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The Rabbinic Conception of Conception: An Exercise in Fertility

The extraordinary technological advances of this century have been applied with full force to the field of science, and in particular to genetics and reproductive medicine. Man now has more control over his own reproduction than ever before in history, such that the old notion of the doctor playing God has taken on new meaning. In the ultimate form of *imitatio dei*, it now appears that just as God creates, so does man. We currently have the capability to isolate a single sperm, unite it in-vitro with an egg, and test the resultant embryo for genetic abnormalities before subsequent implantation into a human being for the completion of gestation.[1]

Although all acknowledge the value of this technology, it is not without cost. Whereas the Talmud mentions only three partners in creation (see below), the husband, the wife, and God, current reproductive practices have expanded the list of potential partners to include the sperm donor, egg donor, surrogate mothers, and soon, with the application of genetic splicing to human gametes, the partial gene donor. If our limited experience is any measure, then introducing more partners clearly introduces more complications, be they emotional, financial, legal or ethical.

To solve these ethical dilemmas, secular ethicists utilize philosophical principles, some with historical precedent, others simply products of imagination. In either case, ethicists are in no way bound to the ideas of the past. We, however, as Orthodox Jews who subscribe to the halakhic process and live by the words of *Hazal*, employ the past to solve the dilemmas of the present and future. We turn to our predecessors for both halakhic and ethical guidance.

All contemporary halakhic discussions of reproductive technology cite sources from antiquity to the renaissance to modern times. As the understanding of reproductive anatomy and physiology has changed throughout the centuries, the author of each source, depending on the

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historical period, assumes a unique understanding of embryology and reproductive medicine. Therefore, an awareness of the embryological theories contemporary with each author may aid our understanding of his discussion of medical or scientific ideas. Furthermore, if the context of the source is halakhic, it may enhance our appreciation of the halakhic issues with which each source is dealing. This knowledge can perhaps assist current *poskim* in their utilization of rabbinic source material for incorporation into medical halakhic responsa. I therefore submit that we pause for a moment from addressing modern halakhic dilemmas of reproductive technology and turn our eyes backward to see how our predecessors understood the conception of conception.[2]

This article discusses selected passages from Jewish literature from antiquity to modern times which explicitly address or allude to theories relating to reproduction. The sources will be discussed in their own right as well as placed in a medical historical context. Although rabbinic sources cover the gamut of issues of reproduction and heredity, three topics have been chosen for the purpose of illustration, each highlighting a different aspect of reproductive medicine. The first topic addresses the very nature of the male and female seeds, focusing largely on embryology: who contributes what to the fetus. The second section traces the history of artificial insemination, a matter of reproductive physiology, and contains sources often quoted in contemporary halakhic discussions. Therefore, the rabbinic sources in this section receive disproportionately greater treatment than the secular. The final section addresses a particular notion regarding reproductive anatomy. In each section the secular sources are discussed separately. In the first section only, in order to facilitate our objectives, the secular sources precede the Jewish.

EMBRYOLOGY

Secular Sources

Almost all major figures in the history of science in antiquity devoted time to the study of animal and human embryology.[3] As knowledge of anatomy[4] and physiology was limited, theories were based on simple observation and philosophical intuition. Analogies were often made to agriculture, the male seed being compared to the plant seed and the uterus to the nourishing earth.[5] The male contribution to conception was readily observable, as the male seed was emitted outside the body (more on the male seed below). The nature of the female contribution, however, was a matter of intense debate.

Female Seed

Since the female seed was not visible to the naked eye and was not emitted externally, its very existence was a matter of conjecture. As a result, two competing theories evolved in antiquity which coexisted until pre-modern times.[6] Galen (130-200),[7] following in the footsteps of Hippocrates (4th-5th centuries B.C.E.),[8] maintained that both the male and female contributed seed. The exact identity of the female seed was in question, but he conjectured it might be located in the uterus. He also claimed that the male semen provides the material for the development of the nerves and the walls of the arteries and veins in the fetus, while the menstrual fluid is the source of the blood.[9] Aristotle, on the other hand, denied the existence of a female seed, claiming that only the male possessed seed. This seed provided the "form" and the "principle of the movement" of the fetus, while the female provided the material from which the fetus was formed, i.e., the menstrual blood.[10]

It can be argued which of these theories predominated throughout the middle ages, but the falsehood of Aristotle's theory was decisively demonstrated by William Harvey. Harvey (1578-1657), best known for his description of the circulation of the blood, was also a pioneer in the field of embryology. While the ovum had not yet been described in his lifetime, he nonetheless postulated that all living beings must derive from eggs.[11] Aside from placing the first nail in the coffin of the theory of spontaneous generation,[12] Harvey superseded Aristotle and paved the path for Reinier De Graaf, who in 1672 first described the egg follicle.[13] The microscopic female human egg, as we now know it, was not described until 1827, when Ernst Von Baer published his classic description of the mammalian ovum.[14]

Male Seed

There were three Greek theories regarding the origin of the sperm.[15] The encephalo-myelogenic doctrine claimed that the sperm was ultimately a derivative from the brain and traversed the spinal cord on its way to the male genital organs. The second theory, which Hippocrates advocated, was called the pangenesis doctrine and contended that the sperm was a derivative of the entire body. The sperm extracted from each limb would yield the corresponding limb in the fetus. Aristotle supported the hematogenic doctrine, claiming that the seed originated from blood, and was in fact nothing but blood in a certain state of coagulation.

Although a male seed was always acknowledged, it was not until 1677 that Antony Von Leeuwenhoek first visualized human spermatozoa under the microscope.[16]

Preformation and Epigenesis[17]

The discovery of egg follicles by De Graaf and spermatozoa by Leeuwenhoek gave birth to two opposing theories regarding the embryological development of the fetus in utero. Some scholars maintained that the fetus formed in a stepwise fashion with the development of one organ or limb preceding the next, i.e., epigenesis. Others believed that within the seed, either male or female, there existed a minuscule, complete, preformed being that simply enlarged during the course of gestation. These so-called preformationists were split into two camps, those claiming that the preformed child was within the female egg (ovists) and those claiming it was within the male sperm (animalculists).[18]

So convinced of this belief was one animalculist that he drew a diagram of a completely formed child crouched within the confines of one human sperm. This figure became known as the homunculus.[19] It is unclear exactly when the theory of preformation was disproved, but it had its supporters up to the late nineteenth century.

Jewish Sources[20]

Equipped with the historical background, we can approach the Jewish sources throughout the ages that address embryological theories explicitly and implicitly. For the sake of clarity, the sections on male and female seed are separated, as above. Since the same sources often discuss both seeds, there will be, by necessity, limited repetition. For the repeated sources, the bibliographical information will be referenced the first time the source is mentioned.

Female Seed

The Talmudic source which serves as the foundation of all subsequent rabbinic discussions on embryology, especially with regard to the female seed, is found in *Gemara Nidda* (30a):

> Our Rabbis taught: There are three partners in the creation of man, God, the father and the mother. The father seminates (*mazria*) the white substance, from which are derived the bones, vessels (*gidim*),[21] fingernails, brain and the white of the eye. The mother seminates (*mezara'at*) the red substance, from which are derived the skin, flesh, hair and the black of the eye.[22] God provides the spirit (*ruah*), the soul (*neshama*),[23] the beauty of the features, vision for the eyes, hearing for the ears, speech for the mouth. . . and intelligence. When the time comes for a man to depart this world, God takes back his part, leaving behind the contributions of the mother and father.

It seems clear that the rabbis, similar to Galen and in contrast to Aristotle, clearly acknowledged both a male and female seed, the female seed appearing to be identified with the menstrual blood. It is interesting to note that the list of organs that are derived from the respective seeds roughly resembles that of Galen. However, even though Galen was a contemporary of R. Yehuda haNasi, the compiler of the Mishna, there is absolutely no mention of Galen, or Hippocrates, for that matter, in the entire text of the Mishna and Talmud.[24] As a result, any suggestion of cross-cultural borrowing is purely speculative.

The next source appears in the Biblical commentary of R. Moses ben Nahman. Although Ramban is known for his exceptional Talmudic scholarship, he was also a practicing physician, purportedly at Montpellier,[25] a major center of medicine in the middle ages.[26] One of the few references we have to Ramban's medical practice states that he treated a non-Jew for infertility.[27] The Ramban comments on the phrase in *Vayikra, "Isha ki tazria ve-yalda zahar."* The root of the word "*tazria*" is "*zera,*" or seed, hence the translation could be, "When a woman emits seed." While most Biblical commentators interpret this phrase to mean "When a woman conceives," and thereby ignore the issue of the existence of the female seed, Ramban takes this opportunity to address rabbinic theories of embryology:

> . . . Although it says "when a woman emits seed" . . . the implication is not that the fetus is made from the female seed. For even though a woman has ovaries (*beitsim*) analagous to those of the male (*beitsei zahar*) [testicles], either no seed is made there, or the seed has nothing to do with the fetus. Rather, the term "*mezara'at*" refers to the uterine blood . . . that unites with male seed. In their opinion [*Gemara Nidda* above], the fetus is created from the blood of the woman and the white [semen] of the man, and both of them are called seed . . . and likewise

> is the opinion of the doctors regarding conception. The Greek philosophers thought that the entire body of the fetus derives from menstrual blood, and that the man only provides . . . form to the material.

The mere fact that Ramban mentions this embryological debate reflects that it was still a topic of discussion in his time. Here Ramban accepts the contribution of a female seed and identifies that seed with uterine blood, based on the passage in the *gemara.* He states that this is also the position of the doctors. As we know that the Ramban was himself a physician, we ascribe greater authority to his statement. Although he mentions no names of specific doctors, he may be aligning the Talmudic position with the teachings of Galen. Ramban also clearly rejects what we know to be Aristotle's position.

R. Bahya ben Asher (13th century) follows Ramban in his interpretation of the phrase in *Vayikra,* but adds a novel explanation of the term "*tazria.*" It means, he says, "When a woman gives over the *zera.*" The *zera,* he maintains, is a deposit which is given to the woman by the man for safe-keeping, as a plant seed is deposited in the ground. In both cases the matured seed is to be returned from its repository when the time is right.[28] As mentioned above, the agricultural analogy is one that has been used since antiquity.

While Ramban claimed that a woman may or may not have her own seed independent of the menstrual blood, Rambam clearly acknowledges the existence of a female seed:

> . . . between the *heder* and the *prozdor*[29] lie the two ovaries of the woman and the pathways [?fallopian tubes] wherein her seed matures.[30]

Rambam does not, however, address whether this seed has any role in conception. This issue is discussed in the following sources.

R. Shimon ben Tsemah Duran (1360-1444), Tashbets, devotes a significant section of his philosophical work, *Magen Avot,* to the anatomy and physiology of reproduction. In this citation he confronts the issue of the female seed:

> Regarding whether the female seed has a role in conception, this has been debated by Aristotle and Galen. We have explained that *Hazal* say it has no role whatsoever in conception . . . philosophers have concluded that the female seed has no role in conception . . . and they reached the same conclusion that was received by *Hazal* from the prophets and teachings of the Torah.[31]

R. Duran later identifies the menstrual blood as the contribution of the female.

In contradistinction to the above source, which acknowledges an independent female seed but gives this seed no role in conception, the following reference grants a prominent role to this seed. This passage is excerpted from the work of Meir ben Isaac Aldabi (1310-1360), the grandson of R. Asher ben Yehiel, entitled *Shevilei Emuna*:[32]

> . . . and next to the uterus are the woman's two ovaries . . . and from them the female seed flows into the cavity of the uterus. When the male seed is emitted into the uterus the female seed also is emitted from the ovaries and joins with the male seed (to form the fetus).[33]

This appears to be the first Jewish source that ascribes such significance to the female ovarian seed, and thus ends our discussion of Jewish sources prior to the works of Harvey and Leeuwenhoek. (see above). In summary, all the Jewish sources espouse the doctrine of the two seeds, both male and female, yet opinions differ as to the identity and contribution of the female seed. These sources are better understood in the context of the ongoing scientific debate in the secular world regarding the existence and nature of the female seed.

We now turn to Jewish references to embryology at a time when the scientific world had recently undergone major upheaval. The sperm had been identified, the existence of a female egg was universally accepted, although the egg itself had not yet been observed, and the theories of preformation and epigenesis were prevalent.

Tobias Cohn (1652-1729),[34] a graduate of the famous University of Padua,[35] was educated in this scientific milieu. His classic work, *Ma'ase Tuvia*, covers topics including botany, cosmology, and medicine, and the following passage on embryology reflects the climate of his time. As Cohn was well educated in rabbinic as well as scientific literature, his words are of particular interest:

> Aristotle, who rejected the Torah of Moses, brought a number of disappointing proofs that menstrual blood is in place of the seed, and besides this, a woman has no other seed. However, recent physicians, who accept our holy Torah, have . . . brought other proofs which contradict his disappointing proofs. . . . The first proof is that one cannot deny the existence of a female seed, for it was not for naught that a woman was created with *beitsim* and pathways that transmit seed similar to a man.

> There is almost no need for the proofs brought by the great physician Harvey on the existence of a female seed. . . . The great physicians of late maintain that the purpose of the ovaries (*beitsim*) is to give rise to tiny eggs (*beitsim*), similar to fish eggs, which have been seen with the microscope.[36]

This is probably the first Hebrew source that uses the term *beitsa* to describe the female egg as we understand it today. In all previous sources, the term *beitsim* refers to the ovaries or testicles interchangeably, and the female seed is called simply her *zera*. Given an understanding of the history of embryology, this observation makes perfect sense, as it is only during this period that Harvey's theory of the existence of a female egg was developed.

A more detailed physiological description of conception is found in the anatomical work of Baruch Schick (1744-1808),[37] entitled *Tiferet Adam*. Schick is perhaps best known for translating Euclid's Geometry into Hebrew for the Vilna Gaon.[38] In this excerpt, the author, after discussing the passage from *Gemara Nidda*, mentions the single egg.[39]

> . . . in the body of the woman are found the ovaries . . . the seed emitted by the man . . . induces the emission of a single egg from the ovaries . . .

The next passage alludes to another embryological theory and stems from a question entertained by R. Yakov Emden (d. 1776) regarding whether it was possible for a virgin to conceive in the absence of conjugal relations, e.g. bath house insemination (more on this topic below). In this passage he invokes the theory of preformation, in particular that of the animalculists, to answer the above question in the affirmative. The references to the male and female seeds are as follows:[40]

> . . . such a thing is decidedly not in the realm of the impossible . . . as *Hazal* said, "Maybe she conceived in the bath house?" [*Hagiga* 14b] . . . and this is compatible with the ideas of the scientists, who describe only a limited role for the female seed in conception (. . . but it is now clear that the female seed provides no material contribution to the fetus whatsoever . . . and this does not contradict what is written in the Torah, "*Isha ki tazria ve-yalda*." See the commentary of Ramban on this verse and you will see that it is not a contradiction.)[41] They have found through the use of the glass [microscope] and other experiments that man, like birds and fish, is created from an egg in the ovary of the woman. And in the male seed they have seen . . . the image of a tiny human being, complete with its limbs. . . .

R. Emden goes on to explain that the preformed fetus in the male seed receives its nourishment and sustenance, including warmth and moisture, from the female seed. It is interesting to note that he accepts the notion of the homunculus (preformation) and claims that this is in consonance with the commentary of Ramban. As mentioned above, Ramban granted no role to a female seed independent of the menstrual blood. However, Ramban does maintain, based on the *gemara* in *Nidda*, that the menstrual blood does contribute materially to the fetus. This latter notion is not compatible with the theory of preformation. In any case, R. Emden incorporates the contemporary embryological theories into his halakhic discussion.

The final selection in this section comes from the work of Pinchas Eliyahu Hurwitz (1765-1821), *Sefer haBerit*. This work is a compilation of medical and scientific theories culled from sources in many languages, and served as a valuable resource for its Jewish audience, to whom many of these ideas were otherwise inaccessible. This accounts for the book's popularity and multiple reprintings. This selection gives a balanced view of the opposing embryological theories, while at the same time incorporating the teachings of *Hazal*:

> Some scholars have written that all the features of the entire human body, complete with its limbs, are found within the egg of the woman . . . and some scholars have written that within the seed of the man is the form of a minuscule human being, for when male seed . . . are viewed under the microscope small creatures can be seen within them moving to and fro. . . . God knows the truth of this matter. However, it is known in truth that the woman also emits seed, as the verse explicitly states, "*Isha ki tazria.*" And her seed is not white, but red, as *Hazal* have said, "The mother emits the red substance."[42]

In conclusion of the discussion of the female seed, it is apparent that these sources do not reflect a consensus of opinion regarding the identity and nature of the female seed. Many of the sources, irrespective of the theories they espouse, attempt to align their positions with the words of *Hazal*, in particular the passage from *Gemara Nidda*.

Male Seed

At this point, we will analyze a selection of Jewish sources that address theories regarding the origin and nature of the male seed. Some of

these sources have already been encountered in the above section on the female seed. We begin with a passage from the Talmud, from which can be inferred the understanding of the origin of the male seed:[43]

> Levi was sitting in a bath house and observed a man fall and strike his head. He said, "His brains were agitated (*nitmazmez*)". . . Abaye said, "He has lost the ability to procreate."

According to Rashi, the implication is that an injury to the brain somehow affects the male seed. This is an allusion to the encephalo-myelogenic theory of the origin of the sperm (see above).[44]

In *Sefer haBahir*, a kabbalistic work attributed to R. Nehunia ben haKana (a first century *Tanna*), the reference to the encephalo-myelogenic doctrine is more explicit: "The spinal cord, which comes from the brain, enters the male organ (*amma*) and from there comes the seed."[45]

Meir ben Isaac Aldabi (1310-1360) (see above) mentions the encephalo-myelogenic as well as the pangenesis doctrine, but does not indicate which he advocates:

> The scientists have debated. Some say the seed comes from the brain, via the spinal cord, to the . . . testicles, and there it matures and whitens. The proof to this is that pain in the spine sometimes heals with emission of seed, and also, one whose spinal cord is severed cannot procreate. However, Hippocrates maintains that the seed is an extract from all the limbs of the body.[46]

Tashbets (1361-1444) (see above) refers to the pangenesis doctrine: "We must ascertain . . . if the seed derives from the entire body or not. Behold, the ancients have said this. . .". [47] But he ultimately rejects this in favor of the hematogenic doctrine of Aristotle, which he claims *Hazal* also espoused:

> . . . and this is their intent, *z"l*, when they said, "The seed is intermixed" (*mebalbel zarei*). The meaning of this phrase is that from all the limbs there is a combined power, not that each limb yields its corresponding limb [pangenesis doctrine] . . . this is their opinion, *z"l*, in agreement with the opinion of the philosopher [Aristotle].[48]

In summary up to this point, Jewish sources refer to all three theories regarding the origin of the male seed.[49] We now shift our attention to the period following the discoveries of Leeuwenhoek and Harvey, when the theories of epigenesis and preformation were prevalent.

Pinchas Eliyahu Hurwitz (1765-1821), in the passage cited above, refers to the theory of preformation and mentions the position of the animalculists as well as the ovists. In the following citation, he invokes the position of the animalculists in a novel interpretation of a Talmudic passage.

> . . . and they have seen with a microscope that in the seed of a man . . . exist tiny creatures, whose form resembles that of man, and that are alive and move within the drop.
>
> With this we see how all the words of *Hazal* are to be believed and how all their words are truthful and just . . . even regarding those matters which seem far fetched or inconceivable. . . . Our Talmud treats this sin [*hotza'at zera le-vatala*] harshly, equating it to murder, as it is written, R. Eliezer ben Yaakov said that one who emits seed wastefully is considered as if he killed a soul . . . and so said R. Yitschak and R. Ami in tractate *Nidda*. This statement seemed so far fetched in the eyes of the philosophers amongst our people . . . who were unaware of the looking glass mentioned above [microscope]. How could it be considered murder prior to the conception of the child . . . when the human being had not yet appeared? . . . the seed at this time is only fluid from the brain[50] and is still substance without form . . . . But now, after it has been seen with the aforementioned instrument that living beings in the image of man move to and fro within the seed, it is remarkable . . . to hear such a thing. Every intelligent person would judge such a sin as truly equivalent to murder.[51]

While most Jewish sources accepted the theory of preformation, Baruch Schick (1744-1808) (see above) stood alone, I believe, in rejecting the theory of preformation in favor of epigenesis:

> The limbs of the body are not all formed at once, rather they grow one by one like a tree. . . . Some have said that the form of a small human being is found within the egg, and there is no place for their words. Still others have said that within the male seed is found the image of a tiny living being, their proof being that when the male seed is viewed under the microscope moving objects, like worms,[52] can be observed. They therefore say that these worms are in fact little human beings . . . This assertion is also baseless. First, if they are correct, why are there so many worms [sperm]? Second, the very form of the worm attests that it is not the likeness of a man.[53]

Despite Schick's rejection of the theory of preformation, it was still perpetuated by rabbinic sources, especially with reference to the prohibition of *hotza'at zera le-vatala.*[54] This may be due, in part, to the fact that while *Sefer haBerit* was a popular, widely read work, *Tiferet Adam* was more obscure.

In summary, Jewish sources run the gamut of embryological theories regarding the origins of the male seed. As with the female seed, attempts were made to align these theories with the words of *Hazal*, including areas of halakha. An historical understanding of the various embryological theories contemporary with each of these sources gives us a better appreciation of each author's context and scientific frame of reference.

ARTIFICIAL INSEMINATION

Artificial insemination[55] is a common treatment for infertility. Although the procedure has grown tremendously in popularity and application over the last two decades, the concept of intentionally injecting sperm into a woman for the purpose of impregnation dates back to at least the mid eighteenth century, when John Hunter successfully inseminated a woman whose husband had a severe form of hypospadias.[56] As early as 1934, Hermann Rohleder wrote the first history of the artificial impregnation of human beings.[57] However, since the widespread application of this procedure is, as stated, only relatively recent, it is in this period that we find the proliferation of rabbinic responsa dealing with every imaginable halakhic consequence of artificial insemination.[58] But what sources could there be in the Talmud or *Rishonim* that could possibly aid in the halakhic analysis of this seemingly novel procedure? To answer this question one must mention yet another form of artificial insemination, this one more indirect in nature. There was a widely held belief dating back to antiquity that a woman could become pregnant in a bath house, for it was thought that when a woman bathes in a bath into which a man had previously emitted sperm, she may conceive. The following section briefly traces the history of the notion of artificial insemination in both Jewish and non-Jewish sources from antiquity to the present.

Jewish Sources

Two early references to so-called bath house insemination have served as the source for virtually all contemporary halakhic discussions of mod-

ern artificial insemination. The first case is mentioned in the *Gemara Hagiga*[59] in the course of a discussion about whether a *kohen gadol*, who is prohibited from marrying any woman who is not a virgin, may marry a pregnant woman who claims she is still virginal.[60] How could a virgin become pregnant? Shmuel attests that it is possible to have intercourse without perforating the *betulim*, but the *gemara* entertains another possibility, that of impregnation in the bath house, in which case the woman, still being a virgin, would be permitted to marry a *kohen gadol.*

The second case is mentioned in the Alphabet of Ben Sira[61] in reference to the nature of Ben Sira's birth. This narrative work, of questionable date and authorship (some date this work from the Geonic period), details the life of Shimon Ben Sira (second century B.C.E.), the author of *Divrei Shimon Ben Sira* (The Wisdom of Ben Sira). The relevant passage appears in the first section of this work, which is a biography of Ben Sira from his conception to the age of one year. The passage, apparently omitted in many editions, describes how the prophet Yirmiyahu was simultaneously both the father and grandfather of Ben Sira. Ben Sira's mother was Yirmiyahu's daughter. Yirmiyahu was forced by evil men to perform an act of onanism in a bath house, and his daughter conceived from his emissions when she inadvertently entered the same bath. Ben Sira was born seven months later,[62] the product of artificial insemination.[63] The text further mentions that it is no mere coincidence that the numerical value (gematria) of the Hebrew letters of "Sira" equals that of "Yirmiyahu," thereby hinting that Ben Sira is, in fact, the son of Yirmiyahu.

Not everyone accepted the veracity of the aforementioned story of Ben Sira's birth. Solomon Ibn Verga (15th-16th century) states in his historical narrative, *Shevet Yehuda,* that Ben Sira was the grandson of Yehoshua ben Yehotsadak and makes no mention of relation to Yirmiyahu.[64] R. David Ganz, the seventeenth century chronicler, claims that this story is mere exaggeration, as "I have not found it anywhere in the Talmud, and I have not heard from my teachers that it is found in any aggada or midrash.[65]

Assuming for our discussion the veracity of the passage in the Alphabet of Ben Sira, some important halakhic points can be derived, which explains why it has been so extensively quoted by subsequent *Rishonim* and *Aharonim.* Ben Sira is clearly assumed to be the product of Yirmiyahu and his daughter. Whether this was known to Yirmiyahu by *ruah ha-kodesh* or whether this is because Yirmiyahu's daughter was trusted to have been a virgin is unclear. In either case, despite the fact

that Ben Sira is the product of an halakhically illicit relationship, nowhere does one find aspersions cast on his lineage, and never is he referred to as a *mamzer;* the implication is that only the marital act can create the prohibition of *arayot* and label the resultant child a *mamzer.* The relevance of this case to artificial insemination with donor sperm should be obvious. Secondly, Ben Sira was known as the son of Yirmiyahu. This fact implies that a child born from artificial insemination may be considered halakhically related to the sperm donor.

One of the earliest references to the case of Ben Sira is by R. Perets ben Eliyahu of Corbeil (c.1295) in his glosses on *Sefer Mitzvot Katan* (also referred to as *Amudei Gola*).[66] He states that a woman need not refrain from sleeping on her husband's sheets while she is a *nidda* for fear that that she might bear a child from the remnant seed on the sheet and the child would be a *ben nidda.* However, R. Perets does warn that a married woman should not sleep on the sheets slept on by a man other than her husband. Why R. Perets differentiates between these two cases is a matter of halakhic import, but implicit in these statements is that R. Perets acknowledged that a woman could become pregnant in this manner. He brings proof from the case of Ben Sira. Jacob Moellin (?1360-1427) also mentions the case of Ben Sira in *Likutei Maharil,* where it appears as a statement without particular halakhic context.[67]

More elaborate treatment of this topic is found in the responsa of Rav Shimon ben Tsemah Duran,[68] to whom a question was posed about a woman who claimed to have had a virginal conception. R. Duran, who was also a physician, was asked to determine whether this was in fact possible, and, if so, what would be the halakhic ramifications. Whether this so-called bath house impregnation was actually feasible or simply contrived for the sake of halakhic analysis was a matter of intense debate amongst the *Aharonim,* as we shall soon see. Tashbets was one of few *Rishonim* who addressed this topic. He concluded that it is feasible, marshalling evidence from the aforementioned passage in *Gemara Hagiga,* as well as from the case of Ben Sira. With respect to the latter, he prefaces with the disclaimer that "if we believe the apocropha," then we have proof from Ben Sira. What is particularly interesting is Tashbets's reference in a gloss to two of his contemporaries, one an unnamed non-Jew and the other named R. Abraham Israel, both of whom claimed to have been familiar with cases of virginal women who had conceived.

The next Jewish reference to artificial insemination is not rabbinic in origin, but appears in the case studies of the famous marrano physician Amatus Lusitanus (1511-1568).[69] This discussion, like the aforementioned passage of Ben Sira, is not found in all versions of Lusitanus'

classic work, the Centuria, as it was expurgated by censors.[70] Here Lusitanus invokes the notion of artificial insemination (sine concubito) to exonerate a nun with a uterine mole who was accused of impropriety. He adduces his proofs from the case of Ben Sira, as well as from other scientific sources discussed below.

Another famous Jewish physician makes mention of artificial insemination in his work,[71] but this particular work is halakhic, not medical in nature. Rabbi Isaac Lampronti (1679-1756),[72] in his magnum opus, *Pahad Yitshak*, poses the following riddle: a child is the son of a woman who was impregnated by her father, yet he is not a *mamzer*. How is this possible?[73] He answers, "This is Ben Sira" and recounts the incident in the bath house, "as is written in *ketubot*." This reference is clearly not to the Talmudic tractate, as the story derives from the Alphabet of Ben Sira. The term "*ketubot*" is likely to be translated as "the writings," in which case it may refer to the apocrypha.[74]

We now turn to the scientific question of whether bath house impregnation is even possible. Implicit from all the above sources is that they accepted the possibility of this unique form of artificial insemination. However, few of them address the question specifically, with the exception of Tashbets and Lusitanus, both of whom accept the possibility. One of the first to expressly deny the possibility of such an event was R. Judah Rosanes (d. 1727), who articulates his position in his glosses to the Rambam's *Mishne Torah*, entitled *Mishne leMelekh*.[75] R. Rosanes maintains that a woman can only become pregnant through the completion of the natural marital act (i.e. *gemar bia*). He brings support for this notion from Talmudic sources, and also discusses the Talmudic teaching that a woman cannot become pregnant from the first intercourse (*bia rishona*). Based on these as well as other sources, he concludes that bath house impregnation as impossible.

This passage from the *Mishne leMelekh* is cited widely by subsequent authorities, some with approbation,[76] others with condemnation, as we will soon see. Although a number of *Aharonim* mention the *Mishne leMelekh* approvingly, including R. Moses Schick, perhaps his most enthusiastic advocate was R. Solomon Schick. In a responsum to R. Yoseph Edinger, coincidentally a student of R. Moses Schick, R. Solomon Schick states assuredly and with no ambiguity that bath house impregnation could never happen. In addition to quoting R. Rosanes and R. Moses Schick as his support, he interprets the passage in *Gemara Hagiga* in a novel fashion. As the aforementioned passage follows the story of the four rabbis who entered "*pardes*" (however it is to be defined), and one of those rabbis is the same Ben Zoma of our relevant

passage, and this Ben Zoma was harmed by his journey into "*pardes*," R. Schick maintains that the *gemara* is possibly mocking him. Never, according to R. Schick, did the *gemara* believe that bath house insemination could occur.[77]

Other authorities subsequent to R. Rosanes independently questioned the possibility of bath house impregnation. R. Yosef Hayyim (1833?-1909), author of the *Ben Ish Hai*, espouses a novel position in his work *Torah Lishma*.[78] R. Hayyim was asked whether he would allow sperm procurement from an ill man to facilitate a proper medical diagnosis. The questioner maintained that since the sperm could subsequently be used to impregnate a woman, this should mitigate the prohibition of *hashhatat zera*. R Hayyim's contention is that "nature has changed" (*nishtane ha-teva*)[79] with respect to artificial insemination. Whereas insemination through an intermediary medium (e.g. bath house impregnation) was possible in the times of the *Tannaim*, owing to their greater bodily strength and potency of their seed, such was not the case from the time of the *Ammoraim* and onward. If it was at all possible, it would be an extremely rare occurrence, as, he maintains, was the case mentioned by Tashbets. Therefore, as the likelihood of impregnating a woman with the remaining seed was so remote, sperm procurement would not be allowed.[80] Around the time this responsum was written, John Hunter performed the first successful artificial impregnation of a human being. However, this success was not widely publicized.[81]

Along a similar vein, a number of *Aharonim* also maintained that bath house impregnation was not possible in their time due to the changed nature. However, it was the changed nature of the bath, they maintained, not that of the seed, that explained why insemination was no longer possible.[82] According to this opinion, since the baths in Talmudic times were heated from below,[83] it was theoretically possible for insemination to occur, either because a man was more likely to emit seed in this kind of bath, or because this particular heat source was more conducive to the survival of the seed.[84]

While others questioned the possibility of bath house impregnation, R. Rosanes was always hailed as the main opponent to this notion. His position did not remain unopposed, as a number of *Aharonim* reject his contention.[85] Three different approaches were invoked in response to R. Rosanes. R. Yehonatan Eybeschutz (1690-1764) argued against R. Rosanes based on a re-analysis of the Talmudic passages that R. Rosanes cites, concluding that the latter's interpretations were incorrect, and that artificial insemination is possible.[86] R. Chaim Yoseph David Azulai (1724-1806) mentions in three separate places in his writings that bath

house impregnation is possible because it was accepted as fact by the *Gemara*, as well as by a number of prominent *Rishonim*.[87] The third approach of refutation is scientific in nature and was taken by R. Baruch Mordechai ben Yaakov Libschitz (1810-1885). R. Rosanes had stated that conception could only be accomplished with *gemar bia*. R. Libschutz responded that with respect to bath house impregnation, the waters of the bath could transport the seed to the internal organs of the woman, thereby effectively accomplishing the same result as *gemar bia*.[88]

Contemporary *poskim*, in their discussions on modern therapeutic artificial insemination, refer to some of the aforementioned sources. However, as the possibility of such an occurrence, at least in the modern medical context, is an accepted fact, little space is devoted to the scientific question of feasibility.[89] More time is apportioned for the resolution of attendant halakhic dilemmas.

Secular Sources

The notion of virginal or non-natural conception[90] dates back to antiquity and antedates Christianity.[91] Explicit reference to the phenomenon of artificial insemination, however, is found in sources from the Middle Ages. Avicenna (980-1037), in his *Canon* on medicine, and Averroes (d. 1198), in his *Colliget*, acknowledge the possibility of artificial impregnation.[92] Thomas Aquinas (d. 1274) relates that a woman became pregnant from lying in a bed into which sperm had been discharged.[93] As discussed above, R. Perets of Corbeil (c.1295), a contemporary of Aquinas, accepted this possibility and therefore dealt with the halakhic ramifications. Amatus Lusitanus quotes Avicenna and Al-Jazzar (10th cent.)[94] as authorities who accept artificial insemination.[95]

In 1750, a pamphlet by Dr. Abraham Johnson entitled "Lucina Sine Concubito" was published in London.[96] It was submitted by Johnson to the Royal Society, the pre-eminent scientific body in England, and consists of a personal account of a patient of Johnson's, whom the latter believed had conceived by artificial insemination. In this fantastical essay, Johnson postulates the means by which this insemination was achieved. He believed, based on classical sources, that the reproductive seed derived from the western winds and was accidentally ingested by his female patient.

He claimed that he tested his theory experimentally on his house maid, without her consent, and achieved positive results (i.e., the maid

became pregnant). He therefore submitted his results to the Royal Society with suggestions for wider applications of his technique.

While the belief in artificial insemination persisted into the twentieth century,[97] like the Jewish sources above, it was not without its detractors. Paolo Zacchias (1584-1659), physician to Pope Innocent X and prominent medical legal writer,[98] rejected the possibility, as did the great scientist Albrecht Haller (1708-1777).[99]

In conclusion, since the possibility of bath house insemination is difficult to disprove, whether it has or can actually occur remains a mystery.[100]

THE TWO PATHWAYS *(SHNEI SHVILIN)*

Rabbinic sources throughout the ages have discussed the intricate details of male reproductive anatomy, as they directly relate to the definition of a halakhically infertile man (i.e. *petsua daka* and *kerut shafkha*).[101] In the context of one such discussion, the *gemara* in *Bekhorot* (44b) makes a statement that seems somewhat puzzling today. The *gemara* states that there are two pathways in the male genital organ, one for urine and one for seed,[102] and that these two pathways are separated by a fine membrane the width of a garlic peel whose integrity is necessary for fertility. Should this membrane rupture and allow communication between the two channels, the man may be rendered halakhically infertile *(petsua daka)* and consequently may be forbidden to marry.

The existence of these two pathways in the male organ was an accepted fact amongst *Rishonim* and early *Aharonim*, and many halakhic discussions revolved around cases where one or the other pathway was perforated, especially in cases of hypospadias (i.e. when the opening of the urethra is not at the tip, but at varying points along the shaft).[103] In the latter case it was unclear whether the existing opening was only for the urine, which could easily be ascertained, or whether it was also for seed, which was halakhically difficult to determine given the prohibition of *hotza'at zera le-vatala*. The following section highlights some of the sources, both Jewish and secular, that have addressed this unique anatomical notion.

Jewish Sources

R. Shimon ben Tsemah (1361-1444) mentions the notion of the two pathways in his philosophical work, *Magen Avot*.[104]

> . . . for the organs of reproduction in the man are two, the *ever* and the *beitsim* [testicles] . . . and *Hazal* added the *hutei beitsim*[105] . . . should any of these three organs be damaged a man will be rendered infertile . . . and *Hazal* have written extensively on these topics, based on their *kabbala*, and have understood matters that scientists have not . . . and in the Canon [of Avicenna][106] it states that there are three pathways, one for urine, one for seed and one for [other] fluids . . . but this does not appear to be so according to *Hazal* [who say there are two] . . . all this is based on the true *kabbala*, which the scientists have not acquired . . . and since the wisdom of our sages has been lost through the exiles we must labor (to restore it) . . . and one should not err and say that *Hazal* were not expert in the sciences. . . .

Most *poskim* have understood the passage in *Gemara Bekhorot* to mean that there are two pathways extending all the way to the tip of the *ever*, and such was clearly the opinion of R. Moses Sofer in considering the suggestion of physicians to repair a hypospadias.[107] R. Yisroel Yehoshua Trunk (1820-1893), however, interpreted the *gemara* differently. He understood that the two pathways for urine and seed refer to the internal anatomy, but not that they extended into the *ever*. It is a mistake to think this, he maintained, as both the urine and seed traverse one path in the *ever*.

The Hazon Ish, R. Avraham Yeshayahu Karelitz (1878-1953), apparently agreed with the anatomical observation of R. Trunk, but did not accept his interpretation of the *gemara*:

> In the *gemara* it states that there were two pathways, one for the urine and one for the seed . . . in this matter the nature has changed (*nishtanu ha-teva'im*)[108] as today there is only one pathway in the *ever*.[109]

The Hazon Ish also claimed, based on his discussion with physicians, that the *ever* is subject to variation, be it a function of time or of geographical location.[110] R. Yoseph Hayyim mentions a number of such anatomical variants that were found in the city of Baghdad.[111]

Secular Sources

The notion of there being more than one pathway in the *ever* was prevalent in the middle ages, especially in the Arab world,[112] but does not appear to have clear roots in antiquity. Galen, a contemporary of R. Yehuda haNasi, states unequivocally that there is one path for both

urine and semen,[113] and Hippocrates, to the best of my knowledge, makes no mention of the two path theory. Avicenna (980-1037), as quoted by R. Duran above, claimed there were three canals in the *ever*, and Mondino (d. 1326), the Italian anatomist, described a separate canal for the sperm.[114] These ideas permeated the works of the renaissance artist and anatomist Leonardo DaVinci (1452-1519), who drew two distinct passages in his anatomical drawings.[115]

Andreas Vesalius (1514-1564) is credited with rectifying the Arab beliefs and clarifying, by anatomical dissection, that there is only one pathway in the *ever*.[116] He also postulates how the Arabs came to their conclusion.[117] Interestingly, he cites an actual case of a young man from Padua who had two passages at the tip of the ever, one for semen and one for urine.[118]

The susceptibility of the urethra to anatomical variation, and in particular to duplication, has been recorded in medical case records.[119] Frank Netter, in his contemporary classic, The *CIBA Collection of Medical Illustrations,* draws accessory urethral channels as an example of congenital variations.[120]

NOTES

1. For a remarkable account of the application of this technology, see Jiaen Liu, et. al., "Birth After Preimplantation Diagnosis of the Cystic Fibrosis F508 Mutation by Polymerase Chain Reaction in Human Embryos Resulting From Introcytoplasmic Sperm Injection With Epididymal Sperm," *Journal of the American Medical Association* 272:23 (Dec., 1994), 1858-60.
2. See E. Reichman, "The Halachic Definition of Death in Light of Medical History," *Torah U-Madda*, 4, (1994), 148-74. The same methodological approach was applied to the determination of death.
3. For an overview of the history of embryology, see J. Needham, *A History of Embryology* (New York, 1959); Howard Adelmann, "A Brief Sketch of the History of Embryology before Fabricius" in his trans. of *The Embryological Treatises of Hieronymous Fabricius of Aquapendente* (Ithaca, 1967), I, 36-70. For references to embryology in Jewish sources, see Samuel Kottek, "Embryology in Talmudic and Midrashic Literature," *Journal of the History of Biology* 14:2 (Fall, 1981), 299-315; David I. Macht, "Embryology and Obstetrics in Ancient Hebrew Literature," *Johns Hopkins Hospital Bulletin* 22, 242 (May, 1911), 1-8; W.M. Feldman, "Ancient Jewish Eugenics," *Medical Leaves* 2 (1939), 28-37; D. Shapiro, *Obstetrique des Anciens Hebreus* (Paris, 1904); W.M. Feldman, *The Jewish Child* (London, 1917), 120-44; H.J. Zimmels, *Magicians, Theologians and Doctors*, 62-64; Needham, op. cit., 77-82; Julius Preuss, *Biblical and Talmudic Medicine* (New York, 1978), 41-138; Ron Barkai, *Les Infortunes*

De Dinah: Le Livre De La Generation-La Gynecologie Juive au Moyen Age (Paris, 1991) (I thank Mr. Tzvi Erenyi for bringing this latter book to my attention).

4. There are no clearly documented human dissections from the time of Rashi, although scattered references to autopsies and dissections appear in the thirteenth and fourteenth centuries. Mundinus (1270-1326) is recognized to have been the first to incorporate human anatomical dissection into the medical curriculum. See, for example, C.D. O'Malley, Andreas Vesalius Of Brussels (Berkeley, 1964), 1-20; Ludwig Edelstein, "The History of Anatomy in Antiquity," in *Ancient Medicine* (Baltimore, 1967), 247-302; Charles Singer, *A Short History of Anatomy and Physiology from the Greek to Harvey* (New York, 1957); Mary Niven Alston, "The Attitude of the Church Towards Dissection Before 1500," *Bulletin of the History of Medicine* 16:3 (October, 1944), 221-38; Nancy Sirasi, *Taddeo Alderotti and His Pupils* (Princeton, 1981), 66-69.
5. Hippocrates, in his essay, "The Seed and the Nature of the Child," devotes a lengthy section to agriculture. He says, "You will find that from beginning to end the process of growth in plants and humans is exactly the same." (G.E.R. Lloyd, ed., *Hippocratic Writings* (New York, 1978), 341). See also A.J. Brock (trans.), *Galen On the Natural Faculties* (London, 1916), p. 19.
6. See Joseph Needham, *A History of Embryology* (New York, 1959), for extensive discussion of ancient theories of embryology. The most complete account of pre-Aristotelian theories of sexual generation is by Erna Lesky in *Die Zeugungs und Vererbungslehre der Antike und ihre Nachwirkung* (Mainz, 1950). This work is widely quoted. See also the classic work by Monica Green, *The Transmission of Ancient Theories of Female Physiology and Disease Through the Early Middle Ages*, Doctoral Dissertation, Princeton University, 1985, and Sarah George, *Human Conception and Fetal Growth: A Study in the Development of Greek Thought From Presocrates through Aristotle*, Doctoral Dissertation, University of Pennsylvania, 1982.
7. Galen discusses his theories of generation in many places. See, for example, Margaret Talmadge May, trans., *Galen: On the Usefulness of the Parts of the Body* (Ithica, 1968), vol 2, 620-54. See also Anthony Preus, "Galen's Criticism of Aristotle's Conception Theory," *Journal of the History of Biology*, 10:1 (Spring, 1977), pp. 65-85.
8. Modern scholarship has revealed that the hippocratic corpus is not the work of one author. For ideas of conception see, for example, G.E.R. Lloyd, ed, *Hippocratic Writings* (New York, 1978), pp. 317-46, chapter entitled "The Seed and the Nature of the Child."
9. Preus, op. cit., p. 83. See also Needham, op. cit., p. 78 who cites a similar idea from Hippocrates.
10. See A.L. Peck, (trans.) *Aristotle: Generation of Animals* (Cambridge, 1942), pp. 71, 100-101 note a, 109-12.
11. *Exercitationes de Generatione Animalium* (Amsterdam, 1651), later translated and annotated by Gweneth Whitteridge, Disputations Touching the Generation of Animals (Oxford, 1981).
12. The belief in spontaneous generation in Jewish and secular sources merits its own article. A passage in *Gemara Shabbat* 107b seems to indicate that

the Rabbis believed that lice could spontaneously generate. This passage, as well as others that conflict with our current understanding of science, have been the subject of many a heated discussion. Francesco Redi (1620-97) was the first to scientifically study spontaneous generation, and he dealt the theory its first major blow in his work, *Esperienze Intorno Alla Generazione Deg'lisetti* (Florence, 1668). Louis Pasteur (1833-93) laid the theory to rest. For treatment of this topic in Jewish sources see Isaac Lampronti, *Pahad Yitshak* (Bnei Brak, 1980), s.v. *Tseda haAsura*; Arye Carmel, ed., Eliyahu Dessler, *Mihktav meEliyahu* (Jerusalem, 1984), vol.4, 355, note 4; Arye Carmel and Yehuda Levi, *"R'ot haEnayim bi-kviut ha-halakha,"* *HaMaayan* 23:1 (*Tishrei*, 1983), pp. 64-9; David Ruderman, "Contemporary Science and Jewish Law in the Eyes of Isaac Lampronti of Ferrara and Some of His Contemporaries, *Jewish History*, 6:1-2 (1992), pp. 211-24.

13. See his *De Mulierum Organis Generationi Inservientibus Tractatus Novus* (Leyden, 1672).
14. *De Ovi Mammalium et Hominis Genesi* (Leipzig, 1827).
15. See Pieter Willem Van Der Horst, "Sarah's Seminal Emmission: Hebrews 11:11 in the Light of Ancient Embryology," in *Greeks, Romans and Christians: Essays in Honor of Abraham J. Malherbe*, edited by David Balch et al. (Minneapolis, 1990), pp. 287-302. I thank Dr. Shnayer Leiman for directing me to this source, which places a number of Rabbinic sources into the context of Greco-Roman theories of embryology. Horst provides a nice summary of these three theories. See also Sarah George, op. cit.
16. A.W. Meyer, "The Discovery and Earliest Representation of Spermatozoa," *Bulletin of the Institute of the History Of Medicine* 6:2 (February, 1938), pp. 89-110.
17. Needham, op. cit., pp. 205-11; A Du Bois, "The Development of the Theory of Heredity," *CIBA Symposia* 1:8 (November,1939), pp. 235-46.
18. According to the theory of preformation, either Adam or Eve, depending on whether one is an ovulist or animalculist, contained the preformed bodies of all the people that would populate the earth. Within each preformed seed must exist the preformed seed of the next generation, and so on.
19. Regarding the origins of this depiction and its initial false attribution to Leeuwenhoek, see A.W. Meyer, op. cit.
20. See David Feldman, *Marital Relations, Birth Control and Abortion in Jewish Law* (New York,1974), esp. chaps. 6 and 7, for his excellent treatment of these topics. Some of the sources from this section derive from this book.
21. The term *gidim* can mean either blood vessels or nerves and has been used interchangeably in rabbinic literature. The clarification of Hebrew medical terms, especially in the middle ages, has plagued many a doctor and historian throughout history. The confusion stemmed from differing etymologies of medical terms, ranging from Latin to Greek and later Arabic, as well as the fact that these terms were not easily rendered into Hebrew. Some terms were transliterated, others translated and often entirely new words were devised. This confusion led many Jewish physicians to include a glossary of medical terms in their books. On Hebrew terminology see, for example, Juan Jose Barcia Goyanes, "Medieval Hebrew

Anatomical Names," *Koroth* 8:11-12 (1985), pp. 192-201; A.S. Yahuda, "Medical and Anatomical Terms in the Pentateuch in Light of Egyptian Medical Papyri," *Journal of the History of Medicine* 2:4 (Autumn, 1947), pp. 549-73. Multiple articles have appeared over the years in the Journal *HaRofe haIvri* on the topic of hebrew medical terminology.

22. It is interesting that blood is not mentioned as one of the contributions of the female seed, especially since this seed, according to the *gemara,* is itself comprised of blood. For a discussion about this discrepancy, see *She'iltot deRav Ahai Gaon*, She'ilta 56 and commentaries of R. Isaiah Berlin (*She'ilat Shalom*) and R. Naftali Tzvi Yehuda Berlin (*Ha'amek Sh'aila*) on this passage. I thank Dr. Maier Halberstam for directing me to this source.
23. The terms *ruah, nefesh* and *neshama* are all abstract and difficult to define. They are often used interchangeably. See Samuel S. Kottek, "The Seat of the Soul: Contribution to the History of Jewish Medieval Psycho-physiology," *Cliomedica* 13:3-4 (1978), pp. 219-46.
24. Rabbinic sources of the Middle Ages and beyond clearly knew of Galen. In addition, Galen himself was at least peripherally familiar with Jews and Jewish medicine. See Reichman, op. cit, esp. p. 166, n. 6.
25. We know of Ramban's medical practice primarily from the responsa of his student, R. Shlomo Ibn Aderet (Rashba). Responsa numbers 177, 413 and 825 discuss the Ramban's use of an astrological figure of a lion to cure a kidney ailment. The Rashba discusses the halakhic issues involved in using astrological figures. See also R. H.Y.D. Azulai, *Shem haGedolim Ma'arekhet Gedolim*, s.v. Ramban, and David Margalit, *Hakhmei Yisrael KeRofim* (Jeruslaem, 1972), pp. 128-35.

    Medical historians have mentioned that Ramban practiced in Montpellier. See Isaac Alteras, "Jewish Physicians in Southern France during the 13th and 14th Centuries," JQR 68 (1977-78), p. 218. No Jewish sources that I have found corroborate this claim.
26. On the University at Montpellier in the Middle Ages see Sonoma Cooper, "The Medical School of Montepellier in the Fourteenth Century," *Annals of Medical History*, new series 2 (1930), pp. 164-95; *CIBA Symposia* 2:1 (April, 1940), entire issue devoted to Montepellier.

    Regarding the Jewish presence at Montepellier see Luis Garcia-Ballester, "Dietetic and Pharmacological Therapy: A Dilemma Among Fourteenth Century Jewish Practitioners in the Montepellier Area," *Clio Medica* 22 (1991), pp. 23-37; Joseph Shatzmiller, "Etudiants Juifs a la Faculte de Medicine de Montepellier Dernier Quart du XIV Siecle," *Jewish History* 6:1-2 (1992), pp. 243-55.
27. Rashba, responsum 120, also quoted in R. Yosef Karo, *Bedek haBayit* on Y.D. 154.
28. Commentary on *Vayikra*, 12:2.
29. These terms derive from the *Mishna* in *Nidda* 2:5 and have been the source of much discussion regarding their anatomical identification.
30. *Hilkhot Issurei Bia* 5:4.
31. 40a.
32. This book is a compilation of theories in philosophy, theology, psychology and medicine. The material was culled from the existing literature of

that time, as stated by Aldabi in his introduction, but unfortunately there are no references, for which Aldabi apologizes. This book was first printed in 1518 in Riva di Trento, but because of its immense popularity it has been reprinted many times over the centuries, the last time being in Jerusalem, 1990.

33. *Shevilei Emuna* (Jerusalem, 1990), pp. 177-8.
34. For biographical information on Tuvia Cohn see his introduction to *Ma'ase Tuvia*. See also Dr. D.A. Friedman, *Tobias Cohn* (Tel Aviv, 1940); *Encyclopaedia Judaica* (Jerusalem,), s.v. Cohn, Tobias.
35. On the Jews of the University of Padua see, for example, Cecil Roth, "The Medieval University and the Jew," *Menora Journal* 9:2 (1930), pp. 128-41; Jacob Shatzky, "On Jewish Medieval Students of Padua," *Journal of History of Medicine* 5 (1950), pp. 444-47; Cecil Roth, "The Qualification of Jewish Physicians in the Middle Ages," *Speculum* 28 (1953), pp. 834-43; David B. Ruderman, "The Impact of Science on Jewish Culture and Society in Venice (with Special Reference to Jewish Graduates of Padua's Medical School) in *Gli Ebrei e Venezia* (Venice, 1983), pp. 417-48.
36. (Cracow, 1908), 118. Note his mention of the microscope, which was first designed in the late 17th century.
37. Note that this author has been variously referred to as Baruch of Shklov, Baruch Shklover or Baruch Schick, the latter name under which he is listed in *Encyclopaedia Judaica*. For biographical information see David Fishman, "Science, Enlightenment, and Rabbinic Culture in Belorussian Jewry, 1772-1804," Ph.D. dissertation, Harvard University, 1985; ibid., "A Polish Rabbi Meets the Berlin Haskalah: The Case of R. Baruch Schick," *AJS Review* 12:1(Spring, 1987), pp. 95-121; Noach Shapiro, *"R. Baruch Schick mi-Shklov," HaRofe haIvri* 34:1-2 (1961), pp. 230-35; David Margalit, *"Dr. Barukh Schick veSifro 'Tiferet Adam'," Koroth* 6:1-2 (August, 1972), pp. 5-7. There is debate in the above sources as to whether Baruch Schick was a physician. See also Israel Zinberg, *A History of Jewish Literature: The German-Polish Cultural Center* (New York, 1975), pp. 271-74.
38. Hague, 1780. In the introduction to this book appears the oft quoted notion, in the name of the Vilna Gaon, that scientific knowledge is needed for the study of Torah.
39. *Tiferet Adam* (Berlin, 1777), 3. This book was printed together with *Amudei Shamayim*, an astronomical work by the same author. As this latter work appears first in the combined volume, the book is often referenced by its name only.
40. This is a loose translation from *Iggeret Bikoret* (Zhitomer, 1868), 25b.
41. Parentheses are in original text.
42. *Sefer haBerit* (Jerusalem, 1990), vol. 1, chap. 2, p. 240.
43. *Hullin* 45b.
44. loc. cit. s.v. *she-eno molid.*
45. *Sefer haBahir* has also been referred to as *Midrash R. Nehunia ben haKana.* Ramban refers to it by this title in his biblical commentary. This citation is from chapter 51 and is quoted by Moshe Perlman in his *Midrash haRefua* (Tel Aviv, 1926), p. 23.
46. *Shevilei Emuna* (Jerusalem,1990), *netiv* 4, p. 211.

47. *Magen Avot* 38b. Tashbets mentions some of the proofs to this doctrine. These proofs make fascinating reading and reflect the medieval understanding of heredity, particularly the inheritance of acquired characteristics. The concept of heredity in *Hazal* is another topic that merits medical/historical analysis.
48. Ibid., 39a.
49. The encephalo-myelogenic doctrine was also mentioned by R. Yehiel Mikhel Epstein in his Halachic work *Arukh haShulhan*, E.H., 23:3.
50. This is a reference to the encephalo-myelogenic doctrine.
51. *Sefer haBerit* (Jerusalem, 1990), *ma'amar* 16, chapter 3, pp. 232-3.
52. Many scientists of that time referred to sperm as seminal worms. See for example, William Cullen, (trans.), *Albrecht Haller, First Lines of Physiology* (Edinburgh, 1786), p. 205.
53. *Tiferet Adam* (Berlin, 1777), pp. 3b-4a. Other arguments against the preformationists are cited in Needham, op. cit., p. 210.

    It appears from the last sentence of this citation that Schick may himself have viewed the sperm under the microscope. There is debate amongst historians whether Schick had a laboratory where he performed medical experimentation. See Shapiro, op. cit., pp. 234-5; Israel Zimberg, op. cit., p. 282.

    It is also interesting that this entire passage is strikingly similar to the writings of Albrecht Haller, whose works were very popular in the scientific world at the time Schick was writing. Compare the passage below with the one by Schick:

    > To the father some have attributed everything; chiefly since the seminal worms, now so well known, were first observed in the male seed by the help of the microscope. . . . But in these animals there is a proportion wanting betwixt their number and that of the fetuses; they are also not to be constantly observed throughout the tribes of animals. (from Cullen, op. cit., pp. 205-6)

    A broader comparison between *Tiferet Adam* and the works of Haller may yield interesting results.
54. R. Yosef Hayyim ben Eliyahu, *Rav Pe'alim,* vol. 3, E.H. 2; R. Yehiel Mikhel Epstein, *Arukh haShulhan*, E.H. 23:1; R. Eliezer Waldenberg, *Tsits Eliezer*, vol. 9, 51.
55. A number of authors have previously written on this topic from an historical perspective. See H.J. Zimmels, *Magicians, Theologians and Doctors* (London, 1952); Immanuel Jacobovits, *Jewish Medical Ethics* (New York, 1959), pp. 244-50. This essay treats the topic more comprehensively.
56. John Hunter (1728-1793) was a prominent scientist and comparative anatomist who is known for his self-experimentation with venereal disease. His original manuscripts, detailing his application of artificial insemination, are currently housed at the Hunterian Museum in London, where one can also see on display thousands of human and animal anatomical specimens which Hunter collected during his lifetime.
57. *Test Tube Babies* (New York, 1934).
58. See, for example, Fred Rosner, *Modern Medicine and Jewish Law*, 2nd ed. (New York, 1991), pp. 85-100; Abraham Steinberg, *Encyclopedia Hilkhatit Refuit* (Jerusalem, 1988), pp. 148-61. For a bibliography of responsa

on this topic, see R. Yaakov Weinberg and R. Maier Zichal, "*Hazra'a Melakhutit*," *Assia* 55 (December, 1994), pp. 75-89.

59. 14b-15a. Some have construed this passage to be a sarcastic allusion to the Christian doctrine of immaculate conception. See R. Yehoshua Boymel, *Emek Halakha*, 1:68; Jacobowits, op. cit., p. 359, n. 31. Preuss, op. cit., p. 477, claims that this cannot be, as the doctrine of immaculate conception was not yet known at the time of Ben Zoma (1st century C.E.). Preuss' historical interpretation however, is disputable.
60. See *Tosafot*, loc. cit., s.v. *betula*. Whether it is only claimed or actually verified that the woman is a virgin is a matter of discussion.
61. The text is based on an Oxford manuscipt, which was published in A.M. Haberman, *Hadashim Gam Yeshanim* (Jerusalem, 1976), pp. 125-7.
62. See Pieter W. Van Der Horst, "Seven Months' Children in Jewish and Christian Literature from Antiquity," in his *Essays on the Jewish World in Early Christianity* (Gottington, 1990), pp. 233-47. (I thank Dr. Shnayer Leiman for this reference.) Van Der Horst does not include Ben Sira in his list.

    There is a notion in *Hazal* that babies born in the seventh and ninth months are viable, whereas those born in the eighth month are not (see, for example, T.B. *Shabbat* 135a and *Yevamot* 80a). This was a prevalent notion in antiquity and the Middle Ages and is another example of a topic where a medical historical analysis may shed light on Rabbinic sources. This issue has been previously addressed. See Neria Gutal, "*Ben Shemona: Pesher Shitat Hazal beNogea leVladot Benei Shemona*," *Assia* 55-56 (1989), pp. 97-111; Dr. Rosemary Reiss and Dr. Avner Ash, "*Ben Shemona Mekorot Klasi'im LeEmuna Amamit*," ibid., pp. 112-17. See also Ron Barkai, "A Medieval Hebrew Treatise on Obstetrics," *Medical History* 33 (1988), pp. 96-119, esp. pp. 101-104. For further information on the secular sources see Ann Ellis Hanson, "The Eight Months' Child and the Etiquette of Birth: Obsit Omen!", *Bulletin of the History of Medicine* 61 (1987), pp. 589-602; Sarah George, op. cit., pp. 204-33.
63. The text also mentions that the *Ammoraim* Rav Zeira and Rav Pappa were also born by artificial insemination, but unlike Ben Sira, the identity of their fathers was unknown. Yechiel Halperin in his *Seder haDorot* (Jerusalem, 1988), section 2, 118, quotes *Sefer Yuhsin* by Abraham Zacuto, who, in turn, cites this notion from *Sefer Kabbalat haHasid*. Halperin then cites the original source of this idea from the alphabet of Ben Sira and subsequently refutes the belief that R. Zeira and R. Pappa were products of artificial insemination. He does not, however, assail the belief that Ben Sira was a product of artificial insemination.
64. (Pietrikov, 1904), introduction.
65. *Tsemah David*, section 1, *eleph revi'i*, 448. See also *Tsits Eliezer*, vol. 9, no. 51, gate 4, chap. 1, letter *tet*.
66. This reference is mentioned by the *Bayit Hadash* (R.Y. Sirkes 1561-1640) in Y.D. 195 (s.v. *ve-lo*) as appearing in the "*Hagahat Semak Yashan*" of R. Perets. The glosses of R. Perets first appeared in the printed text of *Sefer Mitsvot Katan* in the mid 1500's and all subsequent editions invariably contained these glosses. I consulted the 1556 Cremona edition and could not find this particular gloss. It seems that this gloss remained in manu-

script form and was never printed, hence the term "*yashan*" of the Bah likely refers to an old manuscript edition. This fact is further evidenced by the comment of R. Chaim Y.D. Azulai (*Birkei Yoseph* E.H. 1:14) that after much effort he was finally able to locate this particular gloss of R. Perets in an old manuscript.

A passage similar to that of R. Perets appears in the *Shiltei haGiborim* on *Rif* (T.B. *Shavuot* 2a) attributed to an author referred to by his acronym, *HR"M*. Rav Eliezer Waldenberg (*Tsits Eliezer* vol. 9, no. 51, gate 4, chap. 1, letter *het*) has postulated that this may be a misprint, and the text should actually read *HR"P*, an acronym for HaRav Rabbenu Perets.

67. *Sefer Maharil*, Shlomo Spitzer, ed. (Jerusalem, 1989), pp. 611-12.
68. Vol. 3, no. 263.
69. On Lusitanus, see essays in Harry Friedenwald, *The Jews and Medicine* (Baltimore, 1944), Vol 1, pp. 332-90. The section relevant to our discussion is on page 386. Preuss (op. cit., 464) also quotes Lusitanus in discussing the *Gemara Hagiga*.
70. Friedenwald, op. cit., p. 363, n. 98.
71. See the work of another famous Jewish physician, Tobias Cohn (1652-1729), who mentions artificial insemination in his *Ma'ase Tuvia* (Cracow, 1908), section 3, 118b.
72. Although known for his halakhic expertise, Lampronti was a prominant Italian physician and a graduate of the University of Padua. See Abdelkader Modena and Edgardo Morpugo, *Medici E Chirurghi Ebrei Dottorati E Licenziati Nell'Universita Di Padova dal 1617 al 1816* (Bologna, 1967), pp. 55-57. These authors mention that Lampronti consulted the famous physician Morgagni for assistance with his difficult medical cases. Saul Jarcho elaborates on these consultations in his article, "Dr. Isac Lampronti of Ferrara," *Koroth* 8:11-12 (1985), pp. 203-6. For a discussion on the interface between science and halakha in the work of Lampronti see David B. Ruderman, "Contemporary Science and Jewish Law in the eyes of Isaac Lampronti of Ferrara and Some of his Contemporaries," *Jewish History* 6:1-2 (1992), pp. 211-24.
73. *Pahad Yitshak* (Bnei Brak, 1980), s.v. *Ben Bito*. David Margalit does not mention this passage in his essay, "*Erkhim Refui'im she-bi-Encyclopedia haHilkhatit Pahad Yitshak LeR.Y. Lampronti*", *Koroth* 2:1-2 (April, 1958), pp. 38-61.
74. Although the *Wisdom of Ben Sira* is included in the works of the apocrypha, the *Alphabet of Ben Sira* is not.

    See R. Yehoshua Boymel, *Emek Halakha*, no. 68, regarding the citation of R. Lampronti:

    > . . . even though he did not cite his source for this, still his words are believed, and this *tsaddik* is free from iniquity.

    R. Boymel apparently thought the word "*ketuvim*" to be a generic reference, not a reference to a specific work or body of works.
75. *Hilkhot Ishut*, 15:4. See also *Mishne leMelekh* on *Hil. Issurei Bia* 17:15, where R. Rosanes discusses these matters in great detail and states that the passage of Ben Zoma in *Hagiga* is not considered halakhic.
76. See, for example, Malakhi ben Yakov HaKohen (d. 1785-1790), *Yad Ma-*

lakhi (Berlin, 1857), *kelalei Ha-dinim* no. 247; R. Moshe Schick, known as Maharam Schick, *Taryag Mitsvot* no.1.

77. *Teshuvot Rashban*, E.H. no.8.
78. (Jerusalem, 1976), no. 481. R. Hayyim wrote these responsa under a pseudonym.
79. The concept of "*nishtane hateva*" has been invoked many times in Rabbinic literature. See, for example, *Tosafot* in T.B. *Avoda Zara* 24b, s.v. *Para*; *Tosafot* in T.B. *Hullin* 47a, s.v. *kol*; E.H. 156:4 in the *Rema*. For comprehensive treatment of this topic see N.M. Gutal, *Sefer Hishtanut HaT'vaim B'halakha* (Jerusalem, 1995). Two areas where authorities often discuss this principle are *Hil. Terefot* and *metsitsa* in *mila*. See also later in this article regarding the two pathways of the male genital organ.
80. R. Hayyim cites other reasons for forbidding sperm procurement in this case, such as that some seed might spill in the process of collection, or, even if they collect all the seed, it might not all be used for the purpose of insemination. These concerns have been voiced by current *poskim* in their discussions on artificial insemination.
81. See Rohleder, op.cit.
82. R. Yaakov Reischer, *Iyyun Yaakov* (Wilhelmsdorf, 1725), on *Gemara Hagiga* 14b. See also R. Pinchas Horowitz, *Pitha Zuta al Hil. Nidda uTevilla* (London, 1958), 195:7, who explains the position of R. Reischer. Both of these sources question why Rambam omits the case of Ben Zoma from his code.
83. See O.H. 230:3 and *Mishna Berura*, loc cit.
84. R. Yekutiel Greenwald, in his *Kol Bo Al Avelut* (New York, 1947), pp. 305-6, n. 8, states that the majority of *poskim* hold that bath-house insemination could never happen. However, if it was ascertainable that such an event had occured, the parents and children would be obligated to mourn for each other. Another halakhic question unique to a child born from bath-house insemination is whether such a child could have his *mila* performed on Shabbat. See R. Moshe Bunim Pirutinsky, *Sefer haBerit* (New York, 1973), 9, who states, based on the interpretation of R. Hananel to the *Gemara Hagiga*, that since such a birth is considered miraculous, and not by natural methods of conception, the *mila* could not be performed on Shabbat.
85. Many Aharonim still maintained the possibility of bath-house impregnation without specifically addressing the *Mishne leMelekh*. See R. Yaakov Emden, *Iggeret Bikkoret* (Zhitomer, 1868) and *Sheilat Ya'avets*, vol. 2, no. 97. Emden also discusses artifiicial insemination in his unpublished commentary on Tractate *Hagiga, Kolon Shel Sofrim,* Oxford manuscript Neubauer #516 (Ms. Michael #326), p. 28. Here he states that bath house insemination is not possible since nature has changed. However, since the manuscript is in poor condition, it is unclear whether this is Emden's own opinion or a citation.
86. *Benei Ahuva* (Jerusalem, 1965), on *Rambam, Hil. Ishut* chap. 15.
87. *Birkei Yosef*, E.H. 1:14; *Yair Ozen, ma'arekhet* 1 no. 93; *P'takh Enayim* on *Gemara Hagiga* 14b. See also R. Y.S. Nathanson, *Shai laMore*, Glosses on E.H. 1;6; ibid., *Responsum Shoel uMeshiv*, Vol. 3, section 3, nos. 34 and 132 (end); R. Eliezer Fleckles, *Teshuva me Ahava*, Y.D. no. 195.

88. *Berit Yaakov* (Warsaw, 1876), E.H. no. 4. The author employs the same logic with respect to R. Perets's pronouncement about a woman becoming pregnant from seed remaining on the sheets. Here, too, he maintains that a woman may use the sheets for internally cleaning herself, thereby bringing the seed into close proximity with the uterus.
89. See R. Shalom Mordechai Shvadron (1835-1911), *She'elot uTeshuvot Maharsham* (New York, 1962), vol. 3, no. 268, who was asked whether it was permissible to undergo artificial insemination.
90. For the material on artificial insemination in medieval times, I have relied on secondary sources, primarily Preuss. The primary sources are in Arabic and Latin and, for the most part, remain untranslated into English.
91. See Robert Graves, *The Greek Myths* (Baltimore, 1955), 51 for descriptions of non-natural methods of conception. I thank Dr. Louis Feldman for this reference.
92. Preuss, 464.
93. Ibid. Preuss provides no reference for this statement.
94. On this author see Gerrit Bos, "Ibn Al-Jazzar on Women's Diseases and Their Treatment," *Medical History*, 37 (1993), 296-312. In personal communication, Dr. Bos says he is unaware of any reference to artificial insemination in the extant works of Al-Jazzar.
95. Preuss, 464.
96. This work was reprinted and appended to Hermann Rohleder, *Test Tube Babies* (New York, 1934).
97. Preuss, 464, cites Stern, who stated that the belief in bath house insemination was still prevalent in Turkey at that time, i.e., early 20th century. See also George Gould and Walter Pyle, *Medical Curiosities* (New York, 1896), 42-45, who state that the possibility of bath house insemination was still being debated. They also relate an extraordinary, if not fantastical, story from the civil war of how a woman, struck in the abdomen with a bullet that previously hit the testicle of a soldier, gave birth, after 278 days, to an eight pound boy.
98. On Zacchias and other medical legal writers see Bernard Ficarro, "History of Legal Medicine," *Legal Medicine Annual* (1979).
99. Both Zacchias and Haller are mentioned in Preuss, op. cit., 464.
100. Although I have been unable to find any contemporary medical references to bath house insemination, I have found an interesting case which attests to the viability of the human sperm. See Douwe A.A. Verkuyl, "Oral Conception: Impregnation Via the Proximal Gastrointestinal Tract in a Patient with an Aplastic Vagina," *British Journal of Obstetrics and Gynaecology*, 95 (Sept., 1988), pp. 933-4.
101. See E.H. 5.
102. See also *Rashi* on T.B. *Yevamot* 75b, s.v. *guvta*.
103. See *Otsar haPoskim* (Jerusalem, 1962), E.H. 5, no. 25 and Abraham Tzvi Hirsch Eisenstadt, *Pithei Teshuva*, E.H. 5, no. 5 for a series of halakhic queries regarding both acquired and congenital variants of the male genitalia.
104. 37b. A loose translation of the passage follows.
105. It is a matter of debate as to the halakhic definition of *hutei ha-betzim*. For our purposes we can assume it refers to the vas deferens.

106. Avicenna (980-1037), known in Hebrew sources as Ibn Sina, was a Persian physician of great reknown. His main work, *The Canon*, was considered the authoritative work on medicine for many centuries, and is quoted extensively by Rabbinic sources. The only extant Hebrew medical incunabula is a copy of Avicenna's *Canon* (Naples, 1491). Many Hebrew manuscripts of Avicenna were found in the Cairo Geniza. See Haskell D. Isaacs, *Medical and Para-Medical Manuscripts in the Cambridge Genizah Collections* (Cambridge, 1994).

    It appears that the printer of *She'elot uTeshuvot Havot Ya'ir* (reprinted, Jerusalem, 1973), by R. Yair Bacharch, was not familiar with the work of Avicenna, as I believe there is a misprint in responsum no. 234. In this responsum, addressing the permissibility of using *Talmudic* remedies for medical treatment, R. Bachrach discusses a particular theory of medical therapeutics. R. Bachrach claims that he found support for this theory in, as it appears in the printed adition, "*Sefer haKinyan leEven Pina.*" I have found no bibliographical reference to such a work, and, given the medical context of the statement, believe the proper reading should be "*Sefer haKanon leIbn Sina.*"

107. R. Moshe Sofer, *Teshuvot Hatam Sofer* (Vienna, 1882) vol. 6, no. 64, s.v. *akh ma.*

108. See the position of R. Yosef Hayyim above in section on artificial insemination.

109. *Hazon Ish* (Bnei Brak, 1991) E.H. 12, no. 7.

110. Ibid. See *Tsits Eliezer*, vol. 10. no. 25, chap. 24. These two sources deal with the halakhic aspects of prostate surgery, which can involve intentional ligation of the vas deferens. The issue discussed is whether such a procedure renders the patient a *kerut shafkha*. On this topic, see the important responsa of R. Moses Feinstein, E.H., vol. 4, nos. 28 and 29.

    On the effect and importance of geographical location in the Talmud as compared to classical sources, see Stephen Newmyer, "The Concept of Climate and National Superiority in the Talmud and its Classical Parallels," Transactions and Studies of the College of Physicians of Philadelphia, series 5, vol. 5, no.1 (March, 1983), 1-12. On the concept of climatology in general, see Genevieve Miller," Airs, Waters and Places in History," *Journal of the History of Medicine*, vol. 17 (Jan., 1962), pp. 129-140.

    The notion of climatic changes in time and place has been employed to explain the concept of "*nishtane ha-teva.*"

111. *Rav Pe'alim*, vol. 3, E.H., no.12.

112. Preuss, op. cit., 110; *Magen Avot*, cited in the text above; Cecil Roth, ed., *Encyclopedia Judaica*, 2 (Jerusalem), 932.

113. Margaret Talmadge May, ed., *Galen: On the Usefullness of the Parts of the Body* (Ithica, 1968), 660.

114. J. Playfair McMurrich, *Leonardo Da Vinci the Anatomist* (Baltimore, 1930), 202.

115. Ibid., 180; Charles D. O'Malley and J.B. de C.M. Saunders, *Leonardo on the Human Body* (New York, 1983), pp. 460-3.

116. See C.D. O'Malley, *Andreas Vesalius of Brussels* (Berkeley, 1964), 358. The appendix contains a selection of translations from Vesalius' famous work, *De Humani Corporis Fabrica* (Basel, 1543).

117. Preuss, op. cit., 110.
118. C.D. O'Malley, et. al., trans., *William Harvey: Lectures on the Whole of Anatomy* (Berkeley, 1961), 142, n. 509. Harvey followed Vesalius and confirmed that there was only one path in the *ever.*
119. See George Gould and Walter Pyle, *Anomalies and Curiosities of Medicine* (New York, 1896), 317. They also quote the case studies of Fabricius Hildanus (1560-1624), Marcellus Donatus (1538-1602) and others, including Vesalius.
120. *Reproductive System*, vol. 2 (New York, 1988), 31. Here, however, the accessory urethra ends in a blind pouch and does not carry either sperm or urine.