemporary halachic issues relating to surgical mortality.¹⁴

TEXTUAL CONTEXTUALIZATION

An awareness of medical history may also enable the reader to look beyond the text itself and appreciate the particular source in its historical context. What precipitates discussion of certain issues at a certain period in history?

13. *Mor U-Ketzi'ah, Orach Chayiyim*, 328.

14. See E. Reichman, “A Tale of Two Stones: The Impact of Medical History on Medical Halakha,” *BDD* 5(Summer 1997), 33–40.

a) Autopsy—One of the first responsa addressing the issue of autopsy and anatomical dissection is that of R. Yechezkel Landau of 18th century Prague.¹⁵ R. Landau's halachic principle of requiring a "*choleh lifaneinu*," or immediate benefit, in order to violate the prohibitions of desecration and deriving benefit from the body is a cornerstone of many modern halachic responsa. As anatomical dissection and autopsy are today synonymous with medical education, one might ask why the question of autopsy in halachah did not arise earlier in halachic history. Rambam, who trained as a physician, makes no mention of autopsy or anatomical dissection, and the *Shulchan Aruch*, despite its extensive treatment of issues relating to death, burial and exhumation, is conspicuously silent on matters relating to autopsy. What could possibly explain this huge historical gap in addressing such a prevalent halachic problem?

A review of the history of autopsy and anatomical dissection in the western world provides the answer to this enigma. While dissection of the human corpse was practiced in Greek antiquity, for reasons which remain unclear, a universal ban on the dissection of the human body evolved thereafter. Although an occasional autopsy was performed, it was not until the Renaissance that anatomical dissection was formally introduced into the medical school curriculum in Europe.¹⁶ It is therefore evident why neither Rambam nor the *Shulchan Aruch* discusses the halachic ramifications of autopsy—autopsies were simply not routinely performed in this period of history.

b) The Doctrine of the Seven Chamber Uterus—Another example of the importance of chronology in the interpretation of medical discussions in rabbinic literature can be found not in the halachic literature but in the exegetical literature. A curious anatomical notion, the doc-

15. *Noda bi-Yehuda*-, *Mahaduraj Tinyana* Yoreh De'ah, 210.

16. See M.N. Alston, "The Attitude of the Church Towards Dissection," *Bulletin of the History of Medicine* 16:3(October, 1944); C. Singer, *A Short History of Anatomy and Physiology From the Greeks to Harvey* (New York, 1957); C.D. O'Malley, *Andreas Vesalius of Brussels* (University of California Press: Berkeley, 1964), 1–20; L. Edelstein, "The History of Anatomy in Antiquity," in his *Ancient Medicine* (Johns Hopkins University Press: Baltimore, 1967).

trine of the seven chamber uterus, is employed by a number of medieval exegetes in their explication of certain biblical passages.¹⁷ According to this doctrine, the uterus of the female contained seven chambers, three on the right, three on the left, and one in the center. Conception occurring in the chambers on the right would produce a male, while conception occurring in the left chambers would yield a female. The progeny of the center chamber would be either a hermaphrodite (*androgenus*) or have ambiguous genitalia (*tumtum*).¹⁸ One application of this doctrine by rabbinic commentators is in explaining the high reproductive rate of Jewish women in Egypt prior to the Exodus. According to the *Midrash*, each of the women in Egypt gave birth to sextuplets. Rabbi Issachar Eilenburg (1570–1623) invokes the doctrine of the seven chamber uterus in explaining why specifically six children were born to the women in Egypt, neither more, nor less. Based on the doctrine, as a woman had seven uterine chambers, she could potentially give birth to seven children at a time—three males, three females, and one *androgenus* or *tumtum*. According to R. Eilenburg, the women of Egypt were blessed in that they only gave birth to sextuplets, being spared the curse of bearing an *androgenus* or *tumtum*.¹⁹

If this is how the uterus was thought to be constructed, why is this anatomical notion not mentioned in the Talmud? It would certainly be important for the clarification of the laws of *niddah*. Furthermore, we find no primary rabbinic source mentioning this doctrine after the seventeenth century.

17. See biblical commentaries of *Tosafot in Otzar Perushim* (Shulsinger Brothers: New York, 1950), 48; R. Asher ben Yechiel, *ibid.* The authorship of this commentary is a matter of debate. See M.M. Kasher, *Sarei ha-Eleph* (Jerusalem, 1984), 67–68; Isaac ben Judah ha-Levi, *Pane'ach Raza* at Lev. 12:2; R. Chizkiyah Mano'ach, *Chizkuni* at Lev. 12:2.

18. On this doctrine, see F. Kudlien, “The Seven Cells of the Uterus: The Doctrine and its Roots,” *Bulletin of the History of Medicine* 39:5(1965), 415–423; *idem*, “The Legal Aspect of the Doctrine of the Seven Uterine Cells,” *Bulletin of the History of Medicine* 40:6(1966), 544–546; R. Reisart, “*Der Siebenkammerige Uterus*,” *Wurzbürger Medizinhistorische Forschungen* 39(1986).

19. *Tzedad le-Derech* on Ex. 1:7.

Here again, an appreciation of medical history sheds light on this chapter of medical exegesis. The so-called doctrine of the seven chambered uterus is a product of medieval imagination. No such notion is found in the scientific literature prior to this time. What led to the formation of this doctrine at this particular period in history is a matter of scholarly debate. The rabbinic citations of this doctrine, which span from the 12th to the 17th centuries, directly parallel the prevalence or acceptance of this notion in the scientific world. With the rejection of the doctrine of the seven chamber uterus by Berengario de Carpi in the 16th century²⁰ came a rapid decline in the use of this doctrine by rabbinic commentaries.²¹

TEXTUAL UTILIZATION

Not only does the study of medical history enhance textual understanding and chronological sensitivity of rabbinic texts, but, in broadening our scope to view the entire system of halachah, it can also aid in finding halachic discussions, analyses and direct or indirect precedents that can be applied to modern halachic discourse.

Just like in the practice of medicine, where certain historical medical theories or treatments are occasionally exhumed and resuscitated for modern use, such as the case of leeches, there are many long forgotten chapters in the history of medical halachah that might have relevance to the study of modern medical halachah. Some chapters may have direct relevance to modern discourse, dealing with substantively similar issues, albeit from a different scientific vantage point, while other medical halachic chapters, especially when viewed as part of a continuum of the interface of science and halachah, may provide theological or philosophical foundations with which to address new scientific discoveries.

20. See A. Plaut, "Historical and Cultural Aspects of the Uterus," *Annals of the New York Academy of Science* 75:2(January, 1959), 389.

21. Rabbi Akiva Eiger (1761–1837) cites the aforementioned passage of R. Eilenberg in his talmudic commentary, *Gilyon ha-Shas*, on *Berachot* 63b in alluding to how *Oved-Edom ha-Gitti* was rewarded with many children.

1) Halakhic Chapters with Potential Direct Relevance to Modern Medical Halakha

a) Smallpox—The mention of smallpox to a young physician evokes memories of theoretical discussions of the disease in medical school. Only a handful of older physicians have ever seen the disease. Indeed, in perhaps one of the most extraordinary successes in the history of epidemiology and disease control, through a vigilant and widespread global vaccination program, smallpox has officially been declared by the Center for Disease Control as eradicated from the face of the earth.²² The only issue now is whether to retain the few remaining samples of the virus housed in research laboratories in the United States and Russia so a new smallpox vaccine could be synthesized should the virus somehow resurface in the future.²³

From the 17th to 19th centuries there were countless deaths in Europe from smallpox. Smallpox was no less of a plague than AIDS, only it was far more devastating, and less discerning a virus, owing to the ease of its spread. So serious was this disease that one rabbinic authority recommended fasting if a town was stricken by smallpox,²⁴ and another obligated parents to flee with their children from such a town.²⁵

In the late 18th century a preventative therapy for smallpox became popular. The process of inoculation, as it was called, involved the removal of infected fluid from one who suffered from a mild form of smallpox, and the placement of that fluid, through a puncture, into the blood stream of the unexposed individual. Inoculation clearly was an effective therapy, but a significant percentage of inoculants, albeit a minority, developed smallpox and died.²⁶ Only in 1796 did Edward

22. See J.N. Shurkin, *The Invisible Fire: The Story of Mankind's Triumph over the Ancient Scourge of Smallpox* (G.P. Putnam's Sons: New York, 1979).

23. See C. Siebert, "Smallpox is Dead, Long Live Smallpox," *New York Times Magazine* (August 21, 1994); L.K. Altman, "Killer Smallpox Gets a New Lease on Life," *New York Times* (May 25, 1999).

24. *Magen Avraham, Orach Chayiyim*, 576:3.

25. R. Isaiah Horwitz, *Shelah*, cited in *ibid*.

26. See R.L. Miller, "An Old Malpractice Claim," *Lancet* 348(September 28, 1996). Pictured therein is a tombstone with the following epitaph: "In memory of Peleg, son of Thomas and Mary Conklin, who died of the smallpox inoculation. Jan. 27th, 1788. Aged 17 years."

Jenner, in what has been hailed by some as the most important theoretical medical advance in the last millennium, perfected the process of vaccination for smallpox, whereby previously uninfected individuals would be injected with cowpox virus, a virus similar to smallpox, but nonfatal, and which conferred immunity from future smallpox infection.

This new procedure generated a series of halachic discussions on the general permissibility of inoculation,²⁷ as it involves a risk of death for one currently not ill, as well as on the permissibility of receiving inoculation on the Sabbath. The personal loss of two children to smallpox led R. Abraham Nansich to author a small treatise devoted to the halachic aspects of inoculation. Therein, he presents an impassioned plea to the rabbis of his generation to permit the smallpox inoculation.²⁸

From these discussions one can learn not only halachic assessment of risk in medical procedures, but one can gain insight into the halachic issues raised in performing vaccinations. Can one receive an unproven vaccination that carries death as a potential side effect? How high does the mortality rate have to be in order to forbid such a vaccine? If the vaccine is clearly effective, however that is to be defined, can members of a community refuse to take it? If unvaccinated people acquire the disease, they can spread it to those as yet unvaccinated and thereby be guilty of possible indirect homicide. Perhaps all members of the community should be coerced or forced to submit to the vaccine. An analysis of this halachic chapter might lay the groundwork for the modern halachic issues that attend vaccination.

b) *The Case of Ovarian Transplantation*—One of the topics addressed at this conference is the complex question of maternal identity in a case of surrogate motherhood, or more specifically, gestational hosthood. Amongst the scant source material available for the halachic analysis of this issue, we find reference to a few early 20th century

27. Y. Z. Kahana, "Ha-Refuah bi-Safrut ha-Halachah Sheli-achar Chatimat ha-Talmud," *Sinai* 14(1944), 76–77; David Margalit, *Derech Yisrael bi-Refuah* (Jerusalem Academy of Medicine, 1970), 376–379; Tiferet Yisrael, *Yoma* 8:3; H.J. Zimmels, *Magicians, Theologians and Doctors* (Edward Goldston and Son: London, 1952), 107–110; W. M. Feldman, *The Jewish Child: Its History, Folklore, Biology and Sociology* (Bailliere, Tindall and Cox: London, 1917), 380–1, 383–4; P.E. Horowitz, *Sefer ha-Brit* (Yerid haSefarim: Jerusalem, 1990), 247–53.

28. A. Nansich, *Aleh Terufah* (Alexander and Son: London, 1785).

responsa dealing with the halachic ramifications of uterine and ovarian transplantation. Unbeknownst to the modern reader, physicians at this historical juncture were experimenting with true ovarian transplantation, with one case recorded in 1906 of a woman who gave birth to a healthy child after her ovaries were excised and replaced with a piece of donor ovarian tissue.²⁹ The rabbis of that time struggled with issues of maternal identity much like the rabbis of today. Upon finding such a reference to ovarian transplantation, one might be inclined to assume that the discussion of such a procedure in the early part of this century was purely theoretical and therefore perhaps limited to one or two responsa. In fact, this was not a theoretical exercise, but a response to a modern scientific advance that stimulated halachic exchanges in a number of scientific journals and books. Knowing that the discussions of ovarian transplantation were not imagined, but reacting to a new discovery, might lead to a more thorough search of the halachic literature for other sources addressing the issue of maternal identity. Such a search would bear fruit, and in fact, aside from the many sources common to both the halachic chapters of the early and late 20th century, there are additional sources from the discussions on ovarian transplantation which could contribute to our modern discourse.

2) Halakhic Chapters with Potential Indirect Relevance to Modern Medical Halachah

Some contemporary halachic issues, such as abortion (multi-fetal pregnancy reduction) or the Sabbath and medicine, can be directly extrapolated from the extant halachic corpus. The same principles and precedents are simply applied to the newly evolving circumstances. Other issues, however, such as genetic engineering, cloning and surrogate motherhood, being products entirely of modern composition, have no clear halachic precedents and test the limits of rabbinic creativity in finding relevant material in the existing body of halachic literature. It is in the latter circumstances that analysis of earlier halachic chapters,

29. For a comprehensive study of this topic, see E. Reichman, "The Halakhic Chapter of Ovarian Transplantation," *Tradition* 33:1(Fall 1998), 31–70.

where rabbinic authorities were grappling with new scientific discoveries, could contribute to modern dialogue and discourse. Viewing a collection of rabbinic responses to a particular category of scientific discovery may yield theological or halachic patterns and themes that would not be discernible from viewing one historically isolated incident. The lessons and principles gleaned from this approach could be assimilated or adapted to our modern context.

Cloning and genetic engineering reflect a paradigm shift in our ability to manipulate the human body, and in the way we view the human being. The attendant halachic issues relate not only to the pragmatic concerns of the definition of personhood and parentage, but also to the larger issues of interference in the process of procreation and the divine order. To assist in the exploration of the broader issues it might be helpful to return to previous episodes in history where the rabbis were confronted with similar concerns. In the early responsa on artificial insemination, for example, the first form of human intervention in the process of procreation, one may find themes that could be applied equally to the issue of cloning. Concerns expressed in these responsa, such as the dissolution of the family structure, ambiguity of lineage, the generation of people with uncertain parentage and the propriety of intervening in matters once thought to be the provenance of God exclusively, are all equally applicable to a discussion of cloning.³⁰

A general approach to scientific theories that seemingly conflict with rabbinic tradition can likewise be gleaned from previous historical chapters. In the 16th century, in a world which accepted the geocentric theory as absolute, objective fact, Copernicus dared challenge this age-old notion so invested with theological significance. With the heliocentric theory came a re-evaluation of the earth's place in the universe. In the 17th century, Francesco Redi, with his simple yet elegant experiments, put the first nail in the coffin of the long held notion that insects generate spontaneously. In the 19th century, Darwinism sparked a debate and re-assessment of the evolution of the human being in relation to the earth. Each of these paradigmatic shifts in the histories of

30. Recent articles on cloning do, in fact, draw on the earlier literature on artificial insemination to some extent.

astronomy,³¹ reproductive physiology³² and biology³³ produced a response in rabbinic literature. Lessons or themes extracted from this literature may contribute to the discourse on modern issues.

CONCLUSION

The principles distilled from the rich history of medical halachah, in conjunction with a knowledge and appreciation of medical history, will better equip us to confront the ever increasing complexities of the medical discoveries that lie ahead. This exercise will hopefully give the reader not only a greater appreciation of the scope and breadth of rabbinic integration of scientific knowledge throughout the ages, but will also provide a context and framework within which to address future halachic issues.

31. Andre Neher, "Copernicus in the Hebraic Literature from the Sixteenth to the Eighteenth Century," *Journal of the History of Ideas* 38(1977), 211–226. Neher incorporated this essay into his expansive work, D. Maisal, trans., Andre Neher, *Jewish Thought and the Scientific Revolution of the Sixteenth Century: David Gans (1541–1613) and his Times* (Oxford University Press: Oxford, 1986). Here Neher provides a thorough analysis of the dynamics of the history of astronomy, as well the views of the Maharal and Rema (the teacher of David Gans) on astronomy and their supposed impact on David Gans.

32. Y. Lampronti, *Pachad Yitzchak*, s. v., *zeda asura*; A. Carmell, ed., E. Dessler, *Michtav me-Eliyahu*, 4(5748), 355, n. 4; D.B. Ruderman, "Contemporary Science and Jewish Law in the Eyes of Isaac Lampronti and Some of His Contemporaries," *Jewish History* 6:1–2(1992), 211–224, reprinted in *ibid.*, *Jewish Thought and Scientific Discovery in Early Modern Europe* (Yale University Press: New Haven, 1995); A. Carmell and Y. Levi, "Re-ot ha-Einayim bi-Keviut ha-Halakhah," *Hama'ayan* 23:1(Tishrei, 5743), 64–69; I. Herzog, *Heichal Yitzchak*, O. H., 29.

33. The literature on evolution merits its own bibliography. See, for example, articles in A. Carmell and C. Domb, eds., *Challenge: Torah Views on Science and its Problems* (Feldheim Publishers: Jerusalem, 1978); D.W. Weiss, *The Wings of the Dove: Jewish Values, Science and Halakhah* (B'nai B'rith Books: Washington, D.C., 1987); L.C. Dubin, "The Reconciliation of Darwin and Torah in 'Pe-er ha'Adam' of Vittorio Hayim Castiglioni," *Italia Judaica* 4(1993), 273–284; essays in H. Branover and Ilana Coven Attia, eds., *Science in the Light of Torah: A B'or Ha'Torah Reader* (Jason Aronson: Northvale, N.J., 1994); B. Sterman, "Judaism and Darwinian Evolution," *Tradition* 29:1 (Fall 1994), 48–75; L. Spetner, *Not by Chance: Shattering the Modern Theory of Evolution* (Judaica Press: Brooklyn, 1996); N. Aviezer, *Fossils and Faith: Evolution, Darwin, Dinosaurs and the Bible* (Ktav, 1998).