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## DEDICATION

We dedicate this issue to the men, women, and children of Gush Katif. These individuals bravely gave up their homes and communities in the hope for a brighter future in the State of Israel. Their sacrifices will not be forgotten. May HaShem grant them the strength to rebuild their lives and may He bring a final and lasting peace speedily in our days.

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## PASUK

"כי אראה שמִיךְ מעֲשֵׂה אֲצַבְעֶתְךָ, יָרֵחַ וּכּוֹכָבִים אֲשֶׁר כּוֹנֵנְתָה...ה' אֲדַנִּינוּ, מִה אֲדִיר שִׁמְךָ בְּכָל הָאָרֶץ"

"When I behold Your heavens, the work of Your fingers, the moon and the stars that You have set in place...*HaShem*, our master, how mighty is Your name throughout the earth."

Psalms 8: 4,10

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# "THE KIDNEYS GIVE ADVICE" REVISITED

ABIGAIL ATLAS

The kidneys are essentially the filtering mechanism of the body. Their purpose seems purely physical, not at all related to the spirit or the intellect. However, when reading various references to the kidneys in the Torah, this does not seem to be the case. In many places in the Torah, the kidneys are associated with the deepest and most hidden parts of the personality. This association is generally assumed to be figurative [1]. Even if one assumes that these references to the kidneys are, in fact, figurative, it is difficult to understand why an association would be made between the kidneys and a person's moral character. It is the goal of this essay to offer suggestions for why this association would be made, taking into account both Torah and scientific sources.

## *A closer look at references to the kidneys in Torah*

In the Torah, the kidneys are credited with the performance of many different functions. Firstly, the kidneys are said to be a source of guidance and wisdom. The Psalmist credits the kidneys with providing him with moral guidance in proclaiming, "also in the nights my kidneys instruct me (Psalms 16:7)" [1]. In the book of Job, the kidneys are said to be the origin of wisdom: "...placed wisdom in the kidneys" (Job 38:36) [2]. The Midrash tells us that our forefather Avraham learned the Torah laws from his kidneys, suggesting that the kidneys provide a sort of intuition [3]. Finally, the Talmud (*Berachot 61a*) tells us "...the kidneys give advice" [2, 4].

Later on this same page, the Gemara tells us that the kidneys offer both good and bad advice. The Gemara says: "There are in man two kidneys, one gives good advice, the other one provides bad counsel" [2,4]. In addition to being credited as the provider of moral guidance, the kidneys are blamed for offering poor counsel.

It seems that because the kidneys are the seat of guidance and morality, or, as the case may be, immorality, G-d tests the kidneys to see a person's true character. Jeremiah expresses this, proclaiming, "Hashem...who examines the kidneys and heart" (Jeremiah 11:20) [2], as does the Psalmist, stating, "for the searcher of ...kidneys is the righteous G-d" (Psalms 7:9-10), and "...Hashem scrutinize my kidneys..." (Psalms 26:2) [5].

Not only do the kidneys, as described in the Torah, direct the person toward specific choices in the realm of morality, but the kidneys also feel the success of advising properly and the regret

after giving immoral advice. The kidneys rejoice after they advise well "and my kidneys will exult..." (Proverbs 23:16) [1], and feel grief after advising badly "my kidneys were sharpened" (Psalms 73:21) [1].

These are just a number of the sources regarding the nature of the Biblical view of the kidneys. A discussion of all Biblical, Talmudic, and Midrashic sources that mention the kidneys is beyond the scope of this essay. At this point, now that a more clear understanding of the Biblical view of the kidneys has been established, the question of the relationship between the modern view of the kidneys, versus the Biblical depiction of the kidneys, can be reintroduced: What is it about the kidneys that makes them associated with morality and choice? Why is it that the kidneys are given descriptions that seem better suited for the brain or the soul?

The same way the kidneys are situated in a way that they are hidden from an anatomic perspective, the secrets of a person and the deepest parts of his or her personality are hidden from everyone else except for G-d.

## *First Suggestion: Embryologic Connection of Kidneys to the Brain*

Early in embryonic development, the notochord, a cellular rod that defines the direction of the growth of the embryo and gives it rigidity, develops beneath the outer layer, the ectoderm, of the embryo. During this process, the development of the neural plate, the layer of cells above the developing notochord, is induced. As the notochord develops, the neural plate is forced to elongate horizontally. As the cells of the neural plate continue to proliferate and are further pushed out of the way by the notochord, which is getting larger and larger, the cells of the neural plate begin to stack on top of each other. The cells then begin to invaginate along the central axis. This forms what is called the neural groove, which is essentially the dip in the previously evenly spread neural plate. The portion of the neural plate on each side of the neural groove is called



the neural fold. As cells continue to proliferate and develop, the two sides of the neural fold begin to approach each other.

Typically, at the end of the third week these neural folds come together to form the neural tube, the precursor for the central nervous system. As the neural folds come together, however, the crests of both neural folds begin to protrude and form an irregular band between the developing neural tube and the ectoderm. These cells are called the neural crest. After the formation of the neural tube, the ectoderm flattens itself out and continues to develop into the epidermis. The cells of the neural crest, which are as yet displaced, have another fate. They differentiate into the spinal ganglia, the ganglia of the autonomic nervous system, the meningeal coverings of the brain and spinal cord, and several skeletal and muscular components. Important with regard to this article is the fact that these cells also differentiate into the suprarenal medulla, the medulla of the adrenal glands, which are located directly on top of the kidneys. [6]

From the embryologic perspective, the glands on top of the kidneys, the adrenal glands, originate from the same cells that eventually differentiate into the central nervous system. The fact that the adrenal glands and central nervous system both originate from the neural plate suggests that there may be a relationship between the two.

### ***Second Suggestion: Secretion of Adrenaline***

As mentioned above, the adrenal glands are located on top of the kidneys. These glands are responsible for the secretion of epinephrine (adrenaline) and norepinephrine. Under certain circumstances, the adrenal glands secrete more than the usual amount of these hormones. When a person is in a high stress situation or involved in strenuous activity, this response occurs. When the body secretes higher volumes of these hormones, certain physiologic changes are induced, preparing the body for a “fight or flight” response. Such changes include increased heart rate, dilated bronchioles to facilitate ventilation, dilation of the pupils, and the conversion of stored energy into usable energy.

It can be suggested that these biological changes, which come

from the adrenal glands, situated on top of the kidneys, are a prime example of how “the kidneys give advice” (Berachot 61a). The kidneys, by secreting increased volumes of adrenaline and other hormones, guide the body in dealing with high-pressure, intense, and difficult situations.

### ***Third Suggestion: Location of the Kidneys***

The kidneys are small and bean-shaped and buried behind and under the ribcage, beneath many other larger organs. The kidneys, and the adrenal glands above them, are surrounded by a glob of fat called the perinephric fat. The perinephric fat is further enveloped by a tough membrane called the “Gerotals Facia.” In addition to these layers which surround the kidneys, the kidneys are surrounded by lymph nodes, glands of the immune system that filter the blood. [8]

The knowledge of the kidneys during biblical times was probably mostly from korbanot, offerings [5]. The people of the time were probably very familiar with the location of the kidneys in the body, their relatively small size, and the many layers that conceal them. With this in mind, it is understandable that the kidneys could be figuratively associated with the innermost depths of a person's personality. The same way the kidneys are situated in a way that they are hidden from an anatomic perspective, the secrets of a person and the deepest parts of his or her personality are hidden from everyone else except for G-d.

### ***Conclusion***

These suggestions offer no definite conclusions as to why the Torah sources would refer to the kidneys as seats of morality or justice. However, these three suggestions offer possible connections between the Torah's understanding of the kidneys and that of modern science and medicine. Hopefully, additional research, both in the realm of Torah and in the realm of science, will shed light on a more obvious overlap between the two seemingly different understandings of the kidneys. ■

### **ACKNOWLEDGEMENTS**

Many of the references to the kidneys in the Torah deal with anatomic descriptions of the sacrificial offerings. This article is concerned primarily with the Torah's non-physical descriptions of the kidneys

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# THE JEWISH WOMAN'S BRCA SCREENING DILEMMA

ESTHER BURNS

Over the last decade, the study of genetics has exploded to become one of the most exciting fields of science. Since the ambitious Human Genome Project was launched in 1990, remarkable advancements in unlocking the code behind our genetic makeup have been made. Only five years into the massive undertaking, scientists had successfully isolated the BRCA1 and BRCA2 genes and had speculated that mutations in these genes were associated with breast and ovarian cancers [1].

Within particular populations, certain genetic mutations are found to be frequently expressed. Until recently, Ashkenazi Jews throughout history have generally not intermarried with non-Jews. Due to the founder effect, they have a particularly high propensity to carry mutations in the BRCA genes. Studies have dated the most common mutation in the BRCA genes to prior to the dispersion of the Jews around 70 AD, when Ashkenazi populations remained geographically and ethnically distinct [2].

The BRCA1 gene is comprised of 5,592 nucleotides and is responsible for encoding a protein that is made of 1,863 amino acids. The most common alteration in the BRCA1 gene, known as 185delAG, is carried by 1% of the Ashkenazi population while the 5382insC mutation is found in 0.1% of Ashkenazim. The larger BRCA2 gene is 10,485 nucleotides in length and encodes a protein of 3,495 amino acids. The most common deletion is the 6174delT mutation and has a frequency of 1.3% in the Ashkenazi Jewish population. The frequency of these mutations is exceptionally high and might be responsible for nearly 25% of early-onset breast cancer within the Ashkenazi populace.

The particularly high expressivity of the BRCA mutations in Ashkenazi Jews has been studied extensively. One renowned study estimated that the risk of breast cancer among carriers of the BRCA mutations is 33% by the age of 50 and 56% by age 70. The expected chance for ovarian cancer is 7% by age 50 and 16% by age 70 [3].

Given that the screening process for certain genes has recently yielded more accurate results and has become more mainstream, questions arise whether such testing should be widely applied. Both the benefits and drawbacks must be considered before deciding to undergo genetic testing. One of the clearest arguments for screening is that positive results could be used to detect the early onset of cancer. Despite the dangers involved in risky medical procedures, a carrier might elect to undergo prophylactic mastectomy or oophorectomy or preventative chemotherapeutic proce-

dures. At the very least, such an individual would be able to maximize her surveillance of possible disease with regular mammograms and breast self-examinations. It must be stressed that carriers of the BRCA mutation will not necessarily develop cancer because the mutated genes exhibit incomplete penetrance. Predisposition to disease is not a diagnosis [4]. With that said, women found to be negative for the BRCA mutations will be spared some degree of psychological stress. Finally, successful screening of young women might help perfect certain testing techniques for future studies.

## Are we permitted to get screened at all and if so, are we obligated to do it?

Despite the substantial case in favor of screening, there are also significant reasons not to do so. A woman who learns that she carries BRCA mutations might confront group stigmatization, which can manifest itself by discrimination from health, life, and disability insurance agencies and in the workplace. It could also lead to problems in spousal selection as well as psychological issues of guilt for potentially transmitting the mutations to her children [5]. Of course, the constant fear could create significant anxiety.

The recent dispute over genetic screening has become a topic of discussion amongst the *poskim*. Rashi's commentary on *Devarim* 18:13 reads "do not seek out the future, rather accept entirely what will come to you." Some have taken this to mean that the Torah forbids us from seeking medical treatment and rather petitions us to put our trust in God alone. This interpretation of the text, however, seems to contradict the commandment of "and heal, he shall heal" (*Shemot* 21: 9). These words have been understood by the Talmud to mean that permission is given for a physician to heal (*Bava Kamma* 85a). These inconsistent biblical injunctions raise the question of whether observant Jews should actively seek to prevent disease or be more dependent on Divine Providence. Are we permitted to get screened at all and if so, are we obligated to do it?

Rav Moshe Feinstein was asked about this difficulty in the early days of Tay-Sachs testing. He fervently responded that despite Rashi's cautionary words, failure to undergo the carrier testing would be tantamount to "closing [one's] eyes [in order not] to see

that which is possible to see” [6]. Rav Moshe seems to maintain that it is irresponsible to ignore the dangers involved in being a carrier. One is biblically obligated to take responsible measures to prevent and cure disease. He adds that since the result of such a disease is tremendously painful to the parents (in addition to the child), it is appropriate to administer the test. While the question was not posed specifically for BRCA testing, Rav Moshe’s ruling in relation to Tay-Sachs could possibly apply to the current matter of screening for the breast cancer genes.

Works of the Rambam seem to support Rav Moshe’s decision that genetic screening is an obligation. He understands the words of *Devarim* 4:9 “take heed to yourself and be especially watchful of your life,” as a commandment to preserve our health. In *Hilchot De’ot* 4:1, he declares, “...a person must distance himself from matters that destroy the body and conduct himself in accordance with matters that promote health and cure.” According to the Rambam, this is one of the 613 *mitzvot* and might therefore include medical diagnostic and or prophylactic measures. When it is generally believed that negative results can be prevented to enhance longevity, the Rambam asserts that we are biblically obligated to take part in the procedure. This presumably would apply to BRCA testing.

While Rav Moshe and the Rambam certainly have rational positions that can be marshaled to support testing for BRCA mutations and for undergoing prophylactic procedures, opposing attitudes exist as well. One of the weightiest arguments relates to the risk factors involved in mastectomies and oophorectomies. Research estimates that prophylactic mastectomy would, on average, improve survival for a thirty year old woman by 3 to 5 years and oophorectomy by 3 months to two years. After age sixty, the longevity would only be marginally increased [7]. To some *poskim*, the benefits for such surgeries would be classified as minor, thus rendering the procedure non-mandatory. It would certainly depend on the probability of gaining twelve or more months of high quality life as a result of the procedure. The risk factors involved might even make the procedure impermissible for individuals with confounding medical problems in which any general surgery would be considered risky. Based on the *halachic* concept of *chayei sha’ah* and *chayei olam*, Rav Abraham Isaac Kook writes that if a woman who does not undergo such a risky procedure would most likely enjoy at least another twelve months of life, she is not allowed to

have the surgery [8]. For individuals for whom general surgery is contraindicated, many *poskim* would agree that one does not have the right to gamble the near certainty of a twelve month survival without surgery for the small possibility of a longer lifespan with surgery [9]. Naturally, for those women who are in otherwise good health, this argument is not relevant.

Another line of reasoning against detection screening and prophylactic procedures for BRCA mutation carriers relates to the logic applied to Rav Moshe’s ruling. It was suggested earlier that BRCA screening is comparable to Tay-Sachs screening and thus may require individuals to undergo genetic testing. There are, however, differences between the two disorders that might make our comparison of the two invalid. Firstly, the gene for Tay-Sachs is an autosomal recessive trait, so individuals screened and found to be only carriers are at no risk of contracting the disease. In BRCA testing, however, positive carrier patients themselves have a higher propensity to develop breast cancer. The emotional load of fear will thus be greater in a BRCA positive patient. Another difference, as stated above, is that while the gene for Tay-Sachs demonstrates complete penetrance (i.e. every individual with both copies of the gene will develop the disease), familial breast cancer exhibits incomplete penetrance. A carrier of the mutation will not necessarily express it and might never develop cancer. Even if she does, it might be many years subsequent to her identification as a carrier. Because of this anxiety-ridden wait, many *poskim*, such as Rabbi Moshe Tendler, are strong opponents of mass screening. Cognizant of the potential emotional distress suffered by carriers, he maintains that women should not be screened for the BRCA genes [5].

With the recent wave of scientific achievements, many *halachic* issues are brought into question. The successful identification of the BRCA mutations has resulted in many challenges regarding the Ashkenazi woman’s responsibility to be cautious of her own health. The value of knowing one’s predisposition to breast cancer has been scrutinized by many *poskim* who hold differing opinions. While there is no conclusive solution, perhaps further scientific research into the effectiveness of interventions might help make the matter more definite and easier to rule. It is important for anyone who considers genetic testing to first receive counseling from a geneticist to fully understand and appreciate the implications of the testing. ■

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# THE PEOPLE OF THE BOOK: ON SEEING, SEERS, AND SIGHT

ARIELLA COHEN

From the beginning of time, Jews have been known as the people of the book. It is therefore not surprising that among Jews eyesight is one of the most important and valued senses. The Torah and the Talmud both attribute a large degree of significance to the eyes and include many discussions on various visual disorders. The importance attributed to eyes is also manifest in the Hebrew language. The etymological root of the Hebrew word for eye, *ayin*, stems from the word *ma'ayan*, a flow of water, because the early Jewish people regarded the eye as the well, the life-force, of the human body [1].

The Tanach demonstrates extreme concern for the eyes in its discussions of the various eyes caused by diseases that afflicted biblical personalities. In Genesis 29:17, the eyes of the matriarch Leah are described as *rakkot*, which can be translated as weak, soft, or, “pale from crying” [2]. Similarly, in Numbers 24:4, Balaam described himself as, “*nophel ugeluyei eiynayim*,” fallen down but with open eyes. The Talmud Sanhedrin 105a notes that, “Balaam was blind in one eye.” Samson and King Tzedkiah are two more personalities who suffered from eye related tribulations. The Philistines poked out Samson’s eyes, while Nebuchadnezzar blinded King Tzedkiah. [1].

Some biblical personalities suffered eye related disorders only in their later years. The scripture states that as Isaac advanced in years, “his eyes were so weak that he could no longer see” (Genesis 27:1). Like his father, Jacob also experienced loss of vision as he aged: “And the eyes of Israel (another name for Jacob) became heavy with age and he was unable to see” (Genesis 48:10). Similarly, the prophet, Elijah “... could not see, his eyes were dimmed with age” (Kings I 14:5). The book of Samuel I (3:2) describes Eli, the priest and judge, as follows: “Now Eli was ninety and eight years old; and his eyes were dim, that he could not see.” In the subsequent chapter (Samuel I 4:15) it says, “his eyes began to wax dim, that he could not see.” The words “began to wax dim,” seem to indicate that there was a point at which Eli’s eyesight began to slowly deteriorate. Apparently, Eli suffered from a gradual loss of vision [3]. Similarly, Kings I 14:4 states, “Ahiyya could not see, for his eyes were fixed in the blindness of old age.” Age related loss of vision is also discussed in Ecclesiastes (12:3): “Those who look through the window look no longer.” One well-known cause for loss of visual clarity associated with aging is cataracts, or the gradual blurring of the eyesight associated with cloudiness of the lenses [5].

The Torah is rife with phrases lauding the value of healthy eyes. The verse in Psalms (17:18) strongly illustrates this point. It states, “Guard me like the pupil of your eye.” A similar idea is found in Deuteronomy 27:18: “A curse be on whoever misleads a blind man.” In several of the books of Tanach, the pupil is called the “apple of the eye,” a term connoting love and care (Deuteronomy 32:10, Psalms 17:8, Proverbs 7:2, Lamentations 2:18 and Zechariah 2:12) [4]. The eye is given such great value, that in some biblical texts it is considered tantamount to an entire limb. The Torah alludes to this idea, in its discussions about the emancipation of a slave, in no less than three places (Exodus 21:23-26; Leviticus 24:20; Deuteronomy 19:21). A master is required to liberate his slave if the master incapacitated any of the slave’s limbs. The Torah includes damages resulting in the loss of an eye in this category and, thus, requires a master to set his slave free for this kind of injury [1].

## “Human eye diseases could have serious religious implications,”

The Jew’s high level of awareness and knowledge of the eye probably stemmed from the religious requirement to carefully check animals for blemishes before offering them as sacrifices to G-d. The inspection of the animal’s physique routinely included careful scrutiny of the animal’s eyes. The Talmud notes that Rav spent eighteen months with a shepherd to learn about eye blemishes that would disqualify an animal from being sacrificed.

Human eye diseases could have serious religious implications, as well. A Jewish priest (*kohen*) was banned from serving in the Temple if he was stricken with an eye blemish. Marriages could be voided if one party did not make known a particular eye ailment to his spouse prior to their marriage ceremony. These latter reasons, coupled with the necessity to thoroughly check animals designated for sacrifices, caused ancient Jews to be extremely knowledgeable about eye-disease. [4].

A comprehensive listing of the ocular diseases that would disqualify a *kohen* from serving in the temple is presented in the Talmud, in Bechorot. The Talmud mentions the following defects: *gibben*,( 43b) a person who lacked eyebrows, *chlazon* or *nachash*, (38b) a person with an extra membrane covering the cornea, *chawarvar*,( 44a) another type of clouding of the cornea, *mayim*,



(44a) may allude to a cataract with an abundance of tears and *pet-zilah*, (43b-44a) possibly strabismus, a disease causing the simultaneous visualization of many images. *Dak*, mentioned in Leviticus, may be the clouding of the cornea. This latter affliction would most probably be a cataract in today's medical terminology [4].

Cataracts are usually age-related and are caused by cloudiness of the lens. Some symptoms of cataracts include sensitivity to bright light and cloudiness of vision. Cataracts affect the lenses, disrupting their normal function of focusing the eye and of allowing it to view both distant and near objects. The lens, made up of water and proteins, is set up in a very specific manner to allow for the passage of light through the lens. As a person ages these proteins tend to coagulate, and cloudiness of the lens ensues. In most cases, cataracts initially affect only a small portion of the eye, but they gradually spread to cover more of the lens [6].

Some modern day eye diseases, such as presbyopia, may have been recognized in the Talmudic times. Rabi Simeon ben Chalafta remarked, "The eyes which used to see at a distance do not now see even near" (Leviticus Rabbah 18:1) [1]. Presbyopia is an age-related loss of close-up vision, usually affecting people over the age of forty-five. As a person ages, the eye's lens loses its flexibility, causing focusing on nearby objects to become increasingly difficult

[7]. This occurs because the eyes complete their growth in adolescence, whereas the lenses continue to grow throughout an individual's lifetime. This may cause the lens to stiffen and fail to focus effectively [8].

The Talmud describes a plethora of herbal remedies used to cure eye ailments. Compresses made of leaves, salves, and pastes were commonly used. Specifically, a paste called collyrium was used as a balm to soothe the eyes. The Talmud, in Baba Metziah 85b, details the curative power of the collyrium salve in healing Rabbi Judah the Prince [4].

Eyeglasses were not mentioned in the Talmud, but telescopes were widely used for seeing far-away objects. This device is discussed in Eruvin 43b. The Talmud also recommends the consumption of various foods such as beets, figs, wine-honey, young kale, and asparagus for the promotion of healthy eyes [4].

Although the Tanach does include a multitude of references and discussions pertaining to eye-diseases, its purpose is not to serve as a medical text from which we are to extrapolate modern day eye treatments. Rather, the Torah highlights the great significance attributed to the eyes and the Talmud provides information on how ocular disorders were diagnosed and analyzed in biblical and Talmudic times [1]. ■

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# THE CASE OF THE YOTZEI DOFEN: THEORETICAL OR ACTUAL?

MICHAL COHEN

The caesarian section, one of the most common surgical procedures annually performed in U.S. hospitals, is employed in almost a quarter of all deliveries. The procedure consists of the surgical delivery of an infant through an incision in the maternal abdominal and uterine walls [1-2]. The original surgery was performed to remove a viable fetus from its deceased mother. Although references to caesarian sections resulting in the survival of the mother appear throughout ancient European folklore and the Talmud, there was no recorded incident of a woman surviving such a procedure until the year 1500. The accuracy of this source has itself been questioned, leading to some ambiguity regarding the time of emergence of the modern caesarian section. Early cases of this procedure performed on living women were very controversial and considered to be inevitably fatal. The caesarian section continued to yield a high mortality rate into the early 20th century, when the introduction of anesthetics, antibiotics, blood transfusions, and uterine suturing began to decrease complications.

Numerous cases referring to procedures similar to the caesarian section are discussed in the Talmud. The Mishnah in *Oholot* (7:6) presents a case in which the unborn fetus endangers the life of the mother. The Mishnah rules that if the majority of the child's body has not yet emerged, the pregnancy must be terminated, "since the life of the mother has priority over the life of the child." Rambam explains in *Hilchot Rotzeach* (1:9) that in such a case, the fetus is considered to be like a *rodef* (i.e., a pursuer) and an embryotomy is performed to protect the mother. This is one of the first recorded cases requiring a fetus to be surgically removed from the mother's womb.

A similar procedure was performed to remove a viable infant from a mother who had died suddenly. Although in most cases it was assumed that the unborn child died prior to the mother, surgery was still performed because of the possibility that the fetus was still viable. The *Gemara in Arachin* (7a) required such a procedure to be performed and did not consider incising the mother's womb to be a desecration of the dead, due to the remote possibility of saving the life of the unborn fetus [3]. The *Shulchan Aruch* (*Shabbat* 330:5) required such a procedure to be performed even on *Shabbat*, stating: "one brings a knife on the *Shabbat*, even through a public domain, and one incises her womb and removes the fetus, since one might find it alive." Rav Moshe Isserles, Rama (1530-1572 CE), concerned with the uncertainty regarding the time of death of the mother, ruled that during his era this proce-

cedure was not to be performed even during the weekdays. Rama's restriction referred to a situation in which the mother was deathly ill or possibly deceased. In such a case, the performance of any procedure that would hasten the demise of the mother would most likely be prohibited. However, in a case in which the life of the mother is not threatened and there is no halachic risk, a woman would be obligated to undergo the surgery to save her fetus [4].

There are a number of sources in the Talmud that seem to discuss the case of a successful caesarian section performed on a living mother, centuries before such cases were scientifically or medically plausible. The case of a "*yotzei dofen*", which literally means one who "comes forth from the walls" (of the mother's abdomen), is discussed in a variety of different contexts. In its discussion of the definition of a *bechor* (firstborn) as *peter rechem*, the first emit-

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ted from the womb, (Exodus 13:2), the Mishnah in *Bechorot* (8:2) states: "A *yotzeh dofen* and the one born after him, neither is considered a *bechor*." Translated literally, this case refers to the extraction of a child from the maternal abdominal wall, equated with the modern procedure known as the caesarian section. This reading of the Mishnah is supported by Rambam's ruling that a male first born child delivered by caesarian section is exempt from *pidyon haben* (*Hilchot Bikurrim* 11:16) and is not considered a first born with regards to inheritance (*Hilchot Nachalot* 2:11). Furthermore, a subsequent child born naturally is also not considered a first born and is, therefore, not subjected to the laws of *pidyon haben* (*Hilchot Bikurrim* 11:16) [3].

Another case involving the *yotzei dofen* is discussed in *Niddah* (5:1). There is a dispute between the *tannah kammah* and Rabbi Shimon as to whether or not a woman who gave birth to a *yotzei*

*dofen* is considered ritually impure. According to the *tannah kammah*, such a woman does not become ritually impure. Rabbi Shimon, however, halachically equates the case of a *yotzei dofen* to a normal birth and rules that the mother is ritually impure [5]. The modern day *halachic* ruling seems to follow the *tannah kammah*, in that a woman who delivered through a caesarian section is not considered to be a *yoledet* in *halachic* terms and is only considered a *niddah* if there was vaginal bleeding (*Shulchan Aruch Yoreh Deah* 194:14). Along these lines, the Gemara in *Shabbat* (136a) ruled that in the case of a *yotzei dofen*, circumcision was performed on the ninth day, if the eighth day coincided with *Shabbat*. A circumcision may be performed on *Shabbat* only if the mother gave birth in the normal way and is *halachically* considered a *yoledet* [6].

Regarding the *yotzei dofen*, the Talmud itself does not provide a clear definition or classification of this procedure. Rashi (1040-1105 CE) described the *yotzei dofen* as a case in which the mother's abdominal wall was surgically opened with a knife to safely deliver her infant (*Chullin* 69b). Rabbeinu Gershom (960-1040 CE), explained this as a case in which a child was not born vaginally, but rather the mother was incised and the infant extracted from the side. Subsequently, the uterus healed and the mother became pregnant again, delivering the second child normally (*Bechorot* 19a) [3].

Rambam (1135-1204 CE), in his commentary on the Mishnah in *Bechorot* (8:2) refutes the possibility of a woman surviving this type of surgery, because it was medically impossible during his era. In an attempt to resolve this seeming contradiction between the text of the Talmud and the medical knowledge at his time, Rambam explained this case as referring to a woman who became pregnant with twins. The mother was incised to remove the first fetus, but the second was delivered normally, followed by maternal death. By limiting the case of a *yotzei dofen* to a case of twins, in which one was born by caesarian section and the other normally, Rambam provides an interpretation that is consistent with both the literal reading of the Talmud and the medical wisdom of his time. The problem with this interpretation of Rambam is that the Mishnah in *Niddah* (5:1) questions whether the mother is impure after delivering a *yotzei dofen*, implying that the mother survived. If the Mishnah were referring to Rambam's case in which a woman died after giving birth to twins, it would not be concerned with the status of the mother's purity [5].

The modern caesarian section has become a popular and relatively safe alternative to vaginal birth. Risks associated with this procedure include possible infection of the uterus and adjacent pelvic organs, increased bleeding, blood clots and, in rare cases, death [2]. A common cause of caesarian sections, which accounts for approximately one-third of these cases, is prolonged labor. When labor is prolonged, contractions do not sufficiently dilate the cervix and if other means are ineffective, a caesarian delivery is

required. Furthermore, an infant that exceeds ten pounds cannot be delivered vaginally because the pelvic cavity is too small for the infant to emerge. Also, if the infant can not tolerate the stress of labor and has an abnormal heart rate or an undesirable blood oxygen level, a caesarian section is usually performed. In the case of a breech presentation, when the infant's buttocks or feet are the presenting body part, a caesarian section is performed if the infant cannot be manually turned before labor [7]. Based on a reading of *Bereishit* (35: 16-17), some modern Biblical commentators suggest that the birth of Binyamin was a breech delivery, a severe complication resulting in the demise of Rachel [8-10].

Prior to the performance of the surgery, the mother is treated with regional anesthesia, such as an epidural, which allows her to remain awake during the surgery and avoids sedation of the infant. A horizontal incision is made in the lower abdominal and uterine region. This reduces the risk of rupture of the uterine wall in a subsequent vaginal birth, making it more preferred than a vertical incision. The infant is removed through these incisions and the umbilical cord is cut, followed by removal of the placenta [11].

Archeology reveals evidence of operations, such as trepanning to extract portions of the cranium, performed as early as 10,000 BCE. In addition, there is evidence from Egyptian papyri dating to the second millennium BCE of surgeries performed for abscesses and minor tumors and disorders of the eye, ear, and teeth. Bonesetting and amputations were also performed, but there was a large risk of hemorrhage, infection, and shock. Before the introduction of anesthesia and antiseptics in the 19th century, surgeries were short, sharp, and precise. Dangerous operations, such as the caesarian section, were performed only in an emergency. Due to the large risk of infection and complications, there was little evidence of a woman surviving such a procedure until the 19th century [12].

Although rare cases indicating a positive outcome for the mother appeared as early as the 16th or 17th century, a discussion of the case of a *yotzei dofen* was recorded in the Talmud well before this time. Because of this discrepancy, it is questionable whether the discussion in the Talmud was merely theoretical or if such a case really did exist before it was thought to be scientifically possible. It is clear from the Talmud that the *yotzei dofen* was some form of abnormal delivery of an infant that provided a positive outcome for both the mother and unborn child. The detailed discussions recorded in the Talmud make it difficult to assume that such a case was merely theoretical. Accepting this assumption would suggest that the Rabbis were able to predict such a case well before it was scientifically plausible. On the other hand, assuming these cases actually reflect the modern cesarean section establishes the Talmud as one of the first sources to document this type of surgery resulting in the survival of the mother. Either option suggests something extraordinary. ■

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# THE BIBLICAL POMEGRANATE—FRUIT OF FERTILITY OR FRUIT OF VERSATILITY

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In the book of *Devarim* (8:8), Moshe commands the Children of Israel to keep all the commandments, for G-d has brought them to a “land of wheat and barley, and vines, and fig trees and pomegranates; a land of olive oil and honey.” Of all the seven species with which Israel is blessed, it is the pomegranate that has relished the limelight recently. Within the past five years alone, over 100 peer-reviewed journal articles elucidating the medicinal properties of the biblical fruit have been published. It therefore becomes essential to trace how the pomegranate evolved from a mere historic fruit of fertility, to a panacea beckoning the title, “fruit of versatility.”

Mentioned countless times in *Tanach*, the pomegranate has long been extolled in Jewish tradition. When Moshe sent spies to scout the Promised Land, they returned with pomegranates, among figs and grapes, as evidence of Israel’s fertile soil [1]. Another biblical reference in the book of *Bamidbar* (20:5) occurs while the Jewish people were in the desert, the wasteland they would be wandering in for forty years. There, they complained to Moshe, “Why did you bring us up from Egypt to this evil place? This place has no seeds, or figs, or vines, or pomegranates...” Undoubtedly, the Children of Israel had a penchant for pomegranates, which would later be satisfied upon entry to the land of Israel.

The pomegranate was not only fit for eating; the whole fruit was also a yardstick of size, as noted in Mishna *Kelim* 17:1: “All the utensils of households are compared to pomegranates.” The rinds were used for dyeing fabrics [2] and after they would hollow out the pomegranate, children made use of the dry husks as instruments to measure sand [3]. Even the pomegranate branch executed an important duty. Consider the Mishna in *Pesachim* 7:1: “How do they roast the *Pesach* offering? They bring a skewer of a pomegranate branch and they spear the paschal offering with it right through from mouth to belly.” Amusingly, as the forerunner of a rotisserie spit, the pomegranate branch performed an important culinary task. All in all, everyone reaped pleasure from the fruit and its tree.

Metaphorically, the pomegranate has much significance. As one would expect, the pomegranate is commended. In the Babylonian Talmud, tractate *Berachot* 57a, Reish Lakish, a Talmudic sage, interpreted the phrase, “Thy temples are like a pomegranate” [4], to mean: “Even the empty-headed ones are full of good deeds as a pomegranate is of seeds.” Another source likens the symmetry and arrangement of the seeds in a pomegranate to

“children who sit and work at the Torah and sit in row after row” [5].

A model for artistic motifs, the pomegranate was also a ubiquitous image, dating back to the First Temple built by King Solomon. Engraved pomegranates decorated the pillars of the sanctuary [6] and coincidentally, the only relic ever recovered from the place of worship was a thimble-sized, carved ivory pomegranate, which is on display in the collection of the Jewish Museum in Jerusalem [7]. It is also noted that adornments in the shape of the pomegranate embellished the hem of Aaron the High Priest’s vestment [8]. No wonder the pomegranate has received much attention from the Jewish nation.

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In addition to the many biblical sources suggestive of the ancient symbolic nature of the pomegranate, modern Judaism and the pomegranate are still inextricably linked. Today, Jews around the world eat the fruit on *Rosh HaShanah* to herald the year’s beginning. As a representative of one of the *simanei milta*, the pomegranate is used to beseech the Almighty for good omens in the coming year. Upon consumption, the prayer, “May it be Your will, *HaShem*, that our merits will increase as the seeds of the pomegranate,” is recited. Incidentally, according to a midrash, the pomegranate contains 613 arils or seeds, the number of biblical commandments (*mitzvot*) Jews are obliged to observe. In addition, its round shape, topped by a “crown,” is reminiscent of kingship, a central *Rosh HaShanah* theme.

It is a common misconception that the pomegranate is solely a Judaic symbol. In fact, it is revered by other religions for partly different reasons. As a fruit mentioned thrice in the Koran, the pomegranate is valued by Muslims. Their bible describes paradise to be plentiful in pomegranates. In fact, Mohammad is said to have encouraged his followers to eat them as a means of purging their bodies of envy and hatred. According to Buddhist custom, the pomegranate is considered one of the three blessed fruits, along



with the citrus and the peach. A legend tells how Hariti, the demoness who devoured children, was cured of her evil habit once Buddha gave her a pomegranate to eat. The fruit is held dear by Christians, as well. Throughout the Middle Ages and the Renaissance period, the pomegranate could be found in numerous devotional statues and paintings featuring the Virgin Mary and Child. Hence, the pomegranate came to represent resurrection and life everlasting.

Equally interesting is the pomegranate's etymology. The genus name, *Punica*, is named after the Phoenicians who were active in spreading its cultivation. Its species name, *granatum*, is derived from the Latin adjective *granatus*, meaning grainy, most likely due to the fruit's multitudinous seeds. Later, the hand grenade derived its name from the fruit since the explosive nature of the weapon resembles the fruit's seed-scattering properties. It is not surprising that pomegranates and war grenades share the Hebrew word, *rimonim*. In addition, the pomegranate also gave its name to the popular ruby-red mineral garnet [9].

Secular folklore features the pomegranate, primarily as a fruit containing some mystical power. While the Babylonians once believed chewing the seeds before battle made them invincible, the ancient Egyptians were buried with pomegranates since the fruits provided hopes for rebirth. At Chinese weddings, the seeds were sugared and served to guests; when it was time to consummate the marriage, pomegranates, evidently emblematic of fertility, were thrown on the floor of the bedchamber to encourage a fruitful union [10].

Furthermore, the pomegranate has been valued as a symbol of health for centuries. Ancient Egyptians used the extract to treat all types of maladies, including dysentery. Traditional Sri Lankan plant-based remedies included brewing a medicinal tea from the buds of the pomegranate tree and imbibing it for treatment of either chronic diarrhea or bronchitis. The beautiful flowers of the tree were also used to relieve sore eyes. Shabtai Donolo, a famous Jewish physician of Italy, recommended:

"Pomegranate juice is a remedy for laryngitis; the patient should drink pomegranate wine before meals and make himself a gargle of it. And pomegranate rinds, dried and ground, should be mixed well with water and warmed and poured into the painful ear" [11].

The Greek philosopher Hippocrates used pomegranates as a plaster to reduce leg and eye inflammations. Preparations of different parts of the plant flower, fruit juice, rind, and bark have been used for a wide variety of conditions, although gastroenterological ailments predominate. Dioscorides, the first-century Greek physician, described some of them:

"All sorts of pomegranates are of a pleasant taste and good for ye stomach . . . The juice of the kernells prest out, being sod and mixed with Hony, are good for the ulcers that are in ye mouth and in ye Genitalls and in the seate, as also for the Pterygia in digitis and for the Nomae and ye excrescencies in ulcers, and for ye

paines of ye eares, and for the griefs in ye nostrills . . . The decoction of ye flowers is a collution of moist flagging gummes and of loose teeth . . . ye rinde having a binding faculty . . . but ye decoction of ye roots doth expell and kill the *Latas tineas ventris* [12]."

Although the language is ancient, it is easy to perceive that the pomegranate was pervasive as an antidote for all sorts of ailments, including "*Latas tineas ventris*," commonly known as gastrointestinal tapeworm infestations. In fact, its use is supported by several early Roman medical writers and is still listed as a treatment for tapeworms and diarrhea in a current encyclopedia of medicinal plants [13].

Clearly, no published studies at the time supported any of its medieval uses. However, as research is being done in the 21st century exposing the pomegranate's therapeutic properties, one can conclude that the legends do, in fact, have some basis. The power of the pomegranate lies in its high polyphenol content, a class of potent antioxidants [14]. Antioxidants are scavengers that neutralize free radicals, helping to prevent cell and tissue damage leading to disease [15]. Therefore, the presence of antioxidants in any food source can benefit the body. The following results, published in the nation's top journals, offer detailed support:

### **Cardiovascular Effects**

Vascular disorders, such as atherosclerosis, cause disturbed blood flow, leading to perturbed shear stress that, in turn, causes endothelial damage. Endothelial dysfunction is exacerbated by increased oxidative stress and decreased nitric oxide (NO) production [16]. Therefore, as the protective effects of NO, namely the maintenance of healthy blood flow, are lost, atherosclerosis develops. Recent findings support the notion that polyphenols inhibit vascular damage via antioxidant effects and NO restoration. Studies found that a diet supplemented with pomegranate juice retards the plaque-forming process of arterial atherogenesis, as well as increases endothelial NO synthase expression, both in vitro using human coronary artery endothelial cells and in vivo in hypercholesterolemic mice [17]. Such data indicate that administration of pomegranate juice significantly reduces the progression of atherosclerosis.

A related earlier clinical study showed that pomegranate juice consumption for 3 years by patients with carotid artery stenosis reduced common carotid intima-media thickness (IMT), blood pressure, and low density lipoprotein (LDL) oxidation. Specifically, the randomized, controlled pilot study included 19 patients within the 65-75 years-old age group. After a year, those patients who did not consume pomegranate juice showed a 9% increase in IMT, while those consuming the juice showed a decrease in IMT of up to 30% [18]. The same research team also discovered pomegranate juice to inhibit serum angiotensin converting enzyme, which results in vasodilation by inhibiting the formation of angiotensin II [19].

## **Chemotherapeutic Effects**

Pomegranate juice shows major promise to combat prostate cancer, the most common invasive cancer and the second leading cause of cancer death in American men. Researchers at the University of Wisconsin Medical School sought to investigate the antiproliferative properties of pomegranate extract in cancerous cells. In a 2005 study published in the *Proceedings of the National Academy of Sciences of the United States of America*, pomegranate extract treatment of highly aggressive human prostate cancer cells resulted in a concentration-dependant inhibition of cell growth and induction of apoptosis. In other words, the higher the concentration of pomegranate extract used, the more cells died. The research team also studied animal model systems. Specifically, mice injected with human prostate cancer cells developed malignancies and were then orally administered pomegranate extract in different doses. The dramatic results indicated that as compared with controls, mice receiving the higher concentration of pomegranate extract showed significant slowing of cancer progression and a decrease in the levels of prostate-specific antigen (PSA), a marker used to indicate the presence of prostate cancer [20].

*In vitro* studies also showed the antiproliferative activity of pomegranate extract on human breast cancer cells [21, 22]. Furthermore, pomegranate extract also inhibited growth of human leukemic cells in culture and promoted their differentiation, an important noncytotoxic therapy referring to the ability of cancer cells to revert to their normal functioning [23]. In addition, pomegranate seed oil has been found to suppress colon carcinogenesis in animal model systems [24], and also seems to serve as a safe and effective chemopreventive agent against skin cancer [25].

## **Dental Effects**

Pomegranate extract incorporated into a dental gel was topically applied to the gums of patients with denture stomatitis (thrush), a yeast infection of the mouth caused by *Candida albicans*. The aim of this Brazilian clinical trial was to assess the antifungal properties of such a gel. Upon evaluation of results, it was concluded that pomegranate extract can serve as an appropriate antifungal agent to prevent thrush [26]. A similar study in Thailand confirmed that the clinical signs of chronic periodontitis were significantly reduced in patients treated with extracts of pomegranate following scaling and root planning [27-28].

## **Dermatological Effects**

Topical applications of dried pomegranate-peel extract promote healing of excision wounds on Wistar rats. The results of the study will be extended to different types of wounds to develop a formulation suitable for commercial dermatological products [29].

## **Gastrointestinal Effects**

Pomegranate extract may act as an alternative medication for the treatment of *Escherichia coli* O157:H7 infection, the causative agent of gastrointestinal infections [30].

## **Neurological Effects**

Animal studies have shown that foods rich in polyphenols provide neonatal neuroprotection through manipulation of the maternal diet [31-36]. Results from a recent study, published on March 16, 2005 in *Pediatric Research* demonstrated that maternal dietary supplementation with pomegranate juice was neuroprotective for the neonatal mouse brain affected by hypoxic-ischemic injury, a significant cause of human infant mortality or permanent disability with an incidence estimated at 2 per 1000 live births [37-38]. Dietary supplementation with pomegranate juice resulted in markedly decreased brain tissue loss in the three brain regions assessed (i.e., the striatum, hippocampus, and cortex), with the highest pomegranate juice dose having the greatest effect. Interestingly, ellagic acid, a polyphenolic component in pomegranate juice, was detected in plasma from treated, but not control, pups. Future studies hope to elucidate whether specific polyphenols or other compounds in pomegranate juice are individually neuroprotective and, if so, by what mechanisms they exert their effects.

## **Osteoporosis**

Pomegranate juice and seed extract, containing the steroidal estrogen, estrone [39-40], inhibited ovariectomy-stimulated bone turnover in experimentally-induced menopausal syndrome in ovariectomized mice. Thus, it is conceivable that the fruit extract may be clinically effective on bone-loss prevention in menopausal women [41].

## **Urology**

Since studies reveal the pomegranate's ability to benefit the vascular system, it became of interest what effect, if any, pomegranate juice consumption has on males with arteriogenic erectile dysfunction. Not surprisingly, pomegranate juice intake increased intracavernous blood flow and improved erectile response in male rabbits and prevented erectile tissue fibrosis. Hence, pomegranate juice may be a useful prophylactic tool for preventing smooth muscle dysfunction and fibrosis in human males [42].

## Conclusion

All in all, the ancient pomegranate has proven to be a remarkable fruit. Although the above delineates just a handful of the multitude of studies published around the world, scientists are seeking to elucidate even more properties of the glorious fruit. ■

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# "OBSESSED WITH ABSCESS"

MEIRA FIREMAN

Our Sages tell us that in a circumstance of *pikuach nefesh*, when a person's life is at risk, one can desecrate all Torah laws with the exception of idolatry, murder, and adultery. Our Sages also tell us that for dental emergencies one can desecrate *Shabbos*, the Sabbath [1]. With this information in mind, the question arises: what constitutes a circumstance of *pikuach nefesh*? Moreover, exactly how much did our Sages know about dental issues and the overall health of the human body such that they allowed for the desecration of Shabbat for such emergencies?

Although dental or medical authorities may not view a situation as an emergency or life threatening, the *halachah*, Jewish law, views it differently. According to Jewish law, a sore inside the lips and mouth, including the teeth area, is considered to be a threat to life as the sore may eventually cause a person's life to be in danger [1]. In truth, many people wait months before they see a dentist to treat dental cavities or other type of oral abscesses (which are collections of pus, formed as a result of infection, that cause inflammation of the surrounding tissue [2]), and survive despite having delayed treatment. What then is the reasoning behind *halacha* considering an oral abscess an absolute danger to life?

Our Sages were aware of the connection between the oral cavity, breathing, and brain function. They knew that infections in the oral cavity could be transmitted to the brain possibly causing severe damage; including swelling which could lead to suffocation and death [3]. Although most abscesses can be treated with pharmaceuticals, this does not change their status of *pikuach nefesh* [1].

Dental decay is an infection caused by bacteria which infect the tooth on the surface and lateral sides, with the possibility of continuing to the nerve and blood vessels within the pulp, the center of circulation. Individuals with this condition respond differently, depending on body composition, genetic composition, tissue PH, overall diet, and activity of the immune system. In some cases of decay a person can wait months before it is resolved, while other forms of decay need to be dealt with immediately so as not to become life threatening [4].

A dental abscess can be active or passive. When passive, the bacteria produces metabolic acid that eats away at the tooth. The patient, in most cases, does not feel discomfort. However after time, the pressure in the abscess builds and can cause the abscess to burst, thus becoming active. The inflammation that results is the body's natural response to bacterial infection. Once the

abscess bursts, the problem becomes localized, that is, it settles in one area and the infection does not spread. The patient will begin to feel pain in the area of infection. If the problem is not treated when it is localized, it will become systemic and can easily spread throughout the body [4].

There are two phases of dental infection: chronic and acute. A chronic infection occurs when bacteria remains on one part of the body for an extended period of time and it is usually asymptomatic, that is, the patient is usually unaware of any problems. An acute infection occurs when a patient has symptoms and has an immediate reaction of pain and swelling. Pain and swelling are only the initial symptoms. If untreated, the infection can lead to fever and fatigue, followed by a change in blood pressure and even death in severe cases [4].

exactly how much did our Sages know about dental issues and the overall health of the human body such that they allowed for the desecration of Shabbat for such emergencies?

As mentioned, bacterial infections from the oral cavity may spread to different areas affecting various parts of the body. The bacteria can flow across the facial bones that separate and connect different regions of the head and neck. Bacteria can also be transmitted to exposed airways, or to fibrous and connective tissues separating and binding muscles and organs. The most common damage due to bacteria in the oral cavity will occur in the cranium or the chest. When in the chest, the infectious bacteria can cause *Ludwig's Angina*, i.e. an inflammation of the neck and the connective tissue at the base of the mouth under the tongue. Inflammation occurs quickly and prevents airflow to the trachea [5].

Though the idea that bacteria in the mouth can cause swelling and thus difficulty in breathing is quite comprehensible, the connection between bacteria in the mouth and swelling of the brain seems to be somewhat of a stretch. With a little biological knowledge, however, it makes a great deal of sense. Inside the skull there



are twenty two bones that form cavities for the nose, eyes, ears and mouth. Within the bone structure there are four sinuses, or airways lined with mucous. Bacteria can penetrate bone, and since the bones in the skull are all connected and the sinuses are lined with mucous, the collection and flow of bacteria throughout the skull and into the cranium can potentially occur [6]. Bacteria travels across the bone and reaches the brain through transport in the blood stream. It penetrates the blood vessels by entering the blood stream and traveling to different parts of the body. The main flow of blood is to the heart and the brain. When the bacteria flows with the blood to the brain it can cause brain abscesses, similar to the way bacteria can cause abscess in the mouth [7].

A second way bacteria can cause a brain abscess is through establishing foci, or sites of infection on the heart valve via the blood stream. Once formed on the heart valve, it can break off and infiltrate the brain causing a stroke. [7].

A third way bacteria from the oral cavity can cause brain abscess is through an improper draining of an infection. The veins drain blood from the sinuses to the plexus, a mesh of blood vessels in the center of the skull. Although this circuit of blood vessels generally flows to the heart, when a person is unable to fight infection, the infection can travel backwards towards the brain and cause abscesses [7].

Getting back to the original question, why does a person's status of *pikuach nefesh* remain unchanged even in a case where there is medication available? Furthermore, when a person has dental decay or a canker sore, why is it then not considered *pikuach nefesh*? It is to be expected that human beings are susceptible to infection and will occasionally have a sore or discomfort, a minor annoyance. However, a sore in the mouth that will not be cured on its own or with medication is considered to be a case where there

is danger to life. Such sores include tooth abscess, jaw swelling and gum infections.

Once a person has established that there is a case of *pikuach nefesh*, how does a dentist perform the needed procedures without violating a biblical prohibition? The *Talmud*, in tractates *Ketubos* (6b) and *Shabbos* (3a and 107a), notes that opening and draining an abscess can be considered either a rabbinic or biblical prohibition depending on the manner in which the procedure is performed. Even though medically the patient is able to wait until after the Sabbath, according to the Jewish law a person can have an abscess opened and cleaned immediately, in any manner. Filling a dental cavity (tooth decay), on the other hand is not permitted, regardless of the degree of pain the patient experiences [1].

In Talmudic literature, there are four known categories of illness: *pikuach nefesh*, danger to one's life, *choleh she'ayno bo sakanah*, an illness without a danger to one's life, *mei'chush be'alma*, a small discomfort, and *choleh she'ayno bo sakanah im tzaar gadol*, an illness without danger to one's life but in a lot of pain. A person with dental problems can fall into two of the four categories *pikuach nefesh* and *mei'chush be'alma*. A dental abscess falls under the category of *pikuach nefesh* allowing the dentist to perform any procedure that is needed to save a person's life. A cavity or dental decay is considered *mei'chush be'alma* [4]; unlike an abscess, a cavity cannot be filled on the Sabbath because minor discomfort cannot push aside biblical or rabbinical prohibitions [1].

Each case or problem in the health field is intricate. Oftentimes, medical procedures arise that seem to come in conflict with the Jewish law. When such situations occur, each detail in both the health issue and the *halacha*, Jewish law, needs to be looked at carefully to determine when and in what manner a person can be treated. ■

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# AN OUNCE OF PREVENTION WHERE NO CURE EXISTS:PREIMPLANTATION GENETIC DIAGNOSIS OF CANAVAN DISEASE AND JEWISH LAW

MICHELLE GOLDBERG

*Lisha Goldberg loves her big brother, David, and her little sister, Amy; she includes them in her games and tells them everything on her mind. Sometimes Amy laughs, but neither she nor David ever says a word.*

In the late 1960s, at ages thirteen and six, David and Amy were the world's two oldest surviving patients with Canavan disease, a genetic condition that severely affected their physical and mental development [1]. More than thirty years later, while some other children with Canavan disease have survived into their early teens due to improved medical care, there is still no cure for this lethal disease that is particularly prevalent among Ashkenazi Jews [2]. By opting for *in vitro* fertilization (IVF) and preimplantation genetic diagnosis (PGD), however, couples can ensure that only preembryos unaffected by Canavan disease are implanted in the mother's womb. PGD is sanctioned by *halacha* (Jewish law) and offers a viable option to observant Jewish couples and others who are carriers for Canavan disease.

Canavan disease is a fatal neurodegenerative disease that first becomes noticeable in infants between three and six months of age. The primary symptoms include macrocephaly (swelling of the head), hypotonia (decreased muscle tone), and head lag. The disease causes severe mental and physical developmental delays and usually leads to death in early childhood, although some patients survive several years longer [2].

The effects of Canavan disease are caused by a mutation in the ASPA gene that encodes for the enzyme, aspartoacylase [3]. Lack of aspartoacylase results in a high level of N-acetylaspartic acid (NAA), which accumulates in the brain and causes the breakdown of the myelin sheath surrounding the neurons. This demyelination leads to the severe neurological problems associated with the disease [2].

Canavan disease is an autosomal recessive genetic disorder. A carrier, a person with one normal and one defective copy of the gene, is totally healthy. However, if both members of a couple are carriers for this recessive genetic disease, there is a twenty-five percent risk of conceiving an affected child. Whereas the carrier

rate for Canavan disease is low in the general population, among Ashkenazi Jews it is approximately 1:57 [4].

Until recently, couples could only determine if their fetus was affected with Canavan disease when the pregnancy progressed far enough to perform an amniocentesis or a chorionic villus sampling (CVS). If the pre-natal diagnosis indicated that the fetus was affected by the disease, the couple would have to choose between terminating the pregnancy and watching their child eventually die of Canavan disease. However, many couples had personal or religious objections to abortion. Couples who did choose to abort a pregnancy would also have undoubtedly preferred to avoid the affected pregnancy entirely. Preventing an affected pregnancy is now possible due to a procedure called preimplantation genetic diagnosis, which can differentiate between healthy preembryos and those with Canavan disease prior to their implantation in the womb [3].

The permissibility of PGD in *halacha* (Jewish law) is particularly relevant in light of the high rate of Canavan disease in the Ashkenazi Jewish population.

To begin the process of PGD, the carrier couple must undergo *in vitro* fertilization (IVF.) Several oocytes taken from the woman's ovaries are fertilized by injection of a single sperm. These fertilized eggs are referred to as preembryos before they are implanted in the womb. To increase the likelihood of having some healthy preembryos that can be selected for implantation, a number of oocytes must be fertilized. Once the early preembryo is at the six- to ten-cell stage, one cell is removed for diagnosis [3]. The cells of the preembryo are totipotent, as they have unlimited potential to differentiate into all the different types of cells in the adult. The loss of one cell will not damage the developing preembryo or cause it

to lack any limbs or organs [5]. To diagnose the cell removed from the preembryo, two sections of the ASPA gene that may contain the Canavan mutations are amplified using polymerase chain reaction (PCR). Preembryos containing two mutated copies of the ASPA gene are discarded, and only healthy preembryos unaffected by Canavan disease are implanted into the mother's womb. This PGD procedure has already resulted in one healthy pregnancy in an Israeli couple who previously terminated two pregnancies after prenatal diagnosis of Canavan disease [3].

The permissibility of PGD in *halacha* (Jewish law) is particularly relevant in light of the high rate of Canavan disease in the Ashkenazi Jewish population. It has already been firmly established that IVF is permissible according to most rabbinic authorities. As Dr. Rosner explained, IVF cannot be considered adultery if the husband's sperm is used. Sperm collection is permissible as the aim is to fulfill the commandment of procreation and is thus not considered a violation of the prohibition of wasting seed [6]. Many rabbinic authorities also permit discarding surplus preembryos. Rabbi Breitowitz noted several reasons for the leniency regarding preembryo discard. First, the preembryo is outside of the woman's body, so there is no concern of *chavala* (harm) to the mother, which is normally one of the concerns regarding abortion. Second, as the preembryo cannot survive to term outside of the womb, it does not have the *halachic* status of a "living being" prior to implantation. Thus, there is no prohibition against *retzicha* (killing) of the preembryo. Third, the preembryo is microscopic so it may not have halachic significance at all, because *halacha* is only concerned with what is visible to the human eye. Fourth, discarding the preembryo is not considered *hashchatat zara* (wasting seed) because the sperm was originally collected for the purpose of fertilizing oocytes.

Furthermore, according to many authorities, the prohibition of *hashchatat zara* does not apply after fertilization. Fifth, instead of actively destroying the surplus preembryos frozen for storage, if they are passively allowed to thaw, then embryo discard is, at worst, failure to act, but cannot be considered *retzicha* or active homicide [7].

PGD is simply IVF with the addition of a diagnostic test and, as such, should also be allowed by *halacha* to prevent lethal genetic diseases. IVF and PGD are certainly preferable to the option of prenatal diagnosis and subsequent abortion. Rabbi Broyde posited that PGD may even be mandatory once it becomes an accepted medical procedure, because the prevention of disease is required by *halacha* just as is the treatment of disease. PGD employed for purposes other than the prevention of genetic disease, such as to determine the sex of the preembryo, is a more problematic *halachic* issue [8].

PGD for Canavan disease offers a new option for carrier couples who would otherwise risk conceiving an affected child. For couples who would not consider abortion, including many observant Jewish couples, PGD is particularly significant. One limitation of the procedure discussed, however, is that it only detects the two Canavan mutations most common among Ashkenazi Jews. This test may not be effective for carrier couples not of Ashkenazi descent because different mutations could be involved. Even when the test is effective, another limitation of this method is the cost and effort necessitated by IVF and PGD. Nevertheless, this procedure offers hope to Canavan carrier couples and may also inspire the development of similar PGD protocols for other genetic diseases with well-characterized mutations. ■

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# SALT: AN AGENT OF PRESERVATION OR DESTRUCTION?

ADEENA GOLDSTEIN

**T**able salt, sodium chloride (NaCl), is probably the most well known chemical compound. Even individuals with no exposure to the sciences are familiar with many of the physical properties of salt, including its distinctive taste, white crystalline appearance, and high solubility in water. Although salt has no caloric value (Eruvin 30a) [1], this spice has been designated as a primary food additive and preservative due to its indispensable flavor. Besides its most common use as a basic ingredient, salt has served as an essential component in various medical treatments. From the time of the Talmud, salt has been used to treat *tzafдина*, or bleeding of the gums (Yoma 84a), an undefined disease of the gallbladder (Shabbat 110a), earaches, and toothaches (Gittin 69a) [1]. Today, various types of salts continue to treat disorders, such as chronic fatigue syndrome, asthma, and iodine deficiency [2]. Interestingly, salt also has a religious dimension and is therefore incorporated into both past and present daily Jewish life.

From the time of creation, G-d promised that salt would have a pivotal role in sacrificial worship in the Temple. On the second day of creation, when G-d decreed, "Let there be a firmament in the midst of the waters and let it separate between water and water" (Genesis 1:6), both the salted and fresh lower waters were distressed and jealous that they were chosen to remain on earth with mortal beings, while the upper waters were to dwell with G-d and the angels in heaven. G-d addressed this complaint of unequal treatment with a promise that once the Temple was erected, the lower waters would too occupy a heavenly position. The salted waters would serve as an obligatory component of every sacrifice (Leviticus 2:13) and the fresh lower waters would be used in the drawing of the water ceremony, *nisuch ha'mayim*, in the Temple during the holiday of *Succot* [3].

Since the main purpose of the sacrifices was to correct past wrongdoings, all the components of the sacrifice, including the salt, symbolized purification of the soul. The *Sefer Hachinuch* (commandment 119) explains that salt adds quality to a sacrifice and therefore the act of salting demonstrates one's efforts to please G-d. Additionally, just as salt is used as a preservative that maintains freshness and prolongs the shelf-life of food, a sinner offers a sacrifice to purge his soul of sin and prolong his own life. Interestingly, in addition to the prohibition against offering an unsalted sacrifice, accompanying a sacrifice with sugar or honey is also strictly forbidden (Leviticus 2:11). Early idol worshipers prac-

ticed offering sweet foods to their idols as a mode of worship. Since the purpose of a sacrifice is to distance oneself from idol worship and to recommit to G-d, the sacrificial incorporation of any factor reminiscent of idol worship is seemingly counterproductive [4].

During present times, in the absence of a Temple in which to offer sacrifices, we engage in symbolic practices to recall the sacrificial worship. To symbolize the sacrificial worship upon the altar, Jewish law states that during meals a blessing should be recited over two loaves of bread accompanied by salt on a table top (Shulchan Aruch Orach Chaim 167:5). Bread dipped in salt is eaten to strengthen a person physically and spiritually, just as the salted *korban* (i.e., sacrifice) was intended to reinforce an individ-

all the components of the sacrifice, including the salt, symbolized purification of the soul.

ual's commitment to G-d [4]. Following the meal, immediately prior to the recitation of the blessing after meals, *birkat hamazon*, the Talmud requires that one perform a hand washing ritual termed *mayim acharonim*, to cleanse one's hands from the "salt of Sodom" present on the table. (Chulin 105b) We are taught that blessing G-d should take place with clean hands, but why would some specks of salt render one's hands unclean and unfit for prayer? The Talmud explains that this guideline was enforced for one's physical wellbeing. Salt's osmotic behavior can cause blindness if merely the saline residue from one's hands enters one's eye [5].

Salt is composed of atoms of sodium (Na) and chlorine (Cl) that reacted chemically to achieve a complete outer valence shell of electrons. Since chlorine is deficient of one electron and sodium has a single electron in its valence shell, the sodium atom donates its valence electron to chlorine, and an ionic bond is formed. Now lacking one electron, sodium acquires a positive charge, becoming the sodium cation (Na<sup>+</sup>), while simultaneously, having gained an extra electron, chlorine becomes the negatively charged chloride anion (Cl<sup>-</sup>). Typically, numerous sodium and chlorine atoms are involved in the reaction as six chloride ions bind



to each sodium ion, while six sodium ions surround each chloride ion, forming an intricate crystal lattice. Since salt is highly soluble in aqueous solutions, once dissolved in water, the sodium and chloride ions immediately separate and are solvated by water molecules [6, 7].

When the solvated sodium and chloride ions are placed into contact with living cells, osmosis takes place. Osmosis refers to the tendency of solvent molecules to migrate through a semi-permeable membrane from a less highly concentrated solute region to an area that contains a higher concentration of solute. Achievement of equal concentrations on both sides of the membrane is dependent solely on the solvent because the solute particles are too large to penetrate the membrane. Therefore, when a solution of sodium and chlorine ions is placed outside living cells, the direction of solvent travel is determined by the relative extracellular and intracellular solute concentrations. When the external solution is hypotonic to the cell, i.e., it contains more solvent than inside the cell, water flows into the cell. Under reverse circumstances, when the extracellular solution is hypertonic to the cell, water rushes out of the cell and enters the solution in an attempt to restore equilibrium [7].

The effects of osmosis are an especially important consideration when providing medical treatment. Doctors injecting intravenous solutions must be certain that the injected solution is isotonic, i.e., has a comparable solute concentration to that of the patient's cells. If a hypertonic solution is injected, the patient's cells will soon shrivel from loss of water and if a hypotonic solution is added, an excess of water will flow into the patient's cells, causing the cells to swell and burst [7]. Both cases can result in severe cellular damage, and even death.

Aware of this important and potentially dangerous behavior of salt, the Talmud forbids the recitation of *birchat hamazon* in the absence of rinsing one's hands. Mistakenly touching one's eye with salty hands can cause salt to bind to the eye. The hypotonic eye cells will then hasten to excrete their solvent in effort to achieve equal concentrations on both sides of the cellular membrane. Excessive water will be lost, causing the eye cells to shrivel, thereby damaging their sight-seeing ability. Therefore, to avoid the potential risk of blindness, the Rabbis obligate us in *mayim acharonim* (Tosefet Chulin 105a) [5].

Another biblical reference to the osmotic properties of salt appears in Judges 9:45. Gideon's son, Avimelech, was in a state of dissonance with the people of Shechem and battled against the city. After killing all the inhabitants, Avimelech destroyed the city and covered the surrounding land with a layer of salt to decimate the land, as well as the crops. Clearly Avimelech realized that salt would make the soil hypertonic in comparison to the crops, thereby causing the crops to release their water and shrivel up.

A solvent's tendency to flow to the hypertonic side of the cellular membrane can also be a source of explanation for the law obligating the Jewish nation to salt all meats. Freshly slaughtered

meats contain a high percentage of blood, and Jewish law forbids the consumption of blood in any quantity (Leviticus 7:27). While an animal's flesh is its physical component, its blood has a higher status because it is considered part of the soul that sustained the body during life. The Bible feared that human consumption of another's soul may cause the individual to feel haughty and in effort to prevent arrogance, the blood, reminiscent of the soul, is forbidden (Sefer Hachinuch—commandment 148). Ridding the meat of all blood is accomplished through heavy salting, for in reaction to the external hypertonic solution, all blood contained within the crevices of the flesh flows outward. Assuming the meat originated from a kosher animal and was slaughtered according to Jewish law, the meat is subsequently stamped with a kosher symbol.

Probably the most mysterious biblical appearance of salt involves human transformation into a saline solid. In Genesis 19:24, G-d destroyed the evil city of Sodom by raining fire and sulfur from heaven. Exhibiting mercy towards Lot and his family, G-d agreed to save them on the condition that they depart from the city immediately without peering back to view the destruction. Lot's wife did not heed the warning and upon turning back, she solidified into a pillar of salt (Genesis 19:26). How could this miraculous event be explained in a natural way? Although one usually associates salt with common table salt, sodium chloride, Lot's wife may have transformed into a much stronger salt, termed calcite. Calcite is formed in a favorable reaction between calcium cations ( $\text{Ca}^{+2}$ ) and carbonate ( $\text{CO}_3^{-2}$ ) anions, both in the aqueous state, with a free energy change of  $-11.38 \text{ kcal/mol}$ . The solubility product constant of  $[\text{Ca}^{+2}] [\text{CO}_3^{-2}]$  is  $10^{-8.34}$ , meaning that when the reaction quotient is greater than  $10^{-8.34}$ , calcite will precipitate until the system adjusts and reaches equilibrium. Both the calcium and carbonate ions are present in human tissues, but in small concentrations that do not allow for large scale precipitation. Additionally, about half of the  $\text{Ca}^{+2}$  ions present are bound to the plasma albumin and need to be released before uniting with  $\text{CO}_3^{-2}$  to form calcite. Therefore, for Lot's wife to die in such an unusual manner, something must have triggered a substantial increase in  $\text{CO}_3^{-2}$  and a decrease in the binding nature of  $\text{Ca}^{+2}$ . Since Lot's wife hardened into saline only upon looking back at the demolition of Sodom, one of the factors present in the city's mode of destruction must have triggered her death. In Genesis 19:28, Abraham viewed the ruins from many miles away, yet described the sight as a smoky furnace. Therefore, Lot and his family, who were just outside the city, must have physically encountered the explosions of scorching air and debris. When Lot's wife turned back she may have been hit with a vigorous gush of fiery wind with a high partial pressure of carbon dioxide ( $\text{CO}_2$ ). A high  $\text{CO}_2$  pressure caused the pH of the body tissues of Lot's wife to decrease drastically and this low pH was responsible for freeing the formerly bound  $\text{Ca}^{+2}$  ions. Meanwhile, the increased partial pressure of  $\text{CO}_2$  also prompted an increase in Lot's wife's bodily content of  $\text{CO}_3^{2-}$  ions seen from the equation:  $[\text{Ca}^{+2}] [\text{pCO}_2] / [\text{CO}_3^{2-}] = 10^{-4.7}$ . With an increased concentration



of both calcium and carbonate, the reaction quotient was much larger than the equilibrium constant. In an attempt to restore the equilibrium, calcite precipitated from the body of Lot's wife and she was thereby transformed into a pillar of salt [8].

Although seemingly passive and harmless, it has been proven that the spice within our salt shakers contains the potential for both destruction and maintenance [3]. Through its osmotic properties salt can destroy crops, blind one's eyes, and cause death. In the rare event that one of the stronger members of the salt family is

coupled with an explosion of heat, human transformation may even take place. Counterbalancing this negative behavior, salt's osmotic properties also provide us with kosher meat, preserved food, and medical treatments such as isotonic intravenous solutions. Previously an obligatory component of our sacrifices, salt presently serves an essential element in our daily diets. Salt has been proven to strengthen the human body and just a sprinkle of salt can enhance any bland dish. ■

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# THE MARKINGS OF A PRIEST

PEARL CHANA GOLDWASSER

Heritage has always been a major factor in Judaism. In modern times we are faced with intermarriage and assimilation that threaten the very existence of this heritage. But this is not a new problem; it is an issue that our leaders have struggled with for many generations. Within the broader concern of maintaining Jewish heritage as a whole, there is also a focus on preserving the intra-national sects found in Jewish tradition. The three sects are called *Kohen* (pl. *Kohanim*), *Levi* (pl. *Levi'im*), and *Yisrael* (pl. *Yisraelim*). The Levi division's members are those descendants from the tribe of *Levi*, the *Kohanim* (or priests) are descendants of Aharon, and those from the remaining tribes belong to the *Yisrael* division.

As stated, the *Kohanim* are descendants of Aharon, who was the older brother of the great leader, Moshe. He was appointed by G-d as the first high priest and he served as such during the time of the *Mishkan* (Tabernacle) while the Jews were wandering in the desert. Although Jewish lineage is passed down maternally, the priestly status is acquired strictly paternally. The Torah states, "G-d has chosen him of all your tribes to stand and serve with the name of G-d, he (Aharon) and his sons forever" (Deuteronomy, 18:5). Therefore, any males that descend from Aharon are considered to be *Kohanim*, or priests.

When dealing with the general problem of Jewish assimilation, there also arises a specific internal concern of maintaining the lineage of *Kohanim*. Lineage carries even more ramifications for the *Kohanim* than for a *Yisrael* or even a *Levi*. In addition to certain privileges for the *Kohanim* (i.e., *terumah*, or partaking of sacrifices), the Torah places extra prohibitions upon them to maintain their elevated spiritual status. For example, the Torah commands that a *Kohen* cannot marry a divorcee or someone who has been desecrated (Leviticus 21:13-14). The concept of pure lineage among *Kohanim* is so important that the *Sanhedrin*, the high court, sat and judged the *Kohanim* before they could serve in the *Beit HaMikdash*. If the *Sanhedrin* did not find anything that would disqualify the *Kohanim*, the *Sanhedrin* would proclaim a holiday and say, "Blessed is

G-d that no disqualification was found in the descendents of Aharon" (*Mishnah Middot* 5:4).

About two thousand years ago, there was a split in the Jewish community. Following the destruction of the second *Beit HaMikdash*, some Jews fled to Eastern Europe and became known as the *Ashkenzi* community, while the remaining Jews escaped to Spain, Portugal, and North Africa and developed the *Sephardi*

community [1]. Despite the divergence of the nation several centuries ago, and the isolation between the two communities, the striking similarities in genetic patterns in *Kohanim* of *Ashkenazi* and *Sephardic* descent suggest a common ancestor [2].

Usually it is difficult to analyze chromosomes within a population and expect to see such similarities, especially when a divergence in the population took place hundreds of years earlier. The genetic recombination and crossing over of homologous chromosomes during meiosis would make this process impossible. However, the Y chromosome differs from the 22 other chromosomes as it is passed on from father to son without recombination (except for the pseudo-autosomal regions). This uniqueness of the Y chromosome enables us to study the '*Kohen* gene'. [2]

Geneticist Dr. Michael Hammer said, "It's a beautiful example of how father-to-son transmission of two things, one genetic and one cultural, gives you the same picture" [3].

Various studies have tested for certain genetic markers, such as whether the Y chromosome contains a Y Alu Polymorphism (YAP). Among 188 participants in the study (68 *Kohanim* and 120 *Yisraelim*), 18.4% of the *Yisraelim* were YAP<sup>+</sup> in contrast to while only 1.5% of the *Kohanim* were YAP<sup>+</sup> [2]. Geneticist Dr. Michael Hammer said, "It's a beautiful example of how father-to-son transmission of two things, one genetic and one cultural, gives you the same picture" [3].

Following the initial discovery of the YAP genetic marker and its ability to distinguish *Kohanim* from *Yisraelim*, researchers collected more samples and increased the number of genetic markers [1]. This new study of a Jewish male sample led to the finding of a prototypical *Kohen* Y chromosome or a modal haplotype characterized by twelve regions on the chromosome (six markers and six microsatellites) [4]. The collection of markers was named the CMH – Cohen Modal Haplotype. Of 106 *Kohanim* tested, 97 carried all six markers [5].

After finding homogeneity in the Y chromosome of *Kohanim*

and, therefore, linking them to a single common ancestor, scientists hypothesized that given the rate of genetic mutations, it is possible to approximate when the common ancestor to all of the *Kohanim* lived [6]. It is important to perform this analysis to determine that the *Kohen* haplotype did not originate recently and that these genetic markers go back to *Aharon*, the first and original *Kohen* [1].

The method for determining when the common ancestor lived is to study the differences in microsatellites on the Y chromosome among *Kohanim* today. Microsatellites are short sequences of nucleotides that repeat many times at any given location on the chromosome. There is a lot of variation in the number of repeats between two random individuals. However, the number is preserved from father to son, with the possibility of a slight variation in the number of repeats (at most one or two) due to an error in the replication process. Over many years, the variation in the number of repeats can accumulate as it is passed down. If all *Kohanim* today had the same, or similar, number of repeats, that would indicate a recent origin of these genes. But if there is a lot of variation of repeats, then the origin of these genes must go back many generations. [1]

Assuming an average of one mutation per generation and 25 years per generation, scientists analyzed the six different

microsatellite regions and concluded that the origin of the *Kohen* haplotype chromosome dates between 84 and 130 generations ago, or 2,100 to 3,250 years ago [3]. *Aharon* lived approximately 3,200 years ago, falling within this range. Dr. Karl Skorecki, a co-author of one of the early studies, stated that, "The study suggests that a 3,000-year-old oral tradition was correct, or had a biological counterpart" [3].

Despite the huge advances in the genetic research among *Kohanim*, the CMH still does not provide a complete verification of the theory, thus impeding any *halachic* ramifications as a result of it. In addition, while these markers allow us to have a broad picture of the origin of the *Kohanim*, the markers have been found in other Jews in smaller percentages [5]. Therefore, testing of individuals does not verify or exclude anyone; it must only be viewed in the greater picture [6]. Using this discovery on a practical level could raise many issues and carries with it numerous dangers, such as extremists requiring a DNA test before allowing any Jewish man to marry a divorcee [3]. In face of these concerns, hopefully the discoveries will progress and provide more insight into our Jewish heritage, and enable us to further the synthesis between Torah, *halachah*, and science. ■

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# HAVE DOGS BEEN IN THE DOGHOUSE FOR TOO LONG? RECENT MEDICAL STUDIES MAY "SHED" NEW LIGHT ON JUDAISM'S VIEW OF PET OWNERSHIP

YONIT GROSS

**T**he Torah is filled with stories of great miracles and great people. Closer inspection reveals that, animals are prevalent in many tales as well. In fact, there are many situations where animals are used to teach important lessons.

In *parshat Chayei Sarah*, Avraham sent his servant Eliezer to find a wife for his son Yitzchak. Upon reaching the well, Eliezer met Rivka, who immediately offered him water to quench his thirst. When Rivka then offered water to his camels, the act of kindness to the animals convinced Eliezer that she was the proper wife for Yitzchak. The Torah chose this story with the camels to teach us a crucial lesson regarding kindness and sensitivity.

Another famous Biblical example involves Moshe Rabbeinu. While acting as a shepherd for his father-in-law Yitro, one of the sheep ran away from the rest of the flocks. Moshe followed the animal as it ran to a pool of water. Feeling bad that the sheep had to run away in order to relieve his thirst, Moshe carried it back to the herd. It was only after this incident in which Moshe demonstrated his immense sensitivity toward animals that G-d found him worthy to lead the Jews out of their slavery in Egypt.[1] [5]

While the Jews were enslaved in Egypt, G-d inflicted ten plagues upon the Egyptians. The last of these was the deadly plague of the first-born, when the Angel of Death swept through Egypt, killing all of the first-born sons. It is written in the Torah, "But among the Bnai Yisroel, a dog will not even sharpen its tongue at man or animal [1]." The Talmud explains that though dogs can sense the Angel of Death, they obeyed G-d and did not make a sound as the plague descended upon Egypt. In his commentary, Rashi explains that just as a guilty person will ultimately be punished, a righteous person will ultimately be rewarded. As a reward for their kindness, Jewish law states that non-kosher meat should be given to the dogs [1].

In these examples, animals are clearly mentioned to pass on important messages. However, despite all the lessons the Torah teaches us using animals, there is still a debate as to whether or not one may own a pet. In the Talmud, there is a discussion con-

cerning the appropriateness of owning a dog. Opinions volley back and forth condemning or approving dog ownership. Some opinions state that if someone were to own an "evil dog" he would be violating the Torah prohibition that states, "do not place blood in your home." Rashi explains that an "evil dog bites and barks, thereby causing pregnant women to miscarry." This implies that as long as the dog is not "evil" or harmful, and does not bark, raising a dog in your home would be allowed. Yet another opinion states that owning dogs is prohibited unless the animal serves as protection or has some economic purpose [2].

However, despite all the lessons the Torah teaches us using animals, there is still a debate as to whether or not one may own a pet.

The *Mishnah*, on the other hand, tells stories of children playing with animals. This seems to indicate that in fact there is no problem with owning pets strictly for one's own enjoyment. The overall consensus on the issue is that pet ownership is allowed as long as the animal does not cause damage [2]. This debate seems to reluctantly allow for people to own pets, provided the animals are not "evil", and according to some, do provide some benefit.

Current medical studies may add a new dimension to this discussion. In a recent article entitled, "Man's best friend is also good medicine," CNN reported on a study done at the UCLA Medical Center. In the study, three groups of patients were monitored and compared. These groups included patients who were not visited, patients who were visited by others, and patients who were visited by a dog. The patients' heart pressure, an indicator of cardiac function and stress hormone levels, was monitored. The patients were

also administered an anxiety assessment questionnaire both before and after the visit. The investigators found that when visited by a dog for only twelve minutes, a patient with heart failure showed decreased anxiety levels [3].

In an article entitled, "Six Ways Your Dog Can Save Your Heart," J. Jacobson and K. C. Madera enumerated six ways owning a dog can be beneficial to health [4]:

1. Owning a pet, such as a dog, was found to lower the pet owner's risk of developing heart disease. Pet owners had lower blood pressure, triglyceride levels, and cholesterol levels than people without pets.
2. By measuring stress levels, it was determined that the act of petting a dog causes one's blood pressure to drop. The blood pressure was lower than if visited by a friend and the decrease remained even after the dog was no longer with the patient.
3. According to the U.S. Department of Health, pet owners have a greater chance of survival after a severe heart attack than people who do not own pets. The agency reported that 28% of people who survived heart attacks were pet owners, compared to only 6% of survivors who were not pet owners.
4. A study published in the American Journal of Cardiology focused on men who were still living one year after having a severe heart attack. Men with dogs were found to be six times more likely to be alive one year after a heart attack than men

who did not have dogs. Of interest, "the presence of a pet affected survival rate even more than having a spouse or friends."

5. Research at the State University of New York at Buffalo was concerned with the effects pets have on the stress levels of stockbrokers. They found that people who kept pets in their offices experienced lower increases in blood pressure when doing stressful tasks compared to people without pets.

6. Another study showed that having a pet can increase a person's walking exercise five-fold, from about 1 to 5 hours. The added exercise was a great benefit in maintaining a healthy life style.

Animals have been anything but absent from the Torah. They helped our forefathers make important decisions, taught us life lessons, and aided the nation in their escape from Egypt. While Jewish law allows for pet ownership, it does not appear to encourage it, despite the significant role animals played in Jewish history and continue to play in the way we conduct our everyday lives. Medicine, however, has added a positive aspect to pet ownership and has magnified what it means for a dog to be "man's best friend." Perhaps with the newly discovered role that dogs play in the health of patients with heart problems, the concept of pet ownership may be evaluated in a new light. ■

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# THE MIND-BODY CONNECTION

RACHAELY LAKER

The connection between the mind and body, currently a subject of major interest in the medical field, has already been established in the Torah. Since man's creation, Hashem formed man not only into a body, "*afar min ha'adama*," but also "*vayipach b'apav nishmat chayim*," Hashem infused man with a living soul (Genesis 2:7). Rashi, on this verse, comments that Hashem created man from both the lower and upper worlds. The body is from the lower world while the soul is from the upper world. The soul is the most exalted aspect of a person because through it, the body derives its vitality and purpose.

According to *Targum Onkeles*, man attained the ability to speak when his body was infused with a soul (Genesis 2:7). Speech, which is the manifestation of the body-soul connection, enables man to attain spirituality. It is the distinguishing feature between humans and other creations. With this understanding of the body-soul connection, one can appreciate that impacting either the body or soul will affect the other's ability to function. Similarly, in Kabbalistic terms, since a parallelism exists between the physical world and the higher worlds, what is needed for the higher soul is also needed in some measure for the physical body and vice versa. The Kuzari says, for example, that just as a person obtains nourishment for his physical body by eating, nourishment for the soul is obtained through prayer [1]. Furthermore, the Rambam, a Torah giant and a doctor of medicine, compares the doctor of the physical body to the spiritual doctor; both are obligated to know the natures of their respective patients before they practice [2].

*Asher yatzar*, a blessing of gratitude to Hashem, said upon emerging from the bathroom, crystallizes the concept of the mind-body connection. This blessing acknowledges that Hashem acts wondrously, "*umafli laasot*." Commentators note that this refers to the wondrous joining of a physical entity, the body, with a spiritual entity, the soul, to form a new creation: a human being. Hashem formed man in His Divine image; He infused a piece of Himself into the body. Therefore, relieving oneself is not purely a physical action; rather it encompasses something greater; it enables the soul to properly function. This union is wondrous and amazing [3]!

Our forefather, Yitzchak, knew of the relationship between the body and soul. Before transmitting his spiritual legacies, Yitzchak requested his son to prepare food for him "in order that my soul will bless you" (Genesis 27:4). He wanted food to nourish his body so his spiritual blessing would be complete [4].

Because of the dual nature of the human being, both the body and soul need to be healthy to function properly and to fulfill one's

purpose in this world. Rambam says that man must be healthy so that he can properly serve Hashem [5]. One must attend to all aspects of himself to maintain a healthy soul in a healthy body. Without bodily nourishment, the soul cannot fulfill its function. Similarly, if the soul is not taken care of, the body also will be weakened.

The Torah, which comprises every aspect of life, is replete with references to healing both the body and the soul. A verse in Deuteronomy says, "Guard your souls very much..." (4:15). Commentators on this verse learn that it is a *mitzva* to guard one's health. It is phrased specifically with the words, "to guard the soul," rather than the body, since man's entire existence on earth is for the sake of the soul and the body is just the means to ensure its well-being. Therefore, the commandment to guard one's physical health is alluded to with the words to guard one's soul [4].

Science today is slowly approaching the Torah's understanding that the state of mind affects physical health.

In *refaenu*, the eighth blessing in the *shmoneh esrai*, said three times daily, one asks Hashem to heal both the physical body and the spiritual soul. The words in *refaenu*, "heal me G-d and I will be healed," were said by Jeremiah who cried out in spiritual distress over the news of the impending destruction of Jerusalem (17:14). Jeremiah recognized that his bodily sickness emanated from his spiritual distress. He also realized that only Hashem could heal his spiritual malady, and by treating the underlying problem, he would better be able to recover from his physical symptoms. Rambam says that it is proper to ask first for spiritual healing and only then for treatment of the physical manifestations of the spiritual ailments. Since everything in the physical world, medicine included, has a counterpart in the spiritual world, being inflicted with a physical illness is a reminder of the necessity to heal the spiritual ailment before becomes too great [6]. Because of this relationship, rabbis such as the Rambam, who were fluent in both Torah and science, were able to use Torah to correct physical maladies, which were merely manifestations of spiritual maladies. The Zohar too, as quoted by the Lubavitcher Rebbe, says that a small hole in the soul

causes a big hole in the body [7]. Because of this relationship, when praying for another's recovery, one beseeches *Hashem* to heal both body and soul (*refuat hanefesh u'rfuat haguf*).

Along similar lines, *Tzara'at*, leprosy, the punishment for speaking *l'shon hara*, ill words against another, was a physical manifestation of the spiritual malady. Miriam, who spoke against Moshe, was immediately inflicted with *tzara'at* (Exodus 12:10).

The Midrash says that at *Matan Torah* the world reached a level of spiritual perfection that was manifested in the healing of all physical afflictions. Everyone who stood at *Har Sinai* was healed of his physical disease. This again shows the symbiosis of a healthy mind and body, a fundamental idea in Jewish thought [8].

Personality and the mind, modes of expressions of the soul, are also the characteristics that make individuals unique. The Torah describes these modes of expression by applying body parts to metaphorically express spiritual, intellectual, and emotional functions. For example, "*lev shomea* (Melachim I 3:9), an "understanding heart," shows intelligence, "*hamu me'ai lo*" (Jeremiah 31:19), "my innards agitated for him," shows sympathy, and "*lev nishbar*" (Psalms 51:19), a "broken/contrite heart," connotes humility. These operations of the body are really functions of the soul. Even when certain body parts cease to function normally, the mind and personality continue to exist, and the essential person lives on. This is because, according to kabbalistic sources, the soul is eternal as it is a part of *Hashem*, Who is eternal. Each person has a piece of *Hashem* which is unique (*chelek Eloka mima'al*). As such, the morning prayer begins with, "the soul which you placed within me." The language of the prayer implies that each human being has a unique soul unlike any other [3].

Mishlei says, "A happy heart enhances one's health and a broken spirit dries the bones" (Proverbs 17:22). This verse directly links the body and mind as well. Onkeles explains that a happy heart improves one's physical health. Metzudat David says further that *simcha* enhances the body like a medicinal remedy. Radak quotes his father, Rav Yosef Kimchi, who explained that a happy heart enhances the healing process, meaning that a joyful disposition and a good spirit, in addition to medicinal treatment, are most effective in the healing process [9].

The people in exile in Ezekiel's time complained, "Our bones have dried up; our hope is lost" (Ezekiel 37:11). This statement too displays the sentiment that a broken body leads to compromised functioning of the mind. Hashem prophesized to Ezekiel that later "When I open your graves and when I raise you from your graves, my nation, I will place a spirit into you and you will live on your land and you will know that I am Hashem, I said and I fulfilled," Hashem says (Ezekiel 13-14). Metzudat David on these verses says that in contrast to the people's state of mind during their exile, when Hashem will infuse the bones with a living spirit, they will be able to live on their land with *menucha*, tranquility and peace of mind.

Flowing from the previous ideas is the notion that faith in *Hashem* and perfecting oneself spiritually are the keys to Jewish

healing. Jewish tradition, according to the Ramban, however, strongly recommends seeking doctors to heal physical maladies. This is termed *hishtadlut*, exertion of one's efforts, but one must recognize that doctors are messengers of *Hashem*, accomplishing only what *Hashem* wills; this in turn strengthens one's *bitachon* (faith) in *Hashem*, which is the ultimate goal of the illness (Leviticus 26:11).

Human will is the part of the soul that also assists in healing. The Lubavitcher Rebbe was known to instruct doctors to maintain and to transmit a happy, positive attitude because this would be infectious and beneficial to the patients' well-being [7].

Science today is slowly approaching the Torah's understanding that the state of mind affects physical health. This is in contrast to the old school of medicinal thought which deemed it appropriate to treat a patient's malady as a lone ailment irrelevant to the rest of the body. Through modern science it is possible to understand the body as an integrated human being, in which all of the systems are intertwined and affect each other, both biological systems as well as psychological and spiritual ones [10].

The therapeutic potential of the mind-body relationship has been demonstrated through experiments. There are many diseases that stem from problems in the mind and soul. When these psychological and spiritual problems are solved, the physical diseases quickly disappear. There is a known concept in Jewish thought that *Hashem*, in His compassion, always prepares the medicine before the sickness. By using the increased understanding of the human body and of the interactions between its biological systems, as well as its spiritual counterpart, these developments in science enable mankind to be like *Hashem*, by participating in the healing process in ways other than prescribing medication. These experiments demonstrate that remedies addressing the mind, such as humor, music, and prayer are effective in the healing process because of the interactive relationship between the body and the soul.

Experiments to assess the effectiveness of psychological remedies on the health of the body have measured the physiological and psychological effects of phenomena that address the mind. Experiments were designed based on the observation that since laughter elevates mood, it should cause some physiological alteration in the body that subsequently creates the overall feeling of well-being. To assess the physiological effects, Derks analyzed brain activity during laughter and showed that 4/10 of a second before laughter, an electrical brain wave cuts through the entire brain, explaining the wide variety of feelings experienced after laughter, such as relaxation, general improvement in one's mood, emotional well-being, and a decrease in anxiety, stress and fatigue, which are all modulated by several parts of the brain [11].

Berk and colleagues assessed the physiological affects of laughter as well. They elicited mirthful laughter from healthy people while monitoring neurochemical activity, to demonstrate that mirthful laughter, a psychological event, modifies physiology, which in turn results in an improvement in psychology. By analyses of

blood samples obtained before, during, and after the subjects watched a humor video, Berk found that mirthful laughter reduces the level of the stress hormone, cortisol, and increases the number of activated T lymphocytes (destroyers of invading microorganisms). This results in increased numbers and activity of natural killer cells that are important to the proper functioning of the immune system [12]. Also, following laughter, blood pressure and heart rate decrease, while the release of endorphins, the body's natural pain-killers, is indirectly stimulated.

Another study added more to this field of research. It is known that levels of immunoglobulin A (IgA), an antibody in the saliva, drop during stress, thereby increasing the possibility of illness. However, these antibody levels were found to drop much less in those who scored high on a humor scale [13]. Further, research by Dr. Kimata observed that during and after watching a Charlie Chaplin video, allergy patients experienced reduced swelling of skin welts [14].

These physiological alterations are affected by higher centers of the brain and central nervous system and suggest that laughter and a good mood will improve one's state physiologically, possibly assisting in patients' healing process. Berk is quoted as having said, "What you wear on your face is what you have inside your body" [11]. Based on Berk's own paper in the results cited above, the opposite would also seem to be true: What you wear on your face is what will determine what you have inside your body.

Findings also suggest that laughter influences psychology. One experiment, which compares the acute effects of physical exercise and of watching a humor video on mood and anxiety, shows that humor, like exercise, triggers the sympathetic nervous system and produces responses similar to those generated by physical exercise. However, while both humor and exercise had an equally positive effect on psychological distress and positive well-being, humor exerted greater anxiety-lowering effects than did exercise [15].

Another study shows that laughter enables people to cope psychologically with their stressful situations. The effect on ill patients is even more pronounced, possibly even facilitating their recovery, suggesting a physiological component. In this experiment, Westburg assessed staff and residents' levels of hope (which she based on inner determination and the ability to plan and to implement those plans) at an assisted living facility. Her findings showed that hopeful people recuperated more quickly from injury, adjusted better to chronic disease or illness, and experienced less pain, depression, and anxiety. Moreover, cancer patients reported health-enhancing effects when participating in humor groups. People with

greater senses of humor lived longer and/or improved their qualities of life. Westburg advised that staff at healthcare facilities and hospitals use humor to deal with their own on-the-job stress and to induce laughter in residents and patients, thus improving the overall climate of the facility and increasing the patients' hope and feeling of well-being. Both healthy and sick people stand to benefit immensely from exhibiting a positive attitude [16].

Music therapy is another mode of healing the spirit and thus the body. An experiment performed by Cruess and colleagues demonstrated that music therapy increased melatonin levels in Alzheimer's patients, which stimulated an improvement in their behaviors and moods [17]. In Jewish philosophy, it is known that a person gets clarity and Divine inspiration only when in an emotional state of happiness. Depression causes a person to lose touch with one's soul. The prophets played musical instruments in preparation for prophecy, to ensure that they would have a happy disposition to deserve of divine inspiration [6].

This field of connecting body and mind, called psychoneuroimmunology, is relatively new in the medical field, but so far findings suggest that it could be a valuable medicinal approach. If stress reduces the immune response and stimulates other positive physiological activities, perhaps eustress (according to Berk, a positive stress, things that elicit mirthful laughter) will cause the opposite effect. Instead of medicine, eustress could be applied [12]. Laughter therapy, humor and medical clowning, music, prayer, religion, and social support groups, all of which address the mind and soul, have potential to heal. They can possibly even be used in healthy people as a form of preventative medicine as well. Because of this great relationship between the body and mind, the improvement of well-being, state of mind, and the enhancement of the soul should be more strongly emphasized in the treatment of illnesses.

One of the greatest problems in testing the effects of these remedies addressing the mind is that they affect many biological and psychological systems (e.g., endocrine, immune and nervous systems and the many levels of the soul as well), which act simultaneously and have effects on each other. It is very difficult to isolate each component when so many systems are intertwined. However, the complexities and intricacies of the human body add to the understanding of the awesomeness and wondrousness of Hashem's creations and facilitate the belief in Hashem and in His *hashgacha*. This is the ultimate purpose of everything in this physical world; for one to come to the awareness that, "All my bones say 'who is like You, Hashem?'" (Psalms 35:10). ■

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# MODERN MEDICINE?

JENNIFER POLIN

The greatest advances in the world of science are found in modern medicine. A clinically dead person can be revived and continue to lead a healthy existence. Previously fatal illnesses can now be easily cured with sophisticated medication. Both caesarian sections to aid difficult deliveries and surgical procedures to alleviate respiratory distress and obesity are now routine procedures. In truth, these so-called “modern” advances have been available for centuries.

The rabbis in the Talmud never presented a *halachic* opinion that was not fully researched. If unaware of the science associated with a case, the rabbis would either experiment using test animals to evaluate the point or contact an expert in the field prior to making their decision. Frequently, the rabbis would discuss medical issues with physicians to ensure their understanding of the function or problem was correct before making a final ruling [1]. They were very careful to ensure that no matter of *halachic* or medical significance was decided until they were fully informed. Such rigorous considerations made them aware of the many medical advances that we today call “modern technology.”

The use of anesthetics to prevent pain during an operation was known in the time of the Talmud. In one incident, a patient was put to sleep through the ingestion of an herbal potion, so as not to feel the pain of the subsequent operation. Similarly, so as not to feel pain, people sentenced to death were given an anesthetic before their executions (*Baba Metzia* 83b).

It is said that Rabbi Eleazer underwent a lipectomy. Prior to the operation, he was given an anesthetic. His stomach was then incised to remove excess fat. In essence, he was treated medically for obesity. Today this commonly used treatment for the removal of fat from the body is known as liposuction [2]. The procedure involves a suction-device inserted hypodermically to remove fat cells from the body.

The rabbis recognized another well-known operation of today, namely the splenectomy. After discovering an animal with an atrophied spleen, it was hypothesized that a person, too, could live without a spleen. Young boys without spleens were thought to be faster runners than others, and removal of the spleen was thought to help protect against certain diseases, such as malaria, which were present in Talmudic societies. In addition, the rabbis postulated that some illnesses were caused by pathologic changes of the organs [3]. Interestingly, the earliest mention of abdominal surgery in modern medical literature was in the nineteenth century when Dr. Ephraim McDowell performed an intra-abdominal procedure.

He, however was not advanced enough to use anesthesia. Only after McDowell published this “ground breaking” procedure did other physicians dare to perform similar life saving procedures [4].

Tracheotomies, albeit performed on lambs, are also mentioned in the Talmud. Interestingly, such procedures were not mentioned for people until the fifteenth century. If the lamb’s throat was cut, the trachea could be “repaired” by inserting a tube of reed into the trachea while the lamb was healing. Shiprah and Puah may have used similar techniques to save the male babies born in Egypt. When a baby was born seemingly dead, they would take a reed and insert it into the baby’s throat and blow air into it. Thus, seemingly modern medical practices used today to save countless lives have, in truth, been around for centuries [5].

## Talmudic rabbis were cognizant of many aspects of so-called modern medicine.

Talmudists discuss the *halachic* ramifications of a caesarian section, a type of childbirth they term *yotzeh dofen*. These scholars were way ahead of their time, as even the Rambam thought it impossible for a woman who had received a caesarian section upon the birth of an initial child to deliver naturally in subsequent pregnancies. Furthermore, in that era few women even survived a caesarian section, for it was often done without the administration of antibiotics [6]. Just a few years ago a woman who gave birth by a caesarian section was forced to have subsequent children in the same manner. Only within the last few years has it been realized that the manner in which an incision is made determines whether a woman will be able to give birth to other children naturally.

Talmudic rabbis were cognizant of many aspects of so-called modern medicine. Mostly their medical knowledge stemmed from studies of animals and their ability to apply what they knew from *schita*, the slaughter of animals, to human beings. For those medical matters unfamiliar to them, they would consult with a physician. They were not opposed to performing medical experiments on animals to have a better understanding of human life and function.

Although much of modern medicine relies on new technology, some aspects have been known for many centuries. Procedures may be slightly updated, but the basis of these life saving measures



were known and practiced by the rabbis of the Talmud. They had a vast knowledge of the structure and function of the human body, for such knowledge was considered crucial for making proper *halachic* decisions concerning a person's health and well-being. ■

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# AN ORTHOPEDIC ANALYSIS OF JACOB'S INJURY

ABIGAIL RABINOWITZ

For centuries, children and adults alike have enjoyed the stories of the Bible, which relay exciting narratives involving angels, giants, and, of course, supernatural events. With the help of biblical commentaries and modern day knowledge of science, however, we are able to delve deeper and gain a greater understanding of the substance behind these fairy-tale-like stories.

*Bereishit* (chapter 32) relates the incident in which after Jacob crossed the Jordan River with his family, he returned to the other side. Rabbi Shlomoh ben Yitzchak, a medieval French commentator known as Rashi, suggests that Jacob returned to retrieve some jugs. There he was, standing at the bank of the river, when Jacob was confronted by a man, who, according to the Jewish sages, was the guardian angel of Jacob's estranged brother, Esau. This confrontation led to a fight, which is described in the following verses:

25. And Jacob was left alone and a man wrestled with him until the break of dawn.

26. When he perceived that he could not overcome him, he struck the ball of his thighbone; and the ball of Jacob's thighbone became dislocated as he wrestled with him...

32. The sun rose for him as he passed Penuel and he was limping on his hip.

33. Therefore the Children of Israel are not to eat the displaced sinew on the ball of the thighbone to this day, because he struck the ball of Jacob's thighbone on the displaced sinew. [1]

The Bible itself does not provide the readers with any details regarding the actual injury that Jacob suffered, relating only that his thigh was hurt and that he subsequently suffered from a limp. The biblical commentators provide a variety of opinions, albeit, conflicting at times, to explain the nature of Jacob's injury. More recently, Dr L.J. Hoenig, a physician, reexamined Jacob's injury in light of current medical knowledge. He provides suggestions as to the possible modes of injury and the accompanying neurological and musculoskeletal damage [2].

Biblical commentators offer several different possibilities as to how the injury itself was inflicted upon Jacob. In the language of the Bible, the angel's contact with Jacob's thigh is indicated by the word "*vayigah*," "and he touched." Very often, when commentators are unsure of the precise translation of a biblical word in a specific context, it is deciphered by looking for other instances using the same word. With this technique, Rabbi Samson Raphael Hirsch, a 19th-century commentator, notes that "*vayigah*" generally conveys

an improper touching or a violent gripping [3]. He explains that the angel gripped Jacob's hip-joint and when Jacob resisted, the muscle was torn from its ligaments, disabling the use of his leg and causing him to limp [3].

On his commentary on the Talmud tractate, Chullin (91a), Rashi suggests that the angel, standing behind Jacob, repeatedly hit him in the buttocks area until he was injured. However, Rabbi Bahya ben Asher, a 14th-century commentator, suggests the injury was inflicted by a blow close to Jacob's genitalia [4].

Rabbi Moses ben Maimon (Maimonides), a 12th-century commentator and physician, takes a very different approach. He suggests that the injury was not inflicted through physical means, but rather, Jacob prophetically envisioned this battle with the angel

The biblical commentators provide a variety of opinions, albeit, conflicting at times, to explain the nature of Jacob's injury.

[5]. Isaac Abravanel, a 15th-century commentator, maintains that although the battle did not physically occur, Jacob did sustain a real injury [6]. He postulates that Jacob may have suffered from a musculoskeletal hip injury due to a sudden, intense bodily reaction to a terrifying prophetic vision [6]. It is interesting to note that in accordance with Maimonides' supernatural approach, *Bereishit Rabbah*, a 3rd-century exegesis on the Bible, suggests that when "*the sun rose for him*," it was to heal his limp; "it was a miraculous healing"[1]. Isaac Abravanel holds that initially Jacob was unable to move and he subsequently developed a limp as he recovered [6].

Within *Bereishit Rabbah* there are several different positions as to what kind of damage Jacob actually sustained, based on their interpretations of the word "*vataykah*," "strained." According to Rabbi Berekiyah and Rabbi Eleazar, Jacob's hip was "flattened" by the angel, suggesting some sort of anatomical distortion to the area [7]. Rav Assi translates "strained" to mean "split" open "like a fish," suggesting that Jacob suffered from some sort of laceration, or open wound [7]. Rav Nahman believes that Jacob's hip was dislocated.

A possible diagnosis for Jacob's injury may be a femoral neck fracture, which is a break right below the hip joint [8]. This would explain why Jacob suffered from a limp after the incident. The first

position in Bereishit Rabbah, suggesting that Jacob's hip was "flattened," might refer to an impaction of the femoral neck.

Aside from the musculoskeletal damage inflicted by the fight, Jacob also appears to have suffered from a peripheral nerve injury. The Talmud in Chullin indicates that the site of Jacob's injury was at the "*gid hanashe*," the "sinew of the thigh bone," which, according to Jewish tradition, is the sciatic nerve. It is called the "*gid hanashe*" because it popped out of its place and moved upward (*nasha*, literally, jumped) [1].

The biblical text does not confirm for a fact that it was the sciatic nerve that was injured, but Hoenig believes that the nature of the injury, based on Rashi in Chullin, would lead to that conclusion [2]. When a peripheral nerve is damaged, there may be interference between the brain and the area that the nerve serves. This could result in an inability to move certain muscles or to feel normal sensations [9]. The sciatic nerve has control over the muscles of the back, the knee, and lower leg and provides sensation to the back of the thigh, part of the lower leg, and the sole of the foot [10]. Because peripheral nerves are so easily damaged [9], if Jacob was in fact hit from behind in the buttocks area, causing a posterior hip dislocation like Rav Nahman bar Jacob suggests, it is very likely that his sciatic nerve was injured and that he was left immobilized or limping [2]. Hoenig also suggests that Jacob may have suffered from a limited neurapraxia of the sciatic nerve, indicated when a nerve temporarily fails to conduct properly [11], because as noted by Bereishit Rabbah, Jacob later regained complete usage of his hip.

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Hoenig postulates other possible neurological injuries sustained by Jacob, such as radicular low back pain, in which the injured person has deep, steady pain in the area of his leg serviced by the injured nerve, which can be accompanied by numbness, tingling, and muscle weakness. This pain radiates from the thigh through the leg and is most commonly associated with pain radiating down the sciatic nerve, known as sciatica [12]. This pathology can be caused by a herniated, or a displaced, lumbar disc and meralgia paresthetica, numbness in the upper thigh area [13]. Meralgia paresthetica could have been evoked by the blow to Jacob's hip area, and the lumbar disc hernia would explain his temporary limp [2]. The Talmud in Chullin, however, seems to support a direct injury to the sciatic nerve, as opposed to meralgia paresthetica [2].

Hoenig also offers several possible soft tissue injuries which can be applied to explain the damage to Jacob's hip. According to Rav Hirsch's explanation, a muscle sprain or rupture would seem likely, though piriformis syndrome could explain Jacob's pain and limp [2]. Piriformis syndrome is the condition in which the piriformis muscle irritates the sciatic nerve, causing the injured person to suffer from sciatica [8].

As readers, we are constantly learning lessons and internalizing morals set out by the Bible. However it is through the biblical commentaries and their concurrence with modern science that we are able to better understand the experiences of our forefathers, allowing us to further relate those experiences to our own lives. ■

# THE GNAT THAT KILLED TITUS

RACHEL RECHTHAND

On September 13 of the year 81 C.E., Titus, the Roman Emperor responsible for the destruction of the second Temple in Jerusalem, died suddenly at the age of 42. The cause of the emperor's death is a compelling mystery, which several historians have tried to explain. Perhaps one of the most puzzling explanations for his death is recorded in the Talmud in *Gittin* 56b:

"Titus took the *Paroches* and formed it into the shape of a wine-carrier. Then he brought all the utensils of the Temple, and put them in it, [and put them on a ship, intending] to go and be praised [for his triumph] in his city.... A storm at sea threatened to drown him [Titus]. He said, 'It seems to me that the power of the G-d of the Jews is only in water. [When] Pharaoh came [against the Jews], He drowned him in the waters [of the Reed Sea]. [When] Sisera came [against the Jews], he drowned him [and his army] in the waters [of *Nachal Kishon*]. [Me] too, He threatens to drown in the waters [of the Mediterranean]. If He is [truly] powerful, let Him come up on dry land and wage war with me!' A heavenly voice emanated and said, 'O evil man, the son of an evil man, a descendant of the evil Esau: I have a puny creature in My world, and it is called a gnat. Go up on dry land and do battle with it.' When he [Titus] ascended to dry land, a gnat came and entered his nose. It picked at his brain for seven years... It was taught in a *Baraisa*: R' Pinchas ben Aruva said, 'I was among the nobles of Rome when he [Titus] died. They split open his head and they found [a gnat] inside it [that was] like a swallow weighing two *selas*.' A *Tanna* taught in a *Baraisa*: '[The gnat was] like a one-year-old pigeon weighing two *litras*.' Abaye said: 'We hold [a tradition that] its mouth was of copper and its nails were of iron.'"

What caused the death of Titus? While they differ concerning the details of his death, most secular historians agree that Titus died of some illness. Their opinions do not necessarily contradict the opinion of the Talmud. The Maharal, drawing upon the themes of the Talmudic explanation, suggests that Titus died of brain cancer. The power of cellular replication took over a few of the cells of Titus' brain, possibly through a carcinogen that existed outside of his body. Thus, G-d chose the smallest of His agents to undo the terribly conceited Titus [1]. While ancient Roman historians attribute the death of Titus to a high fever, D. Gans, a Jewish historian from the 16th century, personally believed that these historians intentionally hid the true cause of Titus' death, so as not to make his death appear to be retribution by G-d for what he did to the Jews.

A similar Turkish legend discusses gnats in the nose of Nimrod. The reappearance of this story, though pertaining to a different individual, suggests that perhaps we are dealing with a "pan-Semitic legend" in which each Semitic nation created a similar story concerning a villain specific to their nation [2]. Based on the text of the Talmud, S.J. Bastomsky noted that the word used for gnat in the Talmud, *yattush*, could also be translated as mosquito, which might suggest that Titus died of malignant malaria. Mosquitoes were known to be spreaders of malaria in the ancient Mediterranean world [3].

These historians intentionally hid the true cause of Titus' death, so as not to make his death appear to be retribution by G-d for what he did to the Jews.

The postmortem examination of Titus's brain, revealed to the Romans a cellular mass and/or insect of some sort. Scientific data would suggest that he suffered from an intracerebral tumor, similar to the opinion expressed by the Maharal. The Roman nobles specifically reported finding a mass resembling a sparrow. The growth in Titus's brain was probably a spherical mass with small emanations, a shape that could easily be described as resembling a small bird. The description of the beak and nails of the bird, which were claimed to be made of metal, suggests that the tumor had a few outgrowing segments of a very hard consistency. Since the "gnat" entered through Titus' ear, the tumor must have been located near the base of the brain. The cellular mass, recorded by historians with two conflicting measures, was either two *selas*, the equivalent of 28 grams, or two *litras*, the equivalent of 640 grams. A possible explanation for these contradicting figures is as follows:

Most likely the brain section of Titus was exposed in the course of the embalming procedure, a burial technique used in Egypt. Egyptians would remove the brain through the nose by using a utensil of metallic hooks to remove one piece of the brain and oil for cleaning out the last part of the brain. At the time, this procedure was performed by funeral workers, not by doctors. The funeral workers probably had removed a large part of the brain, when a

small tumor then appeared. Unable to tell whether the tumor was part of the brain or a formation of its own, they chose to weigh it twice, first weighing the tumor alone (which weighed 28 grams) and then weighing the tumor and large part of the brain that was already removed, (for a weight of 640 grams). If we assume that Titus' entire brain weighed about 1,300 grams, the tumor appeared after the frontal portion of the brain was removed. The imaginary line dividing the frontal lobe from the occipital lobe of the brain goes through the cerebellopontine angle, an anatomic landmark where the cerebellum and pons connect and a common site for tumors of the brain stem. The description of the weights of the sections of the brain suggests that there was a tumor weighing 28 grams, located in the cerebellopontine angle. The description of a gnat hammering against the brain can be identified as tinnitus, a ringing or buzzing in the ear occurring without an external stimulus. Tinnitus is a common symptom of tumors in the cerebellopontine angle, since the vestibulochochlear nerve (CN VIII) is located on the pons[4]. Some Greek and Latin sources claim that Titus died of a raging fever, which he tried to bring down by bathing in snow. This remedy probably just made the situation worse [3]. If fever was the cause of his death, then perhaps the tumor was only responsible for the tinnitus [4].

Roman accounts of the events leading up to the death of Titus fit in with the theory that Titus died of a brain tumor. Suetonius and Dio, in their description of the events preceding Titus' death, speak of what could be classified as depression. Suetonius accounts, "After the Games were finished, at the end of which he had wept copiously in the presence of the people, he made for the Sabine territory in a somewhat gloomy mood..."

In the latter part of the summer of 80 C.E. Titus attended this festival, and there are no records of what occurred in the last year of his life. Dio belittles Titus' achievements from this point on, and notes, "...[H]e accomplished nothing further of importance." So it seems that right before his death, Titus suffered from a period of depression, in which he accomplished little, and then died.

There are very few modern cases of individuals suffering from brain tumors who managed to carry on with their lives at a routine level. One case very similar to Titus' has been found, namely the story of E. Liddell, a great Scottish athlete who competed in the Olympic Games in Paris in 1924. Near the end of the year 1943, it was noted that Liddell had begun walking and talking at a significantly slower pace. In January of 1945, he came down with what was thought to be influenza and acute sinusitis. He suffered from excruciating headaches, a partial stroke, and acute depression. By the end of February he claimed to be feeling much better; however, abruptly after his claim, he began to experience paroxysms of pain. He began convulsing and vomiting, and shortly thereafter fell into a coma and died. When an autopsy was performed a tumor was discovered on the left side of his brain. The tumor had caused hemorrhaging of the brain, and ultimately death. Just like Titus, Liddell experienced headaches, depression, and a significant "slowing down" prior to his death. He, however, could still function at a routine level and felt much better just prior to his death. Titus felt better before he died as well, perhaps explaining why he did not make arrangements for a successor to the throne.

With the above evidence in mind, the unusual passage from the Talmud describing the death of Titus takes on much more meaning [3]. ■

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# THE DICHOTOMY OF TORAH

PESIA SOLOVEICHIK

Many science students have their favorite scientific explanation, be it the mechanism of ATP synthase or the simple fact that hydrogen bonds cause ice to be less dense than water. One striking realization remains constant throughout the study of science: this world makes sense. This realization becomes increasingly complex as one's understanding of science develops. Judaism incorporates several features of scientific thinking, but a notable difference between the two exists. Although Judaism, like science, establishes order in life, Judaism also integrates into the human religious experience the notion that sometimes the world does not necessarily "make sense" in the way that the scientist would like.

In *Halakhic Man*, Rabbi Joseph B. Soloveitchik, "the Rav," describes cognitive man as part of *halakhic man's* personality. Cognitive man seeks to understand the world. The Rav compares cognitive man to a mathematician or scientist; cognitive man creates norms that govern the functioning of the cosmos. He generates laws and then approaches every aspect of the world with this *a priori* view. He matches every breath, each movement, with a different equation; aspects of life do not always match his set equations perfectly, but this does not bother cognitive man. The *a priori* structure is his truth, and viewing life through his scientific lens, he finds parallels between the truth and reality. Similarly, *halakhic man* also seeks to understand and establish norms. He approaches life with a different set of laws: the Torah. *Halakhic man* examines the world with this *halakhic* lens. Sunrise and sunset remind him of *z'man kriyat shema* and *tzitzit*; the world is merely a reflection of his ideal structure of norms. *Halakhah* strips emotions from concepts and objects in life and equalizes them all, for they are all significant components of the same *halakhic* corpus. Whenever Rav Chaim Brisker became frightened of death, he busied himself with the *halakhot* of death, and his fear disappeared [1]. *Halakhah* quantifies the world and conquers it.

I have personally noted this parallel between science and *halakhah*, both in their search for norms and in their all-encompassing outlooks. Both science and *halakhah* involve similar "scientific" processes in their search for truth, be they the hypotheses and experiments of science or the intense back and forth dialectic of *halakhah*. Also, they are both indeed sweeping views of life. Science has influenced my view of everyday occurrences; daily natural phenomena unfold themselves into a magnificent web of facts and equations. Similarly, a friend of mine invented a "*halakhic man game*," which entails looking at everyday objects and naming a

*halakhah* associated with that object. Such an example is perhaps a bit trivial, but it expresses the depth of the internalization of both *halakhah* and science, such that both influence outlooks on all facets of life. Reading the Rav's *Halakhic Man* and seeing this parallel in print granted me deep satisfaction, because it awarded me an understanding of myself and made me realize that perhaps my love for both *halakhah* and science stem from similar modes of thinking.

But is Torah or *halakhah* truly like science? While scientific thinking and its quest for truth are integral parts of Torah, Torah also includes an aspect somewhat alien to the field of science. Life involves contradiction, dichotomies, things that "don't make sense," and this mystery is inherently magnificent and beautiful.

While scientific thinking and its quest for truth are integral parts of Torah, Torah also includes an aspect somewhat alien to the field of science.

Torah is a microcosm of life; "*haya HaKodosh Baruch Hu mabit baTorah u'borei et olamo*"—G-d looked in the Torah and created His world (B'reishit Rabbah 1:1). Thus, Torah incorporates dichotomies as an essential aspect of Judaism. There are ideas in Judaism that man, try as he might, cannot grasp. These dichotomies penetrate all facets of Judaism.

Dichotomies are an integral component of the *halakhic* system. Given any issue, myriads of opinions exist, and we operate with the notion that all opinions are correct—after all, *shivim panim laTorah*—there are seventy faces to the Torah. The idea that all opinions are correct, even if one opinion permits eating a certain *sh'chita* while another one forbids it, does not seem rational. The concept, nonetheless, is fundamental to Judaism. In fact, the Rav writes that dualism exists within *halakhic man* himself. While cognitive man is an important part of *halakhic man*, *halakhic man* also comprises some aspects of homo religiosus, who, the Rav writes, "gazes at that which is obscure without the intent of explaining it and inquires into that which is concealed without the intent of receiving the reward of clear understanding" [1]. If *halakhah*, the

aspect of Judaism most associated with scientific thinking, differs from science in its integration of paradoxes, then all other aspects of Judaism are quite likely interlaced with dichotomies as well.

Indeed, paradoxes and humanly incomprehensible concepts permeate Judaism's entire approach to religion and life. *David HaMelech* writes, "*Ma enosh ki tizkirenu*"—what is man that You should remember him—but he immediately continues with the thought, "*vatichasreihu m'at meielokim*"—You have made him only slightly inferior to G-d (*Tehillim* 8:5-6). Similarly, Rambam declares knowledge of G-d to be the first commandment, but he simultaneously declares the impossibility of any human knowing G-d [1]. Rav Aharon Lichtenstein likewise maintains that we, as humans, do not understand all, and in fact, "faith cannot be contingent upon having all the answers." He writes that as a teenager, he was disturbed by the concepts of destroying *Amalek* and annihilating an *ir hanidachat*. He then remembered that Rav Chaim Brisker would wake in middle of the night and check his doorstep to ensure no one had left an infant there. Rav Lichtenstein concluded that if these *halakhot* did not deter Rav Chaim, clearly a paragon of compassion, from his religious commitment, then "the source of [Rav Lichtenstein's] anxiety did not lie in [his] greater sensitivity but in [his] weaker faith." Rav Lichtenstein writes that he has searched for answers to numerous questions, and he has found many; some questions, however, remain unanswered. Regarding faith, he writes, "Intellectual assent is normative and essential; but, at the personal level, it is generally not the key. In the final analysis, the primary human source of faith is faith itself" [2].

I would like to share one personal example demonstrating another level of dichotomy that Judaism demands. My grandfather died on *chol hamoed Sukkot* when I was studying in Israel. Two of my uncles live in Israel, and my father and his three other siblings flew to Israel for the funeral, which took place on *Hoshanah Rabbah*. I thus spent the last two days of *Yom Tov* in Ramat Beit Shemesh at my uncle's house with my father and all his siblings. My father and three "*chutz la'aretz*" siblings celebrated *Yom Tov Sheni*, while my two Israeli uncles did not. Thus, my two uncles began sitting *shiva* while my father and his other siblings celebrated *Simchat Torah*. My grandparents owned the apartment down the hall from my uncle's apartment. As I walked from one apartment to the other on this eighth/non day of *Sukkot*, I walked from dancing

in the *chutz la'aretz minyan* in my uncle's apartment, to a *shiva* house in my grandparents' apartment. While my uncles sat *shiva*, my father, who was not allowed to sit *shiva* but was allowed to accept *tanchumim*, sat in a normal chair and listened to the stories visitors told of my grandfather. I remember thinking, in my numb state—this is the dichotomy produced by the Torah.

This story demonstrates the emotional dualism that Torah demands. *Kohelet* declares, For everything there is a time, and there is a time for every desire under the heavens... there is a time to cry and a time to laugh, a time for mourning and a time for dancing" (*Kohelet* 3:1,4). Sometimes, however, there is a time both to mourn and dance. Indeed, we say to Jerusalem, "May my tongue stick to the top of my mouth if I do not remember you, if I do not place Jerusalem at the top of my greatest joy" (*Tehillim* 137:6). Even at a time of utmost happiness, we must still mourn Jerusalem.

Judaism thus clearly embraces dichotomy as an integral component of religion. Some may posit that science is no stranger to contradictions or dichotomies; after all, the concept that light is both a wave and a particle is a contradiction. Two different mechanisms can at times both be accepted as true, such as the concerted and sequential models for cooperativity in enzymes. The general approach of science, however, involves quantifying phenomena in a humanly understandable way. If some dichotomies exist, they do not penetrate the scientific system the way paradoxes affect all facets of Judaism. Also, paradoxes in science are accepted but not celebrated as mysteries of life.

My grandfather, Rabbi Ahron Soloveichik, cites his mother's explanation of the two approaches to nature. The scientist studies the structure of each leaf, whereas the poet surveys the entire forest and declares, "How vast are Your creations, O G-d" (*Psalms* 104:24). My grandfather compares *halakhah* to science and *aggadah* to poetry; *halakhah* is the logic of the mind, and *aggadah* is the logic of the heart. He writes that the publication of his *hashkafah shiurim* precedes the publication of his *chidushei halakhah*, because "the logic of the heart precedes the logic of the mind" [3]. Although *hashkafah* is most associated with logic of the heart, all aspects of Judaism incorporate "heart logic" to some degree. I think, however, that my grandfather's statement contains much truth regarding Judaism in general. In many cases, as opposed to science, logic of the heart precedes logic of the mind. ■

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# NATURE'S GUIDE TO SELF-IMPROVEMENT

SARAH WEINERMAN

It is popular to study the relationship between science and Torah in reference to modern *halachic* issues, such as stem cell research and the definition of death. However, another less common but fascinating area of study is the contribution of science to *mussar*, or moral development. Just as science can teach man about his physical, biological existence, so too can it teach him about his spiritual life. Man is a part of nature and is intrinsically linked to his surrounding environment. After all, the first man was called “Adam” since he came from the earth, “*adama*.” Therefore, the Torah encourages man to analyze and learn from the world around him. Through studying biology, including both zoology and botany, one can glean positive personality traits, and by analyzing general principles of chemistry and physics, one can gather valuable insights into proper character development.

A verse in Job indicates that we can learn important lessons from the animals that G-d created, stating “Who teaches us through the animals of the land and makes us wise through the birds of the sky” (35:11). In *Eruvin* 100b, Rav Yochanan expands upon this idea, saying that if the Torah had not been given, we would have learned modesty from the cat, the prohibition to commit adultery from the dove, and the forbiddance to steal from the ant. Rashi elaborates, explaining that cats cover up their excrement and do not defecate in front of people. Doves have relations with only one partner, and ants do not steal food from each other. Additionally, the ant can teach us to work hard and think ahead, as Proverbs 6:6-8 proclaims quite forcefully, “Go to the ant, you lazy person, see its ways and become wise. Though it has no officer, guard, or ruler, it prepares its bread in the summer and stores its food in the harvest.”

In addition to learning from the admirable behavior of animals, we can also gain valuable instruction from plants, as conveyed in *Berachot* 56b. It is taught in a *bereita*, “Pumpkins are shown in a dream only to those who fear heaven with all their might.” Rav Nissim Gaon provides the rationale behind this comparison. Pumpkins, he explains, are one of the largest fruits, yet they remain low to the ground throughout their growing process. Similarly, regardless of the social, economic, or spiritual heights he achieves, a G-d fearing person must always remain humble.

Beyond showing us the specific character traits that we can learn from these individual plants and animals, these Torah verses and *Gemara* segments teach us a more fundamental concept—that we can and should learn from the world around us. This Torah

precedent can be expanded to the analysis of more general scientific laws. Since man is a part of the physical world, the study of nature's organisms, rules, and systems can shed light on the principles that govern his personal life. However, man is different from other natural creatures in that he has free will. Therefore, man can override his instincts and rise above nature, fulfilling G-d's command to Adam to “fill the land and subdue it” (Genesis 1:28). By analyzing science, man can learn about the natural order of the world and unearth moral lessons from nature.

By analyzing science, man can learn about the natural order of the world and unearth moral lessons from nature.

In order to understand this concept, it is beneficial to focus on a specific moral issue: the ability to improve our characters. Caterpillars, who transform from creeping pupa into beautiful butterflies, teach us that we have the ability to change. But how do we bring about change in ourselves? A careful study of thermodynamics gives us insight into answering this question. Thermodynamics refers to the study of heat or energy flow within chemical systems. Its two main laws are crucial to guiding chemical reactions, as well as to helping us achieve our true potential in life.

The first law of thermodynamics states that energy cannot be created nor destroyed. Energy can change form, but the total amount of energy in the universe must remain constant. For example, potential energy can be converted into kinetic energy and chemical energy can become mechanical energy, but new energy cannot be created. On the more metaphysical level, this teaches us that in order to achieve what we desire, we need to work with what we have. For instance, one cannot create happiness out of nothing, as conveyed in the saying of Ben Zoma, “Who is rich? He who is happy with his lot” (Ethics of our Fathers 4:1). However, with the right formula, the right outlook on life, one can change one's situation into one of happiness.

The second law of thermodynamics states that the total amount of entropy, or disorder, of the universe is always increasing; the nat-

ural order of the world is for things to become more disorderly. A reaction that increases the entropy of the universe happens spontaneously, without an input of energy. An input of energy is required to drive a reaction that increases the orderliness of the universe.

As man is a part of nature, this crucial natural law applies to him, although in a slightly different way. A famous metaphor compares one's spiritual state to riding a down escalator—if you're not walking up, you're going down. Just like it is natural for the world to decrease in orderliness, it is normal for one to decline in spirituality. In order to achieve spiritual growth, one must exert energy—mental, physical, and emotional—to make this non-spontaneous “reaction” of spiritual attainment occur.

Determining the way to bring about a positive change in one's life is only half the battle—actually doing it is the hardest part. It is a fact of life that people resist change, and so too, it is a fact of physics. The law of inertia states that an object at rest will remain at rest unless acted upon by an outside force. A ball that has been pushed would continue to roll forever, if not for the force of friction, which acts upon it from the opposite direction, slowing it down and causing it to eventually stop.

Chemistry gives us insight into this typical human behavior, as well. Although some reactions go to completion, in which all of the reactants are converted into products, most reactions reach a point at which the reactants are converted into products and the products are converted back into reactants at an equal rate. This point is known as equilibrium. At equilibrium, there is a consistent amount of reactants and products at any given time. No change is taking place. In order to cause a reaction to occur, some outside factor must disrupt the equilibrium.

So too in our lives we are quite content living as we always have, without change. Sometimes it takes an outside event to wake us up from our monotony and realize that something must be changed, that we must do something new, something better. Unfortunately, this external factor is often the death of a loved one or a communal tragedy. As human beings, we have the ability to overcome this rule of nature and use a desire from within to create change and

improvement in our lives.

Once we realize that something needs to be changed and we are ready to make the next move, how do we go about changing? An analysis of scientific phenomena indicates that the way to achieve the most gain is through a step process. For example, the process of creating a supersaturated liquid shows us that moving slowly and steadily achieves the most gain. Every solute dissolved in a liquid solvent has a characteristic solubility—the amount of the solute that can dissolve in the solvent. At this point, the solvent is holding the maximum amount of solute that it can hold; excess solute will not dissolve, but will remain as separate particles. Solubility is temperature dependent, with solubility either increasing or decreasing with corresponding changes in temperature, depending on the specific solutes and solvents involved. For a system in which solubility increases with temperature, a large amount of solute will dissolve in the heated up solvent, but when it is cooled down, some of the solute will come out of the solution. However, one can “trick” the system, so to speak, by slowly cooling down the heated up solvent. As it cools down, the solvent retains more solute than predicted by its solubility and is called a supersaturated liquid. By continuing to slowly cool the supersaturated liquid, one can create beautiful crystals.

Just like the key to creating a supersaturated liquid is to cool the heated up solution slowly, the way to actualize one's maximum potential is to make steady changes in one's life. If one tries to make a sudden drastic change, it will most likely prove to be unsuccessful in the long run. Only when small changes are patiently made one step at a time do they become a lasting part of one's character.

Science has so much to teach us, and the above are but a few examples of lessons that we can learn from nature. In addition to helping us advance in the fields of medicine and technology, science can help us achieve spiritual heights. Nature contains more than meets the eye, and the Torah teaches us to pay close attention to the world around us and let the lessons we observe penetrate our hearts, affect our behaviors, and make us better people. ■

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# THE SOURCE OF *TECHEILET*: THE IDENTITY OF THE *CHILAZON*

ELISHEVA WEINSTEIN

Since the destruction of the Beis Hamikdash and the beginning of *galus*, intricate details about many mitzvot have been lost from *Klal Yisrael*. The placement of a string of blue *techeilet* on the *tzitzit* garment is one of these mitzvot. There are several different estimates of the date at which this *mitzvah* disappeared. Rav Isaac Halevi Herzog, the Chief Rabbi of Israel from 1936-1959, suggests that the last *techeilet* factories were destroyed during the Muslim conquest of Israel in 638 C.E. [1]. Recently, much effort has been directed at restoring this lost part of Jewish observance by identifying the *chilazon*, the species that produces the *techeilet* dye.

In 1887, Rav Gershon Henoch Leiner, the *Radziner Rebbe*, attempted to rediscover the *chilazon*. Based on passages from the Talmud and from his time spent studying aquatic species at the famous aquarium of Naples, he proposed that the *chilazon* was *Sepia officinalis*, the common cuttlefish. Convinced that he found the long lost *chilazon*, he opened a *techeilet* factory. To this day, the *Radziner* and *Breslov Chassidim* wear *tzitzit* dyed with fluid extracted from *S. officinalis*. However, more recently, the Rebbe's conclusion that *S. officinalis* is the *chilazon* has been overwhelmingly refuted by Rav Herzog and others. It has been proven that the chemicals added in Rav Leiner's processing of the dye were the actual cause of the final blue color, not the *Sepia* dye itself. Those same chemicals when added to any organic compound would induce a blue coloration; the *S. officinalis*, therefore, could not be the *chilazon* [2].

Rav Herzog wrote much of his doctoral dissertation on *techeilet*. He believed that the *chilazon* was a member of the species, *Janthina*. Ultimately, this was rejected, since the dye from *Janthina* turned brown and was not permanent. Rav Herzog then suggested that a snail, *Murex trunculus*, was the biblical *chilazon*. This position is held by many today, including the famous *P'Til Techeilet* Association [3].

The debate about the identity of the *chilazon* is based upon whether the proposed species fits the specifications of the Talmud. In *Menachos* (44a) the crucial statement regarding the *chilazon* is found: "The color of its body is like the sea, its form is like a fish, it comes up once in 70 years, its 'blood' is used for *techeilet*, therefore it is expensive." Elsewhere the word "*potzea*" is used to describe the mechanics of extracting the dye (*Shabbos* 75a). "*Potzea*" means to crush or crack open, implying that the *chilazon* has a hard shell. Additionally, the dye of the *chilazon* is of better

quality if extracted while the organism is alive (*Shabbos* 75a) [3]. The *techeilet* dye is a steadfast dye that does not fade with time or with washing (*Menachos* 42b) [4]. Finally, the *chilazon* is found off the coast of Israel in the biblical portion of *Zevulun*, which today corresponds to northern Israel and southern Lebanon (*Shabbos* 27a) [2].

*M. trunculus* seems to fit these criteria, as it is found off the northern coast of Israel and has a hard shell. However, Rav Herzog was bothered by a few details. First, he felt that *M. trunculus* did not resemble the color of the sea, because its shell is brown with white bands, rather than the blue color of the sea. Dr. Baruch Sterman, co-founder of the *P'Til Techeilet* Association, points out

The debate about the identity of the *chilazon* is based upon whether the proposed species fits the specifications of the Talmud.

that Rav Herzog observed the snail shell after it was cleaned. In its natural habitat, shells of these snails are covered by a sea-fouling that usually takes on a blue-green coloring. Also, in Talmudic Hebrew the phrase "*domeh layam*," can mean "it is similar to the sea bed." *M. trunculus* certainly resembles the surrounding seascape [5].

Second, *M. trunculus* does not have a seventy year cycle, or even a seven year cycle, as the *Midrash* suggests. Dr. Sterman notes that Maimonides made no mention of this criterion in his discussion of the *chilazon*, which led many later commentators to conclude that this was not an essential criterion for identifying the *chilazon* [5].

Third, Rav Herzog observed that the *Murex* dye was not steadfast. However, recent research has shown that although the dye does not bind well to cotton, it does bind extremely well to wool [5].

Rav Herzog's final objection to the *M. trunculus* as the *chilazon* was that the dye obtained from the snail was a purple-blue color, not the pure blue color of *techeilet*. To resolve this, it is important to understand the dyeing process. The dye is extracted as a clear

liquid from the hypobranchial gland of the snail [6]. On exposure to oxygen, the enzyme purpurase, which is present in the gland and in the extracted fluid, turns the liquid into a yellow-green color, which subsequently progresses to a purple-blue color. This purpurase-mediated reaction yields a mixture of indigotin (indigo) and dibromoindigotin [5]. For the dye to bind to the wool, the dye must be brought into a chemically reduced state, which in Talmudic times was carried out by a fermentation process [7]. When exposed to ultraviolet light while in the reduced state, the bromine bonds of dibromoindigotin break, transforming it into indigotin, and thereby changing the purple-blue color to a pure blue [5].

Two important conclusions arise from the discussion of the dyeing process. First, the dye at the end of the process has a pure blue color, which resolves Rav Herzog's objection. Second, the enzyme, purpurase, quickly decomposes upon the death of the snail. Therefore, to produce the *techeilet*, extraction must be accomplished while the snail is still alive. This complies with the Talmud's dictum that the *techeilet* should be taken from a living *chilazon* [5].

Despite all this evidence, there are those who refute the veracity of the *M. trunculus* as the *chilazon*. One of the main arguments is that the indigotin end-product of the dyeing process is chemically identical to plant indigo. Plant indigo is the counterfeit *techeilet*, called *k'la ilan*. The Talmud warns of the use of *k'la ilan*, which is indistinguishable in appearance from the real *techeilet*, and offers a chemical test to distinguish between the two dyes (*Menachos* 42b-43a). The test includes performing a fermentation process. If the color worsens at the end of the test, then the dye is ruled to be *k'la ilan*. However, since plant-derived indigo and the indigo derived from *M. trunculus* are chemically identical, the chemical test offered by the Talmud should not work. Therefore, there are those who conclude that *M. trunculus* cannot be the real *chilazon*, because it would fail the test along with its identical plant counterpart [3].

The followers of the *M. trunculus* school offer several explanations to the previous argument. They suggest that snail *techeilet* and plant indigo are chemically reduced by different reactions during the dyeing process, thereby causing the *k'la ilan* to fail the Talmud's test. Another suggestion is that the impurities inherent in the snail and plant indigos are different, thus affecting the way in which they bind to the wool [2]. Rav Herzog offers a third explana-

tion. He says that if the dye from the *M. trunculus* was invalid, then the Talmud should have warned against its use, as it did for the *k'la ilan*, because the two are identical. Therefore, since the Talmud never mentions an invalid dye other than *k'la ilan*, the dye from *M. trunculus* must be acceptable for use as *techeilet* [5]. Furthermore, the Talmud states that *techeilet* is identical in color to *k'la ilan*, and only *Hashem* can distinguish between them. If *Murex* indigotin and plant indigo are molecularly identical, then they are surely visually identical [8].

There are other objections raised regarding the classification of *M. trunculus* as the *chilazon*. The Talmud notes that the body of the *chilazon* resembles the sea. The word for body is "*guf*," which does not refer to the shell, but to the body underneath. The snail, however, does not have a blue body. Even if "*guf*" did refer to the outer shell, the sea-fouling covering the shell is only sometimes blue and is not unique to this snail because it also covers shells of other species. Additionally, the seventy year cycle is a criterion that cannot be disregarded or ignored. The Talmud clearly suggests that it is unusual for the *chilazon* to be in abundance. However, *M. trunculus* has no such cycle of abundance. The wording in the Talmud of "*lefichach*," indicates that the *chilazon* is expensive. Rashi notes that the statement concerning the once in seventy year appearance of the *chilazon* implies that the dye of the *chilazon* is rare and thus expensive. However, the dye of *M. trunculus* is expensive, not because it is rare, but because the snail yields only a minute amount of liquid. An abundance of snails, therefore, are needed to produce sufficient amounts of *techeilet* [3].

The identity of the *chilazon* is an important issue in contemporary *halacha*. It is one of only a few *mitzvot* that were lost but which can now possibly be reinstated. There is strong evidence to suggest that *M. trunculus* is indeed the long lost *chilazon*. Although there are those who disagree, the evidence seems to be enough for one to follow the dictum of "*safek d'oraita l'chumra*." This rabbinic principle instructs us to be stringent with *Torah*-ordained *mitzvot*. Despite the uncertainty about *M. trunculus*, we should treat it as the *chilazon*, since this *mitzvah* is found directly in the *Torah*. [9]. Furthermore, the *Radziner Rebbe* pointed out that there is no prohibition against wearing a blue thread in *tzitzit*, even if it is not the true *techeilet*, for the intent is not to deceive, but rather to sincerely fulfill the *mitzvah* [2]. Whether or not the *M. trunculus* is the *chilazon*, it is important to continue to strive to revive any *mitzvot* that will bring us closer to G-d and the ultimate redemption. ■

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# LOCUSTS AND ELEPHANTS

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**T**his essay is a discussion of two creatures, locusts and elephants, from a *Torah U'Madda* perspective. Both had an impact on Jewish history and both are discussed in the Talmud.

## 1. Locusts: High in Protein, Low in Carbs

Locusts, the eighth plague. “*Moshe* raised his hand over Egypt and all that day and night, *HaShem* made an east wind blow over the land. When morning came, the east wind

carried the locusts. The locusts invaded Egypt, settling on all Egyptian territory. It was very severe. Never before had there been such a locust plague and never again would the like be seen. The locusts covered the entire surface of the land, making the ground black. They ate all the plants on the ground and all the fruit on the trees; whatever had been spared by the hail. Nothing green remained on the trees and plants throughout all Egypt” (*Shemot* 10:13-15).

Locusts congregate in swarms, defined as large, coherent groups of flying insects, and travel thousands of kilometers from their areas of origin. Of the migrating insects, the desert locust (*Schistocerca gregaria*) forms the largest swarms, averaging a density of about 50 million insects per km<sup>2</sup> [1]. As swarms of locusts are common in Africa, how did Pharaoh know that this particular swarm, albeit exceedingly huge, was actually a plague from *HaShem*? The above-cited verses note that an east wind, blowing over Egypt all the day and night, carried the locust swarm into Egypt and that at the crack of dawn the locust invasion commenced. This is most unusual, as locusts travel and are active only during the daytime, with their migrations beginning in late morning [2]. The east wind carrying the locusts at night and the timing of the locust invasion commencing at dawn are proofs that this swarm was guided by *HaShem*.

The above-cited verses actually underestimate the terrifying psychological aspects of the huge locust swarm. In November, 2004, a moderate locust swarm invaded Israel; an eyewitness gave this account, “It’s a little overwhelming when the sky becomes darkened, you hear a big buzz, and all of a sudden, there’s a shadow and you feel like an airplane is flying above you” [3]. Similarly, the *Radak* and the *Malbim* (*Yoel* 2:2) describe a locust swarm as appearing like clouds and thick fog, blocking the rays of the sun, and darkening the day. The nerve-wrecking buzzing noise, pro-

duced by locust chirping and wing flapping, is also noted in *Yoel* (see *Yoel* 2:5; *Rashi and Malbim to Yoel* 2:9). However, the thrust in the *Chumash* is on the economic devastation. To better comprehend the extent of damage, the following citation [4] from the book, *The Chronicle of Joshua the Stylite*, is presented. “The year 811 in the month of *Adar* of this year the locusts came upon us out of the ground... and they were descending from the sky upon us. ...They ate up and desolated these districts and utterly consumed everything that was in them... Before the year came to an end, misery from hunger had reduced the people to beggary ... and because the locusts devoured all the crops and left neither pasture nor food for man or beast, many forsook their native places and moved to other districts of the north and west.” The potential dev-

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astation of an approaching locust swarm necessitated the sounding of the *shofar*, both as a warning and as prescription for *teshuvah* with the implementation of a communal fast (*Taanit* 3:5).

The *Chumash* (*Shemot* 10:16-17) continues, “Pharaoh hastily summoned *Moshe* and *Aharon*. ‘I have committed a crime,’ he said, ‘both to G-d, your L-rd, and to you. Now forgive my offense just this one more time. Pray to G-d, your L-rd. Just take this death away from me!’” What was Pharaoh’s rush, since the locusts already devastated Egypt? Rav Zalman Sorotzkin [5] suggests that Pharaoh was concerned that if the locusts stayed beyond the three days of the plague, the females would lay their eggs in the soil. These eggs would eventually hatch and the resulting offspring would again evoke devastation, albeit at a later time.



The incident with the plague of locusts continues as follows (*Shemot* 10:18-20): “Moshe left Pharaoh’s presence and prayed to HaShem. HaShem turned the wind around, transforming it into a very strong west wind. It carried away the locusts and plunged them into the Red Sea. Not a single locust remained within all Egypt’s borders.” Rav Sorotzkin [5] questions why a “very strong” west wind was needed to carry off the locust swarm, whereas an east wind (without the phrase, “very strong”) was needed to initiate the plague. He suggests that when the locusts arrived in Egypt they were small and scrawny; however, when they left Egypt they were fattened and, thus, their departure required a “very strong” west wind. Each 2 gram locust eats its weight in crops every day [6]. As a million locusts daily consume as much food as 5,000 people, a “very strong” west wind was needed to transport these overweight locusts from Egypt.

An interesting Midrash describes the perverse attitude of the Egyptians towards the plague of locusts. “Once the locusts came, the Egyptians rejoiced and said, ‘Let us gather them all and fill our barrels with them.’ HaShem said, ‘Wicked people, with the plague that I have brought against you, are you going to rejoice?’ Immediately HaShem brought upon them a western wind... and none were left. What does it mean that none were left? Even those that were pickled with salt and sitting in their pots were blown away.” (*Midrash Rabba, Shemot* 13:7). Rav Sorotzkin [5] suggests that the “very strong” west wind smashed these canning jars and carried away the pickled locusts.

Egyptians are not the only Middle Eastern people who eat locusts. Although the vast majority of species of grasshoppers are nonkosher (*Chullin* 63b), some species are kosher (*Chullin* 65a). The *Chumash* (*Yayikra* 11:21-22) describes the kosher species of locusts and grasshoppers. “Only this may you eat from among all flying teaming creatures that walk on four legs: one that has jumping legs above its legs, with which to spring upon the earth. These from among them you may eat: the *arbeh* according to its kind, the *sal'am* according to its kind; the *chargol* according to its kind; and the *chagav* according to its kind.” The physical criteria of the species of kosher grasshoppers include those with four walking legs, four wings, two jumping legs, and wings covering the greater part of its body. *Rashi* adds that the two long jumping legs should be attached to the body near the neck region, above the walking legs (*Chullin* 59a).

The necessity of reciting a *bracha* upon consuming locusts is discussed in *Berachot* (6:3). Rav Yehuda states that no *bracha* is needed, as a blessing is not recited over a food which has a curse connected with it and locusts are a curse because of their destruction of vegetation. However, the *Tanna Kamma*, which is the accepted opinion, notes that a *she'hakol* is recited. As a food item, locusts are pareve and can be consumed with dairy products (*Chullin* 8:1). As with fish, locusts do not require *shechitah*. Thus, technically, if one was walking in a field and noted some locusts hopping about, the person could catch them for immediate con-

sumption. However, because of the stipulation of “do not be repulsive” (*bal tishaktzu*), a person should refrain from eating locusts while they are alive (*Shulchan Aruch, Yoreh Deah* 13:1). Trapping grasshoppers for consumption is prohibited on *Shabbos* (*Shabbat* 106b). Rabbi Shlomo Korach (*Arichat HaShulchan* 3:136-141) notes that in the Jewish tradition, locusts were never really considered a delicacy, but rather were consumed by the impoverished [cited in 7].

To identify a kosher species of locust there must exist a continuous tradition (*mesorah*) to confirm the correct species. For most Ashkenazim, this *mesorah* has been lost. Thus, Rabbi J.H. Hertz, the late chief rabbi of the British Empire, in his commentary on the *Chumash*, stated that locusts can not now be considered kosher because of the uncertainty about their identification [8]. However, the *mesorah* for locust was maintained by Jewish communities originating from North Africa and Yemen. Anxious to preserve the Sephardic tradition of identifying species of kosher locust, Dr. Zohar Amar, head of the Department of Land of Israel Studies and Archeology at Bar Ilan University, consulted Rabbi Yosef Tzubari and Rabbi Yosef Kapach, originally from Yemen, and the Jerusalem chief rabbi, Shalom Mashash, originally from Morocco, for guidance. These rabbis, who were in their 80s when consulted, have subsequently passed away. However, Dr. Zohar recorded their statements to elucidate and identify the kosher species of locust [9, 10]. Zohar’s studies are also found in a Torah/scientific journal published through Bar Ilan University [11].

In November, 2004, a huge swarm of locusts swept across the Sinai desert into the southern Israeli city of Eilat and then up the Arava plains along the Jordan River. As this species of locust, identified as *S. gregaria*, is kosher, Dr. Zohar took his students to a farm in the Arava; they captured, fried, and then dined on some locusts. To enjoy locusts, before frying, the walking legs, wings, and head should be removed. Although the students observed that the locusts tasted like French fries, Zohar explained that their taste is dependent upon their last meal. Thus, a locust swarm that devoured a sesame field would taste like sesame oil. Locusts are most nutritious, being 60% protein and rich in vitamins [9]. Before dining on these locusts, the students should have considered that, to control the locust invasion, the Israeli Agriculture Ministry sprayed the swarm with insecticide [12].

### **Elephants: Pleasant Dreams**

There is a connection between Chanukah and elephants, although the association is not particularly pleasant. Elephants were initially introduced into *Eretz Yisrael* during the wars between the Hasmoneans and the Syrian-Greek army. In 166 B.C.E., a revolt against Hellenism was ignited in *Modi'in by Mattisyahu* and his five sons. In 165 B.C.E., the fledgling Jewish army retook *Yerushalayim*, destroyed the pagan idols, purified the vessels within the *Bais HaMikdash*, and lit the menorah, which burned for eight

days. However, the war was not over. In 164 B.C.E., at *Bet Zecharyah*, a ferocious battle ensued between the Jewish army and the Syrian-Greek army, led by Lysias and included 100,000 infantry soldiers, 20,000 horsemen, and numerous units of war elephants. Elazar, the youngest of the five brothers, noted a huge, highly decorated elephant, adorned with the royal emblem. Thinking that the king was in its turret, he fought through the enemy troops, reached this elephant, and plunged his spear into its intestines. The elephant collapsed, falling dead but crushing Elazar [13].

There are two distinct categories of elephants, the Asian elephant, living in parts of India and Southeast Asia, and the African elephant, inhabiting Africa south of the Sahara. Male Asian elephants, more easily tamed than their African counterparts, were often used as war elephants in ancient military battles. "There were plenty of military purposes for which elephants could be used. As enormous animals, they could carry heavy cargo and provided a useful means of transport. In battle, war elephants were usually deployed in the center of the line, where they could be useful by preventing a charge or starting one of their own. An elephant

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charge could reach about 20 miles/hour, and unlike horse cavalry, could not be easily stopped by an infantry line setting spears. Its power was based on pure force: it would crash into an enemy line, trampling and swinging its tusks. Those men who were not crushed were at least knocked aside or forced back. Moreover, the terror elephants could inspire against an enemy not used to fighting them could cause them to break and run just on the charge's momentum alone. Horse cavalry were not safe either, because horses, unaccustomed to the smell of elephants, panicked easily. The elephants' thick hide made them extremely difficult to kill or neutralize in any way, and their sheer height and mass offered considerable protection for their riders" [14].

The two groups of elephants are genetically different: the Asian elephant is actually more closely related to the extinct mammoth than to the African elephant [15]. Rabbi Dr. M.D. Tendler [4], in an article discussing evolution and Torah, cited the *Tifereth Yisroel* (see: *Drush Ohr HaChayim*, in the back of the first section of *Seder*

*Nezikim* of the "big" *mishnayot*, *Yahkin Boaz*), who discusses the discovery of fossils and, in particular, of a prehistoric elephant or mastodon. "In the year 1807 they found under the terrible ice of Siberia a monstrous elephant, three or four times as large as those we have today ... whose skeleton can be seen in Petersburg museum. Since Siberia does not have a climate suited to elephants, it proves that the earth was pushed, disrupted, so that the elephant was thrown there [i.e., cataclysmic events occurred] or that Siberia once had a warm climate."

Before television, the Internet, zoos, and professional circuses, viewing an elephant was a rare occurrence (*Shabbat* 128a). Hence, one who saw an elephant recited the blessing, "Blessed is He who diversifies the creations" (*Berachot* 58b). What makes elephants so unusual? Elephants are the largest of the terrestrial animals, are the only animals to have a nose in the form of a large trunk which also functions as a hand. They also have the largest ears, and their tusks are the largest teeth amongst animals [5]. Ivory, derived from elephant tusks, was imported by *Shlomo HaMelech* and used to construct his throne (*I Melachim* 10:22).

The Me'eri has an interesting twist to the recitation of this blessing. He notes that seeing an elephant mandates the recitation of this blessing because an elephant and a human being have much in common, yet are physically very different. Some similarities between human beings and elephants include: elephants have a large brain, rank high in intelligence among animals, have excellent memories, display a wide range of emotions (including laughing, crying, grieving at a loss of a stillborn baby and of a family member), and are sensitive to the needs of fellow elephants (e.g., when a baby elephant complains, the entire family approaches it to caress and touch it; greeting ceremonies are displayed when a fellow elephant, not seen for a while, returns to the group). Furthermore, elephants communicate verbally by making at least 25 different calls, including coarse loud rumbles, low humming rumbles, screams, squeaks, groans, and bellows. Each sound has its own meaning [15, 17]. Interestingly, in *Perek Shirah* the elephant's statement emphasizes intelligence. "How great are Your works, G-d; Your thoughts are tremendously deep" (*Tehillim* 92:6); only an intelligent animal would be cognizant of *HaShem's* intelligence.

Another commonality between human beings and elephants is their susceptibility to psychological disorders, as both species exhibit posttraumatic stress disorder (PTSD). Joyce Poole, who has spent more than 30 years researching elephants, heard stories of elephants intentionally killing human beings. She noted, "I have always believed that these are elephants who have suffered some severe trauma at the hands of man. An elephant whose family members are killed by people is unlikely to forget it very quickly – just as you or I wouldn't forget if an elephant killed a member of our family." She further commented, "African elephant society has been decimated by mass deaths and social breakdown from poaching, culls, and habitat loss. Wild elephants are displaying symptoms associated with human PTSD" [18, 19].

If you attended a circus or a visited a zoo, the “smell” emanating from the elephants probably preceded your actual viewing them. In short, elephants stink! If so, how is it possible that in *Succah* (23a) it states that a chained elephant may be used as a wall for a succah? When I asked this question to Rabbi N. Slifkin (the “Zoo Rabbi” of the Biblical Zoo in *Yerushalyim*), he noted that in those times the people lived in an agricultural society and were always in close proximity to their animals. Thus, odors unacceptable in today’s society, were common to, and were tolerated by, earlier generations. In addition, the close proximity between people and animals in “ancient” civilizations may explain the strange incident reported in *Shoftim* (11:31). Prior to setting out to battle the Ammonites, *Yiftach HaGilaedi* made the following vow to *HaShem*: “And it shall be that whatever emerges from the doors of my house to meet me when I return safely from the Ammonites, shall be to *HaShem* and I will offer it as a burnt offering.” *Yiftach HaGilaedi* thought that perhaps a cow, sheep, or goat would exit from his house. Unfortunately, however, the first to leave his house was his daughter, who ran out to greet him. Apparently, in those civilizations, the concept of separate dwellings for human beings and for domesticated animals, i.e., in a barn, were not, as yet, in practice. It would appear from the story of *Yiftach HaGilaedi* that both human beings and domesticated animals lived in a common dwelling. Thus, having an elephant serving as the wall of a succah does not seem so strange.

The *Gemara* (*Shabbat* 16a) cites the *Mishnah in Mikva’ot* (4:1), that certain types of vessels invalidate water from use in a mikvah; one such type of vessel are the *klei gelalim*, made from dry animal

dung (*Shabbat* 58a; *Tosfot in Menachot* 69a). In *Menachot*, *Tosfot* notes that the *Gemara* teaches that if an elephant swallows a basket and subsequently eliminates it in its fecal waste, the basket has the status of *klei gelalim* [20]. It seems strange that an animal can consume a basket and eliminate it intact. However, it is possible with an elephant. Elephants are herbivores, with a diet consisting of grasses, leaves, twigs and branches, tree bark, roots, and small amounts of flowers, fruits, coconuts, and seeds. A large adult wild elephant can consume about 300 pounds of vegetation a day. Yet, an elephant’s digestive system is relatively inefficient, as only about 40% of the intake is utilized, with 60% eliminated as indigestible waste [21]. Apparently, with an elephant, what goes into its body at one end can be eliminated intact at the other end.

The fear of elephants for mosquitoes is cited in *Shabbat* (77b). *Rashi* comments that if an insect enters the trunk of an elephant, it has the ability to rid itself of the pest. Although elephants are thick-skinned, their skin is surprisingly tender and some insects, including flies and mosquitoes, can bite into their skin [20].

If this short essay evokes dreams of elephants, consider this a positive event. As noted in *Berachot* 56b, wonders occur to a person who dreams of an elephant; dreaming of several elephants evokes the occurrence of several wonders. As explained in the ArtScroll edition of *Berachot*, the correlation between dreaming of elephants and of positive events happening to the dreamer is based on phonetics. The Hebrew word for elephant, *pil*, is similar in sound to the Hebrew word for wonder, *pele*, and the plural of elephants, *pilim*, is similar sounding to the Hebrew word for numerous wonders, *pilei*. So, pleasant dreams! ■

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