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BOOK REVIEW

I. M. Levinger, מאור למסכת חולין ולמסכת בכורות (*Guide to Masechet Hullin and Masechet Bechorot*) Maskil L'David, Jerusalem 1994, 1995.

1. RABBI LEVINGER'S BOOKS

All students of the Talmud must be grateful to Rabbi Levinger for producing these two magnificent volumes, the fruit of a lifetime of scholarship and of practical experience. The books are meant as study guides in two tractates where understanding the text is impossible without acquaintance with the facts, usually of a biological or anatomical nature. The books are organized according to the text of the Talmud, so as to guide the student through the text, page by page. These two volumes consist of photographs (many of them in color), drawings, and terse comments.

It may be superfluous to point out the differences in the roles played by a photograph and by a drawing. In the main, a photograph is a substitute for the actual specimen. In any given situation it is obviously better to be able to see the specimen, handle it if possible, perhaps dissect it and so on. In the main, this is impossible for most students in most situations. So a photograph is a very valuable substitute. A drawing, however, conveys an overall idea of how the information is to be organized, and frequently has something to say about the function as well as the structure of the objects to be studied. A drawing is necessary even in the presence of the specimen. Being presented with the various internal organs without a drawing of the digestive system or of the respiratory system, etc., is confusing at best. In general, a drawing will be a compromise between a schematic representation emphasizing certain essential points (some not readily visible in the specimen) and a realistic representation. Of course, before the advent of photography, one had to use drawings or paintings to convey a realistic picture; Rabbi Levinger includes some very charming paintings of birds from various Italian copies of the book זבחי כהן.

In addition to the photographs and drawings, Rabbi Levinger provides the student with terse comments, some in the form of picture titles and some which stand alone. Sometimes a short comment or a question mark can represent a

major controversy. For example, on page 40 of the second volume, in the title of a picture, Rabbi Levinger simply asks if כספח'אס is to be identified with the species Xiphias? This was a matter of raging debate. I remember that about 25 years ago Rabbi Soloveitchik z"l asked me to write a position paper for him on this particular issue of species identification. For technical reasons that I need not go into here, I needed to find a juvenile of this species of a certain age, which I finally located at the Jordan collection (then) at Stanford University, which I was able to examine and dissect. I submitted my written conclusions to him. Even though I did not publish this paper, I did not escape verbal attack from those who had come to a contrary opinion.

Some of Rabbi Levinger's comments are gentle corrections of erroneous statements of fact; for example, the Talmud (*Bechorot* 7b) states: "those animals which give birth nurse their young while those which lay eggs collect food for their young, except for the bat which lays eggs and nurses its young." Rabbi Levinger (page 16 of his section on *Bechorot*) points out that a bat does indeed nurse its young, but it does not lay eggs.

Rabbi Levinger has made a number of choices of a pedagogical nature which we must respect, even though I might have chosen differently. One is the terseness of his comments, which I agree is an enormous advantage, but which precludes any discussion of alternative opinions and interpretations. Accordingly, the scholarly apparatus is kept to a minimum. The student does not want to be burdened with a heavy dose of footnotes and references when his primary concern is getting to a clear understanding of the text.

A second choice that Rabbi Levinger has made is to eliminate, almost completely, any discussion of the history of ideas and comparative knowledge. The volumes of the Talmud under study deal with an enormous range of biological facts; and simply looking at the pictures in Rabbi Levinger's books will convey the great depth and breadth of interest that the masters of the Talmud had in these matters. But a full comprehension of their statements demands not only a knowledge of the facts as we understand them today, but also of the commonly-accepted beliefs and theories of their time. Earlier works that cover similar ground as that dealt with by Rabbi Levinger, such as Preuss,[1] Katzenelson,[2] and the masterly Levin and Boyden,[3] all try to understand various Talmudic statements within the framework of Greek and other contemporary medical theories. Historical methods are regarded with suspicion in the Yeshiva world, so, no doubt, Rabbi Levinger decided to downplay this aspect of explanation in order that his work have the broadest possible readership. This was a wise decision, but not one that I would have made, because, in the long run, it leaves the student unequipped to deal with the question of error. I don't mean errors which are peripheral to Halakhic practice,

such as whether or not a bat lays eggs, but errors in biology or physiology which have Halakhic consequences.

Before discussing this point at length, I would like to share with the reader an educational experience that I had in the course of preparing this review, as it is closely related to my main topic. Among the defects which do *not* render the animal *terefah* (unfit), the Mishnah (*Hullin* 54a) lists missing kidneys. In view of the vital function of the kidneys, why does this defect not render the animal *terefah*? Preuss (p. 250) says that this reflects the general ignorance of the function of the kidneys in antiquity. Katzenelson tries to amend the text to read one missing kidney, but none of the Halakhic authorities are of this view. Levin and Boyden agree with Preuss, emphasizing that in the Talmud the kidneys serve a "decision making function" or an "advisory function,"[4] and no other biological function. Galen (130-200 CE) was aware that the "function of the kidneys is to purify the blood," but no such statement occurs in the Talmud. Rabbi Levinger writes (his p. 188) that "there is today evidence that proves that ruminants have an excretory system that excretes into the rumen. Hence, in fact, these animals can survive if their kidneys are removed." I was puzzled by this statement and wrote to Rabbi Levinger questioning his statement. He immediately responded with a reference to a series of experiments done in 1970-71.[5] It is indicative of Rabbi Levinger's vast erudition in the field of veterinary science that he was aware of these papers, which were unknown to several experts I consulted. In these experiments the kidneys were removed from seven bulls, and the change in the blood chemistry was studied before the bulls were slaughtered, one four days, two six days, and the remaining bulls seven days after the nephrectomy. The surprising outcome was that not only were the animals alive for seven days, but there was no marked increase in phosphates, acidity, or potassium levels in the blood. This is in striking contrast to nonruminants who would normally die within two or three days due to the increase in the potassium level. The bulls were alert at the time of slaughter and, according to the experimenters, they could have survived longer. However, there was a steady increase of urea in the blood and the animals became totally anorexic. I checked with several of the local authorities,[6] and, after quite a few consultations, my understanding is: ruminants do indeed excrete phosphates and potassium and control pH levels via excretion into the gut, particularly the rumen. But they do not excrete nitrogenous wastes, especially urea, by this alternative method. The increase in urea leads to anorexia, and the animal will die of starvation within about a month if it does not die of other causes sooner. For example, it is likely that the rumen will stop acting as a sink with the loss of its activity, and hence potassium increase will set in which will be fatal. So I do not believe that Rabbi Levinger's statement that the animal can survive is

accurate, and the correct explanation was the one offered by Preuss and by Levin and Boyden. But I am grateful to Rabbi Levinger for informing me of a fascinating biological fact of which I was unaware.

2. THE PROBLEM OF ERROR

Let me now turn to the issue that Rabbi Levinger avoids confronting head on in his book. Thus, the rest of this article should not be construed as a review of Rabbi Levinger's excellent book but as an independent essay, or perhaps a review of a nonexistent book in the spirit of Lem.[7] The broad issue, as indicated earlier, is the following: Halakhot are based on assumptions as to physical or biological facts and theories. In a large number of cases, these factual assumptions are now known to be incorrect, and/or the underlying theoretical assumptions do not coincide with current scientific theories. In many of these cases, the underlying theoretical assumptions made by *Hazal* (the Sages) coincided with one or another of the theories available at the time. How do we deal with these Halakhot in the light of our current knowledge? There are (at least) five approaches which can be found in the current literature:

One, attributed to Rabbi Dessler *z"l*,[8] is to recognize that there are indeed factual or scientific errors in the Talmud, but that the Halakhah has an eternal existence independent of any scientific assumptions, and all the statements of scientific fact or theory relating to any Halakhah as stated in the Talmud were merely "explanations" of the eternally-existing Halakhah to their contemporaries. These "explanations" are no longer valid, but each and every Halakhah remains unchanged because it is based on a tradition going back to Sinai. *Hazal*'s scientific understanding played no role in the formulation of any law. This position is unassailable from the viewpoint of abstract logic, but flies in the face of any reasonable reading of the Halakhic literature. Nevertheless, it has supporters today in the Orthodox community. We might call this approach that of the *inner agenda*.

The second and most popular position today is the position taken by Rabbi A. I. Karelitz, known by the title of his work as the Hazon Ish *z"l*, and then taken to its logical extreme by his students and followers. It is the diametric opposite of Rabbi Dessler's position. The Hazon Ish was aware of the discrepancy between modern medicine and certain Talmudic statements. For example, he deserves the credit for being the first Halakhic authority to note that male human anatomy has the *vas deferens* joining with the urethra at the prostate, in contrast to the Talmudic statement that there are two separate ducts. He is aware that the assumptions about pathology underlying the *terefah* laws do not

apply today. He is aware that today, a baby born in the eighth month has more chance of survival than a baby born in the seventh month (see below). His resolution of these difficulties is based on three principles: 1) That many (if not all) laws were given at Sinai only in general form; it was the task of *Hazal* to crystallize them into precisely formulated laws. Even דינים דאורייתא (Biblical laws) were, in their detailed final form, constructed by *Hazal*.[9] (This third of his positions is remarkably close to that of Zechariah Frankel of the last century, and to the early leaders of the American Conservative movement. It is conveniently downplayed by his followers.) One might think that this would lead to a generally lenient position, but this is not the case because it is supplemented by two additional principles: 2) this "legislative prerogative" of *Hazal* terminated with Rabbina and Rav Ashi, i.e., the close of the Talmud. His theoretical underpinnings for this statement are quite weak. But the consequences are strong: all "crystallizations" made by *Hazal* have the status of biblical law. Now, as we have seen above, these crystallizations depended in part on scientific assumptions. So principle 2) can only work if we adjoin principle 3): All scientific statements by *Hazal* having Halakhic consequences were correct! One must assume infallibility on the part of *Hazal*. So, for example, for the Hazon Ish, human anatomy has changed so that there were indeed two ducts in the Talmudic period even though this is no longer true today. The baby born in the eighth month was not viable in the Talmudic period even though it is viable today, etc. Certain pathologies classified as *terefah* were indeed fatal in the Talmudic period even though they are no longer fatal today. But since only *Hazal* had the right to crystallize the *terefah* laws, these laws remain in effect today even though they no longer represent fatal defects or injuries. In some of the later Halakhic writings, the phrase נשתנו הטבעים had been used as a sort of lip service to reflect all sorts of changes (including changes in our understanding of the facts). But the notion of actual changes in nature became an ideological position for the Hazon Ish. He himself was rather reserved in stating this position: "some doctors have told me that there are possible changes in certain anatomical features," he writes, in conjunction with the discrepancy between the anatomical facts about the urogenital tract and the Talmudic statements. But this position of ascribing infallibility to *Hazal* in all matters having any bearing on the Halakhah has been elevated into a doctrine by his followers. For an extreme statement of this position and adherence to this doctrine see the article on the "Changes in Nature" in the second volume of the prize-winning *Encyclopedia Halakhit Refuit* by Dr. Abraham Steinberg, published by Shaarei Zedek Hospital. According to Dr. Steinberg the Hazon Ish really believed that there was a drastic change in the urogenital anatomy of the human male from the Talmudic period until the present.[10] By implication, we are supposed to take

this position seriously! I will refer to this position as the "Changes in Nature" argument.

A third position taken by many Halakhic authorities is one of denial — to refuse to accept scientific statements (even quite standard ones) if they flatly contradict Talmudic doctrines which have Halakhic implications. For example, the Talmud postulates that a fetus born in the eighth month is not viable, is "dead as a stone," even though a fetus born in the seventh month *is* viable.[11] This was part of standard medical belief until as late as the 17th century. Galen even offers a numerological explanation — an even number being indecisive. Of course, today we know that the longer a child is carried, the better its chances of survival. Many Halakhic authorities apply the principle of השתנות הטבעים (change in nature) to this case,[12] But Rabbi Weiss[13] denies that there have been any such changes in nature, since such changes have not been attested to by previous rabbinical authorities. Thus, the Talmudic ruling is in effect, and one may not violate the Sabbath to save the life of an infant that is known for sure to have been born in the eighth month after conception. (As he points out, it is rare that we can know for sure when the moment of conception was. But there is a famous responsum of the ריב"ש, Rabbi Isaac b. Sheshet, where the moment of conception was accurately determined.[14]) Thus, not accepting current scientific facts can have life or death consequences. Similarly, Rabbi Waldenberg[15] rejects blood type evidence to disprove paternity since, according to Talmudic doctrine, all blood comes from the mother. Many other examples could be added. We will refer to this position as that of "Denial."

As this denial might seem strange to readers of this journal, we should pause a moment to understand what is involved. Science as a whole is a belief system, to the extent that it depends on trust, in the sense that no one individual can understand all the arguments from first principles, or reproduce the basic experiments which constitute the scientific evidence for even the most fundamental and universally-accepted tenets in most fields.[16] It is rare, for example, that an experimental physicist will understand the mathematical details of the arguments that the theorist uses in making predictions that the experimentalist is asked to test. Sir Arthur Schuster, a leading physicist at the end of the last century, writes concerning the thermodynamic investigations of Gustav Kirchhoff.[17] "Nothing impresses the scientific world more strongly than just that little touch of mystery which attaches to a mathematical investigation which can only be understood by the few, and is taken on trust by the many, provided that the author is a man who commands general confidence." (Kirchhoff, by the way, was one of the few scientific giants to achieve great success both in theoretical mathematics and in experimental science.) Mathematicians, as a rule, tend not to use results in their own work whose proof

they have not checked. But this relates to pure mathematics. Those of us who are involved in the application of our theories to physics are completely dependent on what we are told by the physicists. In the biological sciences, students go through a respectable amount of laboratory experience, but this is a tiny fraction of what they must take on trust from their instructors. The above applies to the working scientist. The layman must garner his information from various popularizations which involve a necessary dose of distortion, and perhaps more than is necessary. The man in the street has no more direct experience with bacteria, quarks or buckyballs than he has with demons, the evil eye or astrology. To choose one system over the other is ultimately an act of faith for most people. For someone reared entirely in the Yeshiva world, the Talmud and its commentators represent the ultimate authority. Hence, when thereis a direct challenge to the veracity of statements of *Hazal*, especially when these statements have direct Halakhic consequences, it is easy to understand how one may choose to deny the scientists' claims.

There is a fourth position, that taken by Rabbi Herzog *z"l*, Rabbi Feinstein *z"l*[18] and many of the great rabbinical authorities of the generation of my youth. This position asserts that we must recognize that *Hazal* were influenced by the scientific assumptions of their time, and that we must take into account advances in scientific knowledge. We must use the best theories currently available, even if this means, on occasion, that some details of the Halakhah are modified. These problems cannot be solved wholesale and must be resolved in individual cases, the more pressing problems being dealt with first. It is up to the current generation of Rabbis and halakhic authorities to do the best job possible with the knowledge currently available in as honest a manner as possible. This is the ideology to which I subscribe, even though it is old-fashioned and currently out of mode.

Perhaps it is worth quoting at length from a letter of Rabbi Herzog on the issue of using blood typing to disprove paternity. This letter is to a correspondent whose name is omitted from the printed version, but whose position is similar to the position of Rabbi Waldenberg quoted above – that according to the Talmud all blood comes from the mother, so the blood type of the child can say nothing about who the father is or is not.

> I cannot hide the fact that I am almost ashamed and embarrassed by your derogatory attitude toward the use of blood testing to negate paternity, that is, to prove that this is not the son of that person. What possible relevance is there to talk about the reliability of doctors in a matter that is accepted as a clear cut fact by all the leading medical authorities in the world. Our sages never said that they received as a revealed law that ... and

> there could not have been such a revelation since it is now absolutely clear that this is not so. It is true that that they accepted [the statement about the source of the blood being the mother] as true, and built Halakhot on this assumption, since Aristotle declared it to be so and it was accepted as true by all the philosophers in the world. But look at the huge difference between medical knowledge in their time and in ours! And at the communication that exists today between all parts of the globe; it is as if we all live in one town in comparison to what existed in those times.... It is a shame that while science conquers new worlds and uncovers hidden secrets, even though it may fall into error on occasion, our attitude towards science as it applies to our Holy Torah is like the well known bird who hides its head in the sand....[19]

We might refer to this approach as one of "Halakhic Updating."

A fifth possibility is to take some mixture of the above approaches: to accept the necessity of modifying some Halakhot but not others. For example, Rabbi Moshe Feinstein *z"l* decided to allow a husband to undergo biopsy of the testicle on the basis of current medical knowledge, even though the Talmud explicitly states that a puncture of the testicle makes one unfit for marital relations. But he differentiates very firmly between the law in this case and the *terefah* laws which he declares to be immutable.[20]

3. AN ILLUSTRATIVE EXAMPLE

Perhaps it would be useful to illustrate these various positions with an example. In the *Shulchan Aruch, Yoreh Deah* 40.3 we read:

> If a needle is found in the heart, even though it is not recognized from the outside, [the animal] is *terefah*, and this is the law if [the needle] is found in the membrane of the heart. *Commentary of R. Moshe Isserles [Rama].* But if it is found only in the large branch of the heart and its head [is directed] toward the outside, i.e., toward the cavity of the heart, if the head of the needle is like the pit of a date [in size, the animal] is *kasher*, because we consider that it entered the branch of the heart by way of the windpipe; and since its head is downward, its fate is not to perforate [the heart], but the animal will discharge it through the phlegm and [through] coughing.

Now we all know (more precisely, we are all taught in school to believe) that this

statement of the Rama cannot be correct; the arteries and the heart are filled with blood, and if an object the size of a date pit could be "coughed" out of a branch of the heart, we would be coughing up blood all the time. The heart pumps blood which circulates in the arteries and the veins, and there is no free passageway from the heart to the throat.

Let us now see how each of the first four positions outlined above applies in this case. According to the "hidden agenda" theory of Rabbi Dessler, we would have to say that the Rama had a detailed tradition about the kashrut of needles found in the branch of the heart, and his argument about the animal being able to cough them out was just window dressing! As to the changes in nature theory, even Dr. Steinberg must admit (I would hope) that the circulatory system did not come into existence in the entire animal kingdom within the last five hundred years. As to the tenet of denial, what can I say? Do we really want to be placed in a position where adherence to Orthodox Judaism demands a rejection of Harvey's theory of the circulation of the blood?

To apply the historical method, we must see what were the beliefs of the contemporaries of Rabbi Isserles (1520-72). For this I call on two works, both in print and readily available today, the works of Leonardo da Vinci (1452-1519) on the human body[21] and the work of the great anatomist, Andreas Vesalius (1514-64).[22] On page 89 of the Dover Edition, Leonardo's comments to his drawing of the ventricles of the heart are translated as follows:

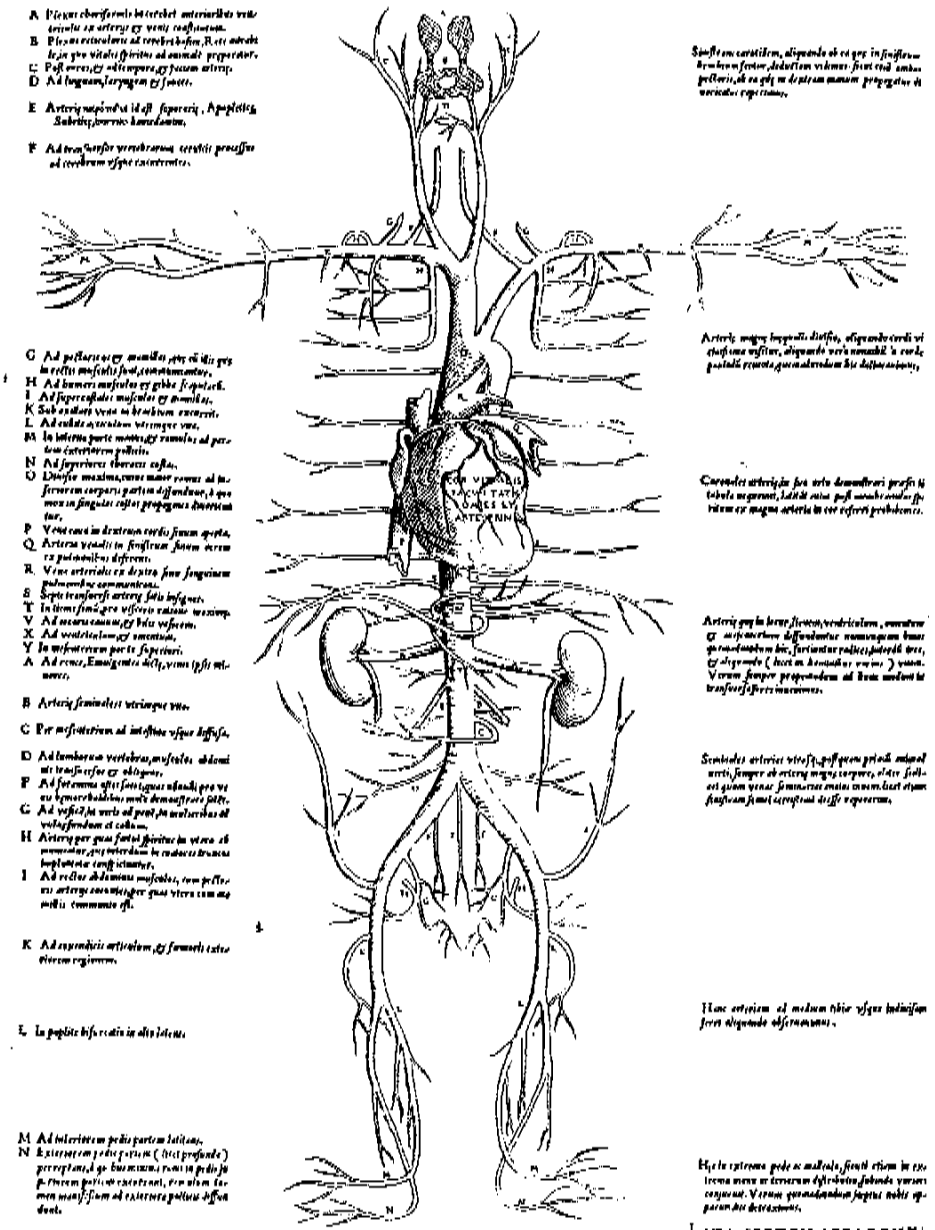
> It is proved that of necessity it must be as here set forth. This is that the heart which moves of itself does not move except on opening and closing. Its opening and closing cause a motion along the line which extends between the apex and the base or crown of the heart. It cannot open without drawing into itself air from the lung which it immediately blows out again into the lung.

As to Vesalius, known as the "father of modern anatomy," on p. 92 is the second of his six anatomical drawings (the *Tabula Sex*) published in April 1538 (plate 88 in the Dover Edition).

Pay attention to the vessel labeled Q, and to Vesalius' note, which reads "The vein-like artery which brings air from the lungs to the left cavity." According to Galenic doctrine, the veins contained blood and the arteries blood and air.[23] A portion of the venous blood contained in the right ventricle of the heart sweats through pores in the septum dividing the two ventricles to the cavity of the left ventricle. Here, the natural spirit of the venous blood is refined by the "pneuma" or air carried to the heart from the lungs by the "vein-like artery" shown at Q, to give rise to the vital spirit which is distributed to all parts of the body and provides its heat.

ARTERIA MAGNA, AOPTH, הנביב HAORTI EX SI

NISTRO CORDIS SINV ORIENS, ET VITALEM SPIRITVM TOTI CORPORI DEFERENS, NATV.



NOTATV DIGNAE ARTERIAE MAGNAE SOBOLES CENTVM ET QVADRAGINTA SEPTEM APPARENT

Vesalius, from *Tabula Sex*, April 1538

To quote Vesalius in his own words, here is a passage from his *Epitome* as translated by Lind[24]:

> The heart attracts this air and draws a large supply of blood from the right ventricle into the left ventricle. From the steamy vapor of that blood, and from that air, by the inborn virtue of its own substance, the heart creates the spirit which the blood, with a rushing flow distributes, thus accompanied and nourished, to the entire body through the great artery; the heart tempers the native heat of each part in the same way that the respiration restores the tinder of the innate heat to the heart. Thus, the respiration and the pulse have the same use; by their rhythms the great artery of the heart is dilated and contracted.

It is amusing to note that there is a typographical error in this plate: the Hebrew word גבוב occurring on the top is the technical term for the vena cava, from the biblical phrase for cavity. It should have been printed on the previous plate, dealing with the vena cava, where the Hebrew word האורטי for the aorta was misplaced. The transliterations from the Hebrew into Latin characters were properly placed. It is interesting to note that Vesalius felt compelled to include the Hebrew words for the various organs to demonstrate scholarship (even though there is no evidence that he had any knowledge of Hebrew).

On a more serious note, we should point out that by the time of the second edition of Vesalius' major work, the *Fabrica*, he no longer believes in the existence of pores in the septum. He is afraid to say so outright, but rather says that it is one of the miracles that blood seeps through the septum through pores that are not visible. It is not unreasonable to say that the year 1543, with the publication of *De Humani Corporis Fabrica* by Vesalius, marks the beginning in print of modern science. (This was the same year which marked the first full publication of the Copernican theory in *De revolutionibus orbium coelestium*.) It was the pioneering work of Vesalius and the legacy of his teaching at Padua which led to the discovery by Harvey (who entered Padua as a medical student in 1598) of the circulation of the blood, announced to the world in 1628 by the publication of his treatise *De Motu Cordis et Sanguinis*.

It is apparent from the above discussion that Rabbi Isserles' statement, although in error, was within the scope of scientific knowledge as it existed at his time.

More problematic is the error in gross anatomy stated by R. Joseph Caro, who writes in the *Shulchan Aruch, Yoreh Deah* 34.10: "At the end of the windpipe where it goes beneath [the breastbone] it divides; and from that point it will separate and will become three main trunks. The one inclines to the heart, one toward the liver, and one toward the lung."

Thus, according to the *Shulchan Aruch*, the aorta and the vena cava are branches of the trachea! The most elementary anatomical investigation will show that this notion about the branching of the windpipe into the aorta is wrong. Presumably Rabbi Joseph Caro did not do the necessary anatomical investigation, but relied on written sources. In fact, we can trace this error at least as far back as Rashi (see his commentary to *Hullin* 45b). For us, this notion is not only wrong, this error is *inconceivable*, for in their normal states, the aorta is filled with blood and the windpipe with air. But, prior to Harvey, this notion was consistent with the understanding of the arterial system and its function. For a correct understanding of the original Talmudic statement of R. Nachman on *Hullin* 45b (and in contrast to Rashi's incorrect explanation), see the stunning photograph in Rabbi Levinger's book on page 135. Here one can truly say that Rabbi Levinger's picture is worth more than a thousand words!

4. LEONARDO AND GALENISM

I would like to say a few more words about Leonardo's anatomical drawings, since they illustrate, for me, some important principles: If we look at plate 204 in the Dover Edition (drawn circa 1500), we find in his written comments "Note... why an infant of eight months does not live." This is the same as the Talmudic statement mentioned above. In the longitudinal and transverse section of the penis we see clearly two penile passages, in complete agreement with the Talmudic doctrine of two openings. (According to the commentator, from Galen came the belief that the sperm came from the testes, "the first cause," and from Hippocrates that the soul, the "second cause," was infused from the spinal cord. The upper penile passage in Leonardo's drawing is for the transmission of animal spirit from the spinal cord, and the lower one for urine and sperm.)

Plate 202 (drawn circa 1520) is the most famous of Leonardo's anatomical drawings – the dissection of the human female. We find many of the principles of Galenic medicine, espcially the relation of the trachea and bronchi to the heart, with the inspired air to be carried to the left ventricle for the formation of the vital spirit, and the prominence given to the septum. But we also find a vein which goes from the uterus to the breast. In Galenic physiology this vessel carries the retained menses to be converted into milk. We find this principle enunciated in the Talmud — דם נעקר ונעשה חלב — as the explanation of why a lactating woman does not menstruate. These examples show how pervasive were the doctrines of medicine, and how the power of theory (especially Galenic principles) overcomes observation. The classical treatment of this whole subject

is the book by Temkin.[25] We also see that we cannot really understand many of the biological statements of the Talmud without a grasp of the history of medicine.

Plate 128 in the Dover Edition — notes on the death of a centenarian (circa 1504-06) — consists of a small drawing at the top, followed by a page of writing. I quote from Ron Philo's comments to this plate in the more expensive Clayton Edition[26]:

> Only a small drawing of the hepatic portal venous system, minus the superior mesenteric vein, graces the top of this sheet. The anatomical bombshells are contained within the notes: the first records of cirrhosis of the liver, arteriosclerosis, calcification of vessels, coronary vascular occlusion, description of changes with age in the appearance of veins, possibly a description both of caput medusae and aneurysm, and a very early usage of the term "capillary vessels". This is an astounding number of "firsts" in the history of medicine. Some of these have been attributed to other individuals who lived centuries later.

Leonardo was one of the great inspired geniuses of all time, not only in the fields of painting, sculpture, and engineering, where his work is well known; his contributions to medicine are mind-boggling. Yet his anatomical drawings contain serious errors (many of which reflect the received ideas of his time). My purpose in this long digression about Leonardo, in addition to illustrating the pervasive influence of Galenism, is to make the following assertion in a setting which is not ideologically threatening, namely that:

Divine inspiration does not imply infallibility.

Any working scientist knows the truth of this assertion, even though some scientists may object to the word "divine," and some religious leaders may object to including supreme achievements in art or science in the category of divine inspiration. In recent years science, as an enterprise, has come under attack from sociologists and sociologically-oriented philosophers who maintain that science is only one of several possible "social constructions," and that it consists of empirical claims whose acceptance is ultimately warranted by certain socially-institutionalized communities.[27] For these people, the notion of inspiration has no meaning.

5. ADVANCES IN BIOLOGY AND THE *TEREFAH* LAWS

Should we update the *terefah* laws? In view of what I have written above, why not? Should we not have a committee of Rabbis meet once every several

hundred years to take into account advances in biology and medicine? Most of the changes would be of a purely "theoretical" rather than a practical nature, and have little economic consequence.[28] If we declare an animal with missing kidneys to be *terefah* rather than *keshera* this will have no impact, since no animal with missing kidneys will ever appear at the slaughterhouses. Similarly, it would be extremely rare to encounter an animal with a needle in the heart. Furthermore, since slaughter is now centralized, in the main, at major industrial plants, any changes would not be visible to the public — who rely entirely on experts, buy packaged meats, and do not personally encounter actual *terefah* problems. (The situation was quite different in my youth. I lived for a year as a teenager in the home of Rabbi S. Schwab *z"l*, and there were regular visits from housewives with quite specific *terefah* questions. In later life I have not had much opportunity to make use of the practical skills I acquired from this experience.)

In reality, there is no *possibility* of any such updating for a combination of historical and polemical reasons. It is instructive to describe at least part of the story. We begin with the Talmud itself (*Hullin* 54a):

> The members of the house of Joseph the fowler used to kill beasts by striking them on the sciatic nerve. When they came to enquire of R. Judah b. Bathyra, he said to them, "Do you believe that we may add to the list of defects [which render an animal terefah]? We accept only those enumerated by the Rabbis". The members of the house of R. Papa b. Abba the fowler used to kill beasts by striking them on the kidney. When they came to enquire of R. Abba, he said to them, "Do you believe that we may add to the list of defects? We accept only those enumerated by the Rabbis". But do we not see that the beast dies [from the blow]? It is established [beyond doubt] that if salves were applied, it would live.

[Rabbi Levinger (his p. 187) interprets both deaths as due to arterial hemorrhaging, the first from the femoral artery and the second from the aorta. Of course, then no amount of salve would help. But this difficulty would apply to any act which causes the immediate death of the animal. So the passage is difficult.]

The implications of this passage are unclear. It states (at the minimum) that anecdotal information cannot be used to overthrow the *terefah* laws which have been established by tradition. But we could make a similar assertion today about the use of anecdotal information in overturning established scientific laws. At the maximum, this passage says that the list of *terefot* cannot be amended by any external evidence.

Rambam (1135-1206) codifies this rule in a famous and equally ambiguous

statement. After listing the *terefot*, he writes (*Shechitah Laws*, Chapter 10, section 12, 13):

> One must not add anything to these laws. For anything that happens to an animal or a bird outside of those (defects) that were listed by the sages of the early generations and were agreed to by Jewish courts, there is a possibility that it will survive, even if it is known to us from the ways of medicine that it will not survive. Similarly, those that were listed and were said to be terefah, even if it would seem from the medical methods in our hands that some are not fatal and it is possible [for the animal to] survive — you should only accept what has been listed by the sages, for it says "according to the law that they will teach you".

Many have pondered over Rambam's intent here. I would like to emphasize that both the medical tradition at the time of Rambam and the Talmud's medicine were within the general framework of ancient medicine. It is hard to choose between small variations in detail. With the revolution in biology brought about by the discovery of the circulation of the blood, and the consequential overthrow of Galenism, the whole system changed; I believe that Rambam would accept current medical knowledge rather than that of the Talmud. (In fact, he violates his own rule by introducing a *terefah* associated to the upper jaw. This caused a storm in the subsequent literature.[29])

Rashba (1235-1310) reacts very angrily to a challenge to one of the rules of *terefah* (Responsa I-98). The beginning of this long responsum is as follows:

> If you saw or heard someone who was lenient and permitted [an animal with] a superfluous [essential organ] or anything else that the Sages included in the list of *terefot* do not listen to him or pay him any heed. Such a thing should not be in Israel! It seems to me that anyone who declares such an animal to be fit is casting aspersion on the words of the Sages. I am now going to expound to you at length on this subject so that you and all others who are pious and fear Heaven should have a solidly built fence; they should not make the holy words of the Sages of Israel into a broken fence so that the fox climbs in.

He continues in this angry mode at length, only softening a bit toward the end. One cannot avoid the impression that the question itself was a setup, that it was a battering ram for an attack by secularists on the tradition; that the Rashba recognized it as such and responded. From this time on what should have been a technical issue in biology and medicine became an ideological minefield.

This ideological conflict between science and Halakhah was joined and broadened two generations later by Rabbi Isaac b. Sheshet (the ריב"ש) (1326-

1408), whose starting point was a purely Halakhic question involving levirate law which he resolved on the basis of the Talmudic assertion that an eight-month-old fetus cannot survive. (We referred to this responsum, in passing, above.) When challenged on this point, he broadened the conflict (in the next responsum, number 487). It is worth quoting from this at length, since it represents the classical formulation of the "denial" position.

> Know, honored sir, that we must not adjudicate any of the laws of our Torah and its commandments on the basis of the opinions of the scientists or the medical authorities. For if we listen to them, the Torah is not from Heaven! (Heaven forbid!) For so they assume with their false logic. If you were to adjudicate *terefah* laws on the basis of the medical doctors, you would receive a large fee from the butchers. For, in all honesty, they would convert the majority [of animals with defects] from the dead to the living [and some] from the living to the dead. For there is no question that in a case where the liver is removed leaving only an olive-sized portion, which we permit, they would say that it would eventually die, and similarly in the case of a [lung that is] dried up by an act of Heaven [as opposed to injury caused by humans]. But there are many, many other cases, such as adhesions and changes in the surface appearance of the lungs that render the animal *terefah*, and also an animal attacked by a predator, and others without doubt, that they ridicule — may molten gold be poured down their throats. And even the Rambam *z"l* when he introduced a minor modification saying that the meeting of the sinews is on the lower bone in birds — they [the later Rabbinical authorities] did not agree to his position because from a reading of the discussion in the Talmud it would appear to be on the middle bone. No mention is made in the Talmud of a distinction between bird and animals on this matter. This even though the Rabbi *z"l* was a master of medical science and of the study of nature and was an expert surgeon. For we do not rely on science or on medical knowledge. We trust our Sages of blessed memory, even if they tell us that right is left. For they received the truth and the interpretation of the commandments man from man all the way back to our teacher, Moses, may he rest in peace. We will not believe Greek or Arabic philosophers who only spoke out of their own theories or on the basis of some experiment or other without paying attention to all the possible errors that can befall such an experiment; in contrast to what our Sages used to do. As it says in the chapter "The woman who aborts" page 30 b "I bring a proof from the Torah and you bring a proof from the fools?"

> In many questions of embryology they differ from the words of our Sages, such as the time of creation of the fetus in forty days before that it is just water, that the father generates the white stuff, the origin of the bones and the sinews, while they believe that all is from the mother, and that the function of the father is to coagulate and solidify the seed of the mother like rennet coagulates milk....[30]

He then goes on to the specifics of how embryological theories impinge on the case he is considering. But the battle lines have been drawn. I repeat, that all this was taking place *before* the scientific revolution, so that there was still some possibility of siding with rabbinical scientific doctrines which were well within the framework of generally-accepted theories.

The decisive episode after Harvey and the scientific revolution has an amusing side, as it involves a chicken, a cat, and a young girl. It also involves a decision of Rabbi Zvi Ashkenazi (1658-1718), the Hacham Zvi, a leading rabbinical authority of the 17th century,[31] and the response to this decision by his contemporaries, and more importantly by Rabbi Jonathan Eibeschutz (1690-1764), a Rabbi of the next generation whose Halakhic writings have been accepted as standard works in the Yeshiva world. Here is the beginning of this long debate, starting with Rabbi Ashkenazi's summary of the question.

> **Question 74.** A girl opened up the belly of a chicken to remove the intestines at the edge of the table, while a cat was standing below next to her, standing and hoping to eat whatever fell to the ground. The girl stated that she did not find a heart in the chicken. Her mother, the owner of the chicken, said that maybe, or rather surely, the heart was thrown to the ground and was eaten by the cat who was standing waiting to eat whatever fell. The girl said "I only threw the spleen to the cat but not the heart". Now this hen was fat and healthy and good, with nothing missing or rotted in the intestines, nor any sign of a heart that might have decayed. It did not exhibit any pathology in its intestines. When it was alive it was strong and healthy: it ate and drank vigorously, it walked and flew and was alert like any other good and healthy hen. It was just that the girl stated that she did not find a heart. This case came before the Rabbinical students and they declared the animal a *terefah* on the grounds of an absent heart.[32] Will our master please teach us what is the law regarding this hen?
>
> **Response.** All those that say so [that the hen is forbidden] are in error. For it is clear to anyone that has a wise heart in his innards or a brain in his skull that it is impossible for any creature in the world to live even for a

> short time without a heart and be similar to any healthy living thing. It is impossible to imagine any case of a heart being removed [in such a way that the law quoted from *Shulhan Aruch* could apply] unless immediately after removing the heart from the animal they slaughtered it. As for a heart absent because of disease, it is impossible that a heart should decay without the animal being in the lowest possible state, worse off than what we would characterize as an animal in imminent danger of death. As to this hen, who was not in imminent danger of death nor sick but rather good and fat, healthy and alert, it is clear that her heart fell out when her belly was opened and the cat ate it. Even though this is obvious on first principles and requires no proof, in order to shut the mouths of those fools who jump to render decisions here....

He goes on to cite sources for his decision. This responsum caused some consternation (because of the ideological implications), and the debate raged through five responsa. Finally he throws up his hands and says: "Look, even if two witnesses were to come and testify that this hen had no heart, they would not be believed, for they surely would be false witnesses. We don't need the presence of the cat to permit this hen for use."

I am not sure whether Rabbi Ashkenazi was influenced by Harvey's discovery and the scientific revolution (living in Amsterdam and visiting London, he was certainly aware of the new developments), or whether he was resuscitating the ancient dispute between the Aristotelians and the Galenists. Primacy was placed by Aristotle in the heart, which was also the seat of the intelligence or sentient soul. In Galen's scheme the vital spirit was carried from the left ventricle to the brain, where it was transformed into the animal spirit which brought the nervous system into action through the supposedly hollow nerves. In any event, Rabbi Ashkenazi is willing to assert that the law as stated in the *Shulchan Aruch* cannot refer to any realistic situation since no animal can survive without a functioning heart.

For this statement, which seems mild and obvious to us, he was severely taken to task by R. Yonathan Eibeschutz in his commentary[33] on the relevant passage in the *Shulchan Aruch*. He agrees with the decision in the case that the cat was present, but is furious with Rabbi Ashkenazi who says that he would not believe two witnesses who testified to the absence of a heart in an otherwise healthy appearing animal. These are bitter waters that the Israelites cannot drink, writes Rabbi Eibeschutz. How dare he render such a decision:

> Does he have a tradition or even a hint for this position from the words of our Sages? It is just a construct of his own mind on the basis of a knowledge of science and reality that one cannot imagine that an animal

> can live without a heart. Is this sufficient to contradict our tradition and our Torah?... To the contrary, we must not follow the realia of nature but rather the Torah which we have as an inheritance. So what if it contradicts the laws of nature? Would this lead to a disaster such as we must worry about if we dare contradict one of the principles of the Torah such as "a *terefah* may not survive" and so on? Especially since the foundations of science are based on experiment. Today there is agreement among men of science on some matter and when other men come and see the opposite they retreat from their position and make a different principle and so is it always; to such an extent that today they reject all the assumptions of Aristotle! Similarly they choose new foundations and assumptions. So how can we allow even a doubtful *terefah* and the basis of "scientific reality"?

He then goes on to postulate an alternative means of respiration and/or circulation for the animal which can survive for a short while without a heart and goes into other technical details. But the lesson to be learned is that the scientific revolution, for Rabbi Eibeschutz, was proof of the unreliability of science! Now, Rabbi Ashkenazi was a respected, but distant figure in the Yeshiva world. His works were not part of the standard curriculum. But Rabbi Eibeschutz was revered as a great scholar whose works were studied and treated as classics. From this time on, it would appear ridiculous to any Yeshiva graduate to contemplate an update of the *terefah* laws while remaining faithful to the tradition. The best one could do is try to isolate the *terefah* laws, keep them intact, so as to be able to apply modern scientific knowledge to the resolution of pressing modern problems.

For example, the ancient controversy about the primacy of the brain or the heart has resurfaced in our own time as a pressing matter of major practical interest — the issue of defining the moment of death. With the advent of modern technology, machines, respirators and the like, one must move inexorably to accepting total cessation of brain (including brain stem) function as the definition of death, instead of cessation of breathing or of heartbeat. [I want to reiterate that I am talking about total cessation of all brain functions — what is known as brain death — not merely the cessation of the higher cortical functions as occurs in persistent vegetative state.][34]

It is unfortunate that the current trend in the educational system in most Yeshivot is to move even more toward closure and less openness to science and the real world. This can only have disastrous consequences for the future.

I would like to close with a quote from the Klausenberg Rav, in the introduction to his book on *Hullin*.[35] He writes that there can be no doubt that

the Talmudic edict saying that "words of the oral tradition may not be written down"[36] was to avoid the existence of written codes, so as to allow the Rabbis of each generation to adjust the tradition to new knowledge and circumstance. I learned of this reference from Rabbi Levinger when I was a guest at his home for Shabbat lunch several years ago.

Shlomo Sternberg

NOTES

1 Julius Preuss, *Biblisch-Talmudische Medizin* (1911; reissued by Ktav: New York, 1971). An English translation with additional comments by Rosner is available.

2 L. Katzenelson, התלמוד וחכמת הרפואה (Berlin, 1928).

3 S. I. Levin & Edward A. Boyden, *The Kosher Code of the Orthodox Jew* (University of Minnesota Press, 1940; reprinted by Hermon Press: NY, 1969).

4 For example, in *Berarhot* 61a we read: "Our Rabbis taught: Man has two kidneys, one of which prompts him to good, the other to evil; and it is natural to suppose that the good one is on his right side and the bad one on his left, as it is written, A wise man's understanding is at his right hand, but a fool's understanding is at his left. Our Rabbis taught: The kidneys prompt, the heart discerns,...." See also *Shabbat* 33b, *Hullin* 11a, *Midrash Rabbah Gen.* LXI: 1, 2 *Gen.* XCV: 3, *Eccl* VII: 28, 30, *Eccl.* XII:4.

5 C. Watts and J.R. Campbell, "Biochemical Changes Following Bilateral Nephrectomy in the Bovine," *Research in Veterinary Science 11* (1970), 508-514 and "Further Studies on the Effect of Total Nephrectomy in the Bovine," ibid. *12* (1971), 234-235. I was able to find later experiments of a similar nature on sheep in *Acta vet. scand. 20* (1979), 595-597 and *Can. J. Comp. Med.* (1982), 217-221. I also found reference to a similar experiment on buffalo calves in *Archiv fur Exp. Veterinarmedizin 38* (1984), 875-883.

6 I would like to thank Professors Norm Hollenberg, Arthur Lage, and Jim Jones for help on this matter.

7 Stanislav Lem, *A Perfect Vacuum* (Harvest Press: NY, 1983). The ingenious idea behind this work is: most people don't read your book, just the book review. So why brother to write the book. Go straight to the review and write it yourself. My experience is that it has been easier to get controversial ideas published when inserted into book reviews (where editors seem to be more flexible) than in regular articles.

8 4 הע' 355 עמ' מכתב מאליהו ח"ד "In these and similar matters the law never changes even though it would appear that we do not understand the reason. On the contrary, we must seize the law with both hands for *Hazal* knew the Halakhah by tradition for many generations.... As far as the scientific explanations are concerned, it is not the scientific reason which determines the law but the opposite: the law requires an explanation. The reason given in the Talmud is not the only possible reason in the matter. If, on occasion, they gave explanations according to the state of scientific knowledge of their day, it is incumbent upon us to seek out other explanations which will establish the law according to the science of our times."

9 Here are some illustrative references from the publications of Hazon Ish: On the issue of reliability of a single witness attesting to the death of the husband אבן עזר נשים כ"ב: ג. Also צער בעלי חיים, and מת מצוה there. On the *terefah* laws יורה דעה ה: ג. On property rights and nuisance law חושן משפט נזיקין י"א: א. On partnership law חושן משפט נזיקין ח: א.

10 See his footnote [70] to the article השתנות הטבעים in his Encyclopedia. All further references to passages from this article will be denoted by "Steinberg." For a whole book devoted to the changes in nature theory, see השתנות הטבעים בהלכה by הרב נ.מ. גוטל Jerusalem (1995). This book contains discussions as to which Halakhic authorities are competent to declare that a change in nature has indeed taken place, when such a change implies a change in the law, etc. I would like to thank Prof. E. Westereich for calling this book to my attention.
Editorial Note: For a review of this book see Hebrew section pp. 81-96.

11 שבת קלה א.

12 See Steinberg, note [35] for a list of references.

13 ש"ת מנחת יצחק ח"ד ס' קכג אות יה.

14 שו"ת הריבש סימן תמר.

15 שו"ת ציץ אליעזר חלק י"ג סימן קד.

16 For a deep discussion of this issue, see the article by E.P. Wigner, "The Limits of Science," which appeared in the *Proceedings of the American Philosophical Society 94* (1950), reprinted in his *Symmetries and Reflections* (Indiana University Press, 1967).

17 *Encyclopaedia Britanica*, 11th edn., vol. XXV, p. 622d.

18 With some reservations, see below.

19 This letter was reproduced in the article on blood-typing and paternity ... קביעת אבהות by פרופ' דב פרימר which appeared in אסיא 5 185-209. The letter appears on pages 196-197. According to a recent article by Prof. E. Westereich in the journal משפטים, this letter was addressed to Rabbi Unterman *z"l*.

20 אגרות משה אבן העזר ב-ג ב.

21 I will refer, in the main, to the inexpensive Dover Edition, *Leonardo on the Human Body* (Dover Publications: New York, 1983).

22 *The Illustrations from the works of Andreas Vesalius of Brussels* (Dover Publications: New York, 1973). Also in print and inexpensive.

23 For a succinct explanation of the Galenic doctrine on this point, see Ibn Ezra's commentary to ויקרא יז יד. He writes: "Its blood is in its spirit" — it adheres to the spirit. For it is known that the arteries that leave the left side of the heart are divided into half blood and half pneuma.

24 *The Epitome of Andreas Vesalius*, English translation by Lind (MIT Press, 1973) p. 59.

25 Oswei Temkin *Galenism: The Rise and Fall of a Medical Philosophy* (Cornell University Press, 1973).

26 *Leonardo da Vinci — The Anatomy of Man*. Martin Clayton with comments on anatomy by Ron Philo, The Museum of Fine Arts, Houston (Little Brown Co.: Boston, 1992), p. 47.

27 See the book *Higher Superstition: The Academic Left and Its Quarrels with Science* by Paul Gross and Norman Levitt (1984). See also the review by Max Perutz in the *New York Review of Books*, Dec. 21, 1995 of a book attacking Pasteur and the ensuing correspondence between the author and the reviewer in the April 4, 1996 issue.

28 For a fascinating study of the impact of economics on the *terefah* laws, especially the impact of the massive involvement of the Jews of Poland in the beer and liquor business on the laws of adhesions of the lungs, see the classic book by Ben Zion Katz, מזקנים אתבונן (Warsaw, 1894; Tel-Aviv, 1964). I learned of this reference from Rabbi Soloveitchik *z"l* many, many years ago.

29 I do not want to go into this too much. Briefly, see the inquiry of the scholars of Lunil and

Rambam's response, see טור יורה דעה ס' לג, and ים של שלמה, חולין ג: ז who points out that the Rambam violates his own stated principle. An attempt to defend the Rambam appears in ערוך השלחן לג ב-ד.

30 I cannot resist making a number of side comments here. The ריב"ש correctly attributes the "curdling" theory of the formation of the embryo to Greek sources. In fact the analogy between the formation of the embryo and the curdling of milk occurs in Aristotle's book *On the Generation of Animals*. But this analogy also occurs in Jewish sources; in fact it occurs in the Book of Job 10:10, "Hast thou not poured me out as milk, and curdled me like cheese?" הלא כחלב תתיכני וכגבינה תקפיאני. Does this Aristotelian connection tell us anything about the mystery surrounding the authorship and date of composition of the Book of Job? For the vast range of the diverse opinions on this subject, see the discussion in *Baba Bathra* 15ab. The Talmudic citation made by ריב"ש is to a series of dissections carried ont on condemned pregnant women slaves at various times from the moment of conception. (It was disputed whether the moment of conception could be fixed with accuracy, as there was no way of controlling the sexual activity of these slave women.) The Talmud refers to these experiments as having been performed (presumably by Egyptian doctors) on slaves of Cleopatra, the Greek queen. Now there was a woman writer, Cleopatra, a gynecologist contemporary with Galen, one of the very few women scientists known to us from antiquity. Needham (*A History of Embryology* [Arno Press (New York Times): NY, 1975]), pp. 65-66 suggests that perhaps this experiment was associated with the gynecologist, Cleopatra, who was then confused, in the tradition, with Cleopatra the queen (of Egypt).

31 שו"ת חכם צבי עו-עח.

32 *Yoreh Deah* 40-5. The passage reads "If the heart is absent, whether [removed] by hand or because of disease, [the animal] is *terefah*."

33 כרתי ופלתי ב-ד.

34 See, for example, D. Lamb, *Death, Brain Death and Ethics* (Croom Helm: London, 1985).

35 Moses Samuel Glasner, דור רביעי (reprinted; Jerusalem, 1978).

36 Gittin 60b.