

DERECH HATEVA

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Derech **HaTeva**

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We thank you for making this opportunity possible.

Allison Tawil
Elana Perlow
Hannah Piskun
Miriam Saffern

Dedication

In prior volumes of *Derech HaTeva* the coeditors authored the dedication. For this issue, I requested permission to compose the dedication. In November, 2016, while crossing the street, a vehicle struck me and fractured five vertebrae. As a result, I spent about 2-3 weeks in a hospital and 5-6 weeks in rehabilitation centers. It is most appropriate to state the blessing, “Blessed are You, *HaShem*, our God, King of the universe, Who has kept us alive and has sustained us and brought us to this season.” I would like to dedicate this volume of *Derech HaTeva* to all those who reached out to me in my time of crisis. Specifically, appreciation is expressed to the SCW administration, Dean K. Bacon, Dean E. Orlian, and Mrs. M. Schechter, to my colleagues both within the Biology Department and in other departments, to the students of SCW for their continuous prayers and well wishes, to Allison Tawil and Elana Perlow, who served as editors-in-chief of *Derech HaTeva*, and to the co-editors who volunteered to transform the manuscripts into a beautiful publication, to the rabbi of my *shul*, Rav Yisroel Reisman, Agudath Yisrael of Madison, and to the congregants, to my wife, children, daughter-in-law, grandchildren, brother and sister-in-law, and to Mark Platnick, who assisted in my transport to and from medical facilities.

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In 2016, Susan Jacobson, beloved wife of my friend, David, passed from this world to the next. Susan personified an *eishes chayil*; this volume is dedicated in her memory. I know that *Sarah Malka bas Aharon*, of blessed memory, who always accepted whatever *Hashem* deemed best for her, will be our advocate in the world above in the years to come.

Harvey Babich, Ph.D.
Biology Department

The heavens declare the glory of God,
and the firmament proclaims His
handiwork.

(*Tehillim* 19:2)

הַשָּׁמַיִם מְסַפְּרִים כְּבוֹד קָל
וּמַעֲשֵׂה יָדָיו מְגִיד הַרְקִיעַ:

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Technology is transforming the medical field as the world knows it. Whether facilitating new scientific discoveries, accurate diagnoses, efficient and sophisticated treatment, or patient management, biotech provides tools to service the needs of both doctors and patients. Due to the creation of new technologies, surgical procedures are improved with tools that minimize recovery length and risk of infection; technological implants are able to regulate normal bodily function; advanced prosthetics are designed with enhanced functionality; effective medicines are created; cures for chronic illnesses are progressing. For instance, 3D imaging allows for the discovery of suitable ligands to block active sites of harmful proteins and prevent disease. Even hospital rooms employ technological advances for the betterment of their patients, such as the implementation of circadian lighting. As scientists increase the available information, technology is able to assist in turning the research into reality. At this point, the artificial reproductive technology that will enable parents to select “favorable” traits for their offspring is just around the corner.

These “designer babies” are subject to debate among those in the ethics community [1]. Many science fiction films and novels, such as Aldous Huxley’s *Brave New World*, depict the disastrous effects of controlling genes upon society. Of course, at the moment, the conversation is strictly theoretical, as the technology has not been developed completely. However, in the age of technology and rapid advancement, the innovation of such capabilities seems imminent, thereby rendering the topic ever relevant.

In vitro fertilization (IVF) is the process of manually combining an egg and sperm in a laboratory dish and transferring the healthy embryo into the uterus for development [2]. This technique is commonly used by couples who experience infertility. Many *halachic* authorities have permitted the use of this procedure to overcome infertility and to promote procreation. Preimplantation genetic screening (PGD) is a derivative of this original scientific breakthrough. Using such artificial reproductive technology, the genome of the embryo is examined so that the couple can ensure that the embryo implanted is devoid of any serious genetic disease. The blastomeres, or cells formed by the division of the embryo, are inspected to determine the gender and, thereby, to eliminate sex-linked diseases. While PGD is one-hundred percent effective, there is another, less certain, technique wherein sperm is separated into those containing X-chromosomes and Y-chromosomes. Once accomplished, the desired sperm can be inserted either by IVF or by intra-uterine insemination (IUI) into the egg. Naturally, as a result of these new procedures, the focus has shifted from the ethical validity of the original technology to the question of whether

couples should have the right to select desired genes for their child, rather than limiting gene-control only to those exclusively pertaining to health.

Some find the idea of selecting preferable genes to be eerily similar to eugenics utilized by the Nazis to wipe out millions of people during World War II. The technology, if misused, could be dangerous. For instance, one bioethicist, Julian Savulescu, believes that the use of artificial reproductive technologies is a form of such eugenics [3]. By selecting the “best” embryo, one effectively destroys the less desirable genomes. Savulescu posits that one must realize that children are a gift from G-d, and, therefore, their destiny cannot be humanly controlled. Contrarily, philosopher David Heyd points out that gender selection is not equivalent to eugenics, rather, it simply provides parents with reproductive autonomy [4]. Reproductive decisions are already subject to the parents’ personal desires with regard to aspects such as timing of conception and number of children. Giving parents additional procreation options is merely an extension of their inherent rights, yet other experts fear the ultimate creation of two unequal societal classes. While the upper class possesses the monetary means to pursue procedures that enhance their children’s genotypes, thereby contributing to the creation of a perfect society, the rest of the population becomes doomed to inferiority because access to such enhancements is limited by lack of sufficient funds [5]. As the protagonist of *Gattaca*, a science fiction movie which centers around this quest for a genetically perfect society, said, “I belonged to a new underclass, no longer determined by social status or the color of your skin. No, we now have discrimination down to a science.”

Yet, the concept of enhancement is already present in our society. From immunizations, medications preventing disease to the increasing of intelligence and physical capabilities and even stressors that positively affect a person’s psyche, this “pursuit of perfection,” as Sheila and David Rothman call this mentality, occupies a strong presence in our culture [6]. Similarly, gene selection uses technology to select the best version of a given person, eliminating unnecessary impediments and, therefore, positively impacting the way an individual lives his or her life. If the advancement of this technology is inevitable, then the conversation should not be focused on its ethical status but rather concentrate on the ways in which the technology can be controlled to prevent abuse of power. The scientific community should be focused on influencing the direction that science takes, instead of attempting to staunch its development [7].

Modern Jewish decisors are constantly confronted with issues that develop in conjunction with the advancement of science. With the task of relating ancient texts to

contemporary issues, they struggle to make *halacha*, Jewish law, relevant. As complex genetic technology becomes reality, the question of the permissiveness of gene selection has surely risen.

Man has a specific role in the world. G-d's command to "fill the earth and conquer it," refers to Man's responsibility to be active and to create (Genesis 1:28). Similarly, the narrative of creation describes G-d resting from "which [He] has created, to do," which alludes to the fact that G-d intentionally left creation unfinished, to be completed by Man (Genesis 2:3). This completion can only be achieved by following His example, which entails the concept of *tikkun olam*, improvement of the world. The Maharal, a Jewish scholar and mystic from the 16th-17th century, writes that human creativity is inherent in the creation of the world, stating:

The creativity of people is greater than nature. When God created in the six days of creation the laws of nature, the simple and the complex, and finished creating the world, there remained additional power to create anew, just like people can create new animal species through inter-species breeding... People bring to fruition things that are not found in nature; nonetheless, since these are activities that occur through nature, it is as if it entered the world to be created...
(*Be'er Hagolah*, 38:9).

Rav Soloveitchik, a major modern Orthodox rabbi of the 20th century, extends this call for positive action to a direct responsibility. As such, man's job is to actualize his creativity, rather than remaining a passive bystander in the world. An excerpt from Rav Soloveitchik's *Loneby Man of Faith* enumerates his claim:

Dignity of man expressing itself in the awareness of being responsible and of being capable of discharging his responsibility cannot be realised as long as he has not gained mastery over his environment... Man of old who could not fight disease and succumbed in multitudes to yellow fever or any other plague with degrading helplessness could not lay claim to dignity. Only the man who builds hospitals, discovers therapeutic techniques and saves lives is blessed with dignity... Civilised man has gained limited control of nature and has become, in certain respects, her master, and with mastery, he has attained dignity as well. His mastery has made it possible for him to act in accordance with his responsibility... [8]

From this perspective, perhaps humanity's creative duty permits the use of technology to play a role in determining the genome of the future generation, improving the existing traits, and creating a more perfect population.

There is evidence that *halachic* literature is both aware of,

and even values, the genetic influences on an offspring, in addition to the notion of perfecting it. When choosing a mate, Jews take precautions, such as genetic screening, in order to avoid birth defects and possible diseases, both of which may affect not only the health, but also the appearance of their offspring. Rabbi Yochanan, a scholar between 200-500 CE, was said to have attempted to effect the genetic outcome of offspring. By standing outside of the *mikvah*, he believed that he would influence the nature of any offspring women may have conceived that night [5]. Rabbi Bleich notes that the Talmud (*Niddah* 31a) discusses suggestions for conceiving a child of a certain sex and concludes that the matter under debate is the method by which this process is achieved, not whether the process itself is permissible [9]. Therefore, influencing the genetic outcome of a fetus is seemingly permitted, and this discussion of gender predetermination in the Talmud serves as a quasi-endorsement.

Another important Jewish value is *gmilut chasadim*, acts of loving-kindness, which extends to the limiting of another's anguish. Judaism does not condone unnecessary suffering. For instance, the legal principle of *inny hadin* ensures that a criminal does not receive any more than the punishment incumbent upon him. Specifically, the individual responsible for dealing the requisite amount of lashes must ensure that he does not exceed the designated number or else he, himself, may be tried (Deuteronomy 25:3). Similarly, the court is prohibited from delaying the execution of a pregnant woman on death row until after her pregnancy because this is considered a form of torture (*Erchin* 7a). Therefore, the use of artificial reproductive technologies would seemingly be permitted to limit the familial suffering.

A prime example of implementation of the principle of *inny hadin* pertains to an instance of Tay Sachs disease. Parents who have a child affected by the disease undergo tremendous emotional hardship. To avoid such psychological trauma, modern technology, such as PGD, can be used to prevent an affected embryo from developing. This method serves to replace the alternative approach of aborting the fetus, which is, indeed, permissible in this situation, according to the decision of Rav Eliezer Waldenberg, and modern Jewish scholar [10]. Rabbi Zilberstein, a rabbi and medical ethics expert, similarly concludes that "one cannot close the door in the face of despondent people who suffer mental anguish in fear of giving birth to sick children," since there are serious implications to consider regarding the couple's well-being when the prospect of an unhealthy child is in play. The justification of any ruling that would forbid the possibility of genetic screening through IVF is, therefore, tenuous at best in the instance of genetic disease [11]. This importance of mitigating suffering as it pertains to genetic diseases is also acknowledged by Rav Shlomo Zalman Auerbach, a renowned Orthodox rabbi, in a generally accepted opinion,

wherein he permits the use of sex selection to prevent sex-linked diseases, the operative argument being that mental anguish creates a medical need [12].

According to *halacha*, can sex selection be used for reasons other than reducing the risk of disease and pain within families?

The loftiest form of *chesed* is *chesed shel emet*, providing assistance without the expectation of reward. Parents are required to provide for their children and give them the basic tools for life so that they can function independently. The Talmud goes so far as to specify a father's obligation to teach his son to swim (*Kiddushin 29a*). When parents choose desirable traits, such as the level of intelligence or physical capabilities, they can help their child function better in society.

However, interfering with intelligence may present a *halachic* concern previously unconsidered, namely, that of effectively eliminating the toil of Torah. While some authorities question whether there is a risk of losing the *amal*, or struggle, that is meant to be present in Torah study, Dr. Shimon Glick [5], an Israeli physician and member of Ben Gurion University's Faculty of Medicine, explains that gene selection does not, in fact, challenge this concept. He believes that raising a child's level of intelligence and functionality only serves to elevate standards beyond those possible without the use of the technology. Examining 21st century life in contrast with past periods, one observes technology's incredible impact, drastically improving lifestyles and making menial tasks infinitely easier. Yet, there are still struggles and challenges in the world; the bar is just set higher.

Assuming IVF entails selecting specific fertilized eggs to be implanted and discarding any excess, gender selection would be permitted, since the remaining embryos were to be destroyed regardless. While IVF presents an issue with *hashchatat zera*, wasting seed, a prohibition to which there is hint in the story of Judah and Tamar (Genesis 38), the fact that fetuses have no Jewish legal rights during the first forty days post fertilization (*Yevamot 69b*) can be relied upon in order to permit the procedure for the purpose of procreation. Therefore, the *halachic* issues relevant to IVF procedures were overruled by rabbinic authorities due to the presence of infertility, as procreation is a positive obligation. Because of the specificity of the scenario that this ruling addresses, IVF might not be permitted for those who are fertile and merely seeking sex selection, despite the fact that it ultimately helps to fulfill the obligation to procreate. Rabbi Shafran, a modern rabbi, is one such authority who rejects the idea of using IVF solely for sex selection. He writes, "With regard to life in general and reproductive issues in particular, our goal is not simply to realize one's desires, though they might be lofty..." [13] Rabbi Zilberstein similarly views sex selection as a disruption of the natural relationship between a couple and G-d, which is infused with holiness, and explains that,

"[Normally] God joins with a man and his wife [in creating a child], but here it is the doctor's hand [instead]" [11]. Pointing out that IVF is generally permissible, Rabbi Zilberstein mentions an opinion that questions the *halachic* status of the father, and, therefore, sees no reason to go through the arduous medical and *halachic* process merely to choose a specific gender. Interestingly, while both authorities champion the importance of normative marital relationships, they agree that this focus on normalcy is not considered absolute; *halacha* is open to new technologies.

Another aspect of sex selection which is highly contested within the rabbinate concerns the use of sex selection to balance gender within a family. Rav Shlomo Zalman Auerbach permitted sex selection to prevent disease, but not for family balancing [12]. In contrast, the Israeli Ministry of Health allowed sex selection even for the purpose of family balancing because the Ministry evaluated that a having a child of the undesirable gender would cause mental anguish for parents and possibly the child as well. Yet, the Ministry of Health condemned the use of sex selection for personal parental satisfaction other than balancing. Therefore, the permissibility of the use of this technology must be determined on a case-by-case basis [14]. Interestingly, Rav Ovadia Yosef, a recent Sephardi Chief Rabbi of Israel, ruled that PGD can be used for sex selection for parents of families with six kids of one gender, who would not consider having another child unless they knew without a doubt that it would be of the desired gender [15]. Similarly, Rav Mordechai Eliyahu, Rav Ovadia Yosef's successor as Sephardi Chief Rabbi of Israel, permitted PGD with couples of five kids of the same sex [16]. Philosopher Heyd interestingly believes that although parents should be given autonomy in their reproductive process, using artificial reproductive technology for the sole purpose of sex selection is morally problematic, as it undermines the principle of unconditional love [4]. While some permit such selection in specific situations, the fact that the inability to have a child of a certain sex induces psychological distress is indicative of a deeper psychological trauma, but is not necessarily a reason to allow PGD.

Additionally, the process of PGD, and by extension that of IVF, comes with its own risks, both medical and financial, especially since the long-term effects are still unknown. For example, hormonal stimulation used to produce eggs may increase the likelihood of developing breast and ovarian cancer and may also cause Ovarian Hyper-Stimulation Syndrome (OHSS), which creates life-threatening complications. In addition, a woman experiences a higher chance of contracting infection, hemorrhage, and psychological trauma when using PGD [17]. As a result, the prohibition of *chavala* (*Bava Kama 90b*), or self-endangerment, might prevent one from being able to undergo PGD, as it does with elective surgery [18]. However, as technology develops, and possibly reduces the risks involved, *halachic* conclusions may be modified.

Two prominent women within the field of medical ethics, Doctors Feige Kaplan and Deena Zimmerman, contribute to the discussion of sex-selection. Dr. Feige Kaplan, an associate professor in the Department of Human Genetics, Pediatrics and Biology at McGill University, invokes a caveat: if a couple is able to have healthy children naturally, the use of these procedures should not be permitted to them. The potential risks are only outweighed by the alternatives of having a sick child or none entirely [19]. As Dr. Deena Zimmerman, a pediatrician and *yoeztzet balacha*, or women's advisor on Jewish family law, points out, these risks are accepted to fulfill the positive commandment of procreation, but are not necessarily overlooked to achieve the desired gender [20]. Additionally, they note that parents should not be forced to appropriate finances in an effort to create perfect children to keep up with society as doing so inflicts an unnecessary burden. If parents are not able to afford PGD, they will be fraught with guilt. As a result, a polarized society will form, one faced with an "impossible and insatiable perfection" [21]. Through this quest for the ultimate perfection, "childbirth ceases to be... an act of reproducing the human species... [it] become[s] a means of duplicating those who best represent the culture's prevailing preferences and values" [22]. In order to avoid this eventuality, each couple must examine their true intentions for using artificial reproductive technology and honestly ask themselves whether they are using these resources to aid their desires or to ensure their children's health.

This discussion of using one's genes to determine the future undermines the concept that a person's surroundings affect his development. By acknowledging this ethical debate, the scientific community is effectively choosing nature over nurture as the primary influencer, thereby resolving an ancient debate. However, Judaism espouses the belief that everyone has behavioral tendencies that cause him to sin, yet, G-d grants a person the means to overcome them. A person is shaped by, and learns from, his or her environment. Therefore, a parent's job is not necessarily accomplished after merely selecting the favorable genes for his or her offspring. Rather, parents must play a constant role in inspiring their child and helping him or her to grow. Health promotion, and, therefore, disease prevention, have always been at the forefront of Jewish values. G-d promises

that "the diseases that I brought on Egypt I will not bring unto you for I am the Lord your healer," elucidating the important role preventative medicine occupies within the community (Exodus 15:22). The power to save another's life is taken seriously, evidenced by the fact that the positive commandment of *pikuach nefesh*, the preservation of human life, is one that can override almost any other *mitzvah*, commandment, in the Torah. However, while one is meant to be active and use his abilities to help others and prevent disease, he must recognize that he is not G-d. For it is written, "Fortunate is the man who is ever fearful" (Proverbs 28:14). Whether or not parents' duties towards their children include interfering with their genomes, one must be wary of his true intentions as he goes through this process and be sure that he is not trying to "play G-d." In Genesis, Eve is rebuked for viewing herself as god-like after giving birth. She names her first son Cain because she had "acquired a man with G-d" (Genesis 4:1). By claiming this, she equates herself with G-d in the process of procreation. Eve wanted to actualize her ability to create, but gave herself too much credit. She only repairs her sin when she is faced with the same situation in the naming of her third son, Seth, where she proclaims, "G-d has provided me another child in place of Abel" (Genesis 4:25). With the naming of her third son, Eve demonstrates her acceptance of G-d's omnipotence and her minimal involvement in this process. Using advanced technologies to influence genetic material, Jews must be careful to avoid Eve's mistake and not equate human intelligence and capabilities with the abilities of G-d. Jews are challenged with this task of taking one step back and practicing self-restraint, recognizing that, ultimately, everything originates from G-d.

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Today, there are thousands of dental hygiene products on the market, including mouthwashes, toothpastes, and gums, to cure halitosis, commonly known as bad breath. This condition is mentioned as far back as the Talmud and has serious implications on both marriage laws and the work of the *kobanim*. The Talmud in *Berachot* 43b writes, “What is it that the soil enjoys but the body does not? It is the sense of smell.” The sense of smell is connected to a human’s memory and emotions [1]. Bad breath, a condition of which millions of people suffer, is considered to be a serious medical problem since the time of the Talmud until today.

Almost 90% of bad breath cases stem from the mouth, while only 5-10% originate from the nasal passages. Bad breath arising from the oral cavity is related to decomposition of glycoproteins by Gram-positive bacteria. Bacterial deglycosylations of glycoproteins result in proteins that subsequently undergo proteolysis by enzymes secreted by Gram-negative bacteria. Degradation of these proteins leads to free amino acids, which, upon further decomposition, result in foul odors. Degradation of amino acids produce unpleasant-smelling molecules, such as hydrogen sulfide (from cysteine), methyl mercaptan (from methionine), cadaverine (from lysine), and indole and skatole (from tryptophan), all of which contribute to bad breath. The most common site in the oral cavity for malodor production is the tongue, stemming from postnasal drip. Food and epithelial cells collect on the back of the tongue and are broken down by the resident bacteria on the tongue. In addition, gingivitis, mouth dryness, and sleep can contribute to oral malodor [2]. In the times of the Talmud, there were different causes of halitosis, such as acetone breath from uncontrolled diabetes, oral infections, which were a common cause of death, and insufficient water supply, which led to oral dryness [3].

The *kobanim* with bad breath were disqualified from working in the Temple. The Talmud in *Ketubot* 75a recommended that the priests place a pepper in their mouths to rid themselves of bad breath so that they could continue to work in the Temple. Furthermore, bad breath was considered to be legal grounds for divorce. A husband was allowed to annul his marriage if he detected a serious disability in his spouse that was not divulged before the wedding. Serious disabilities included ungainly breasts, a thick voice, non-obvious lesions of the head and neck, sweat, and oral malodor (*Ketubot* 75a). Although the right to divorce was in the hands of the husband, bad breath was considered such a major problem that a woman could divorce her husband if he had oral malodor (*Ketubot* 77a). Bad breath even exempted a woman from *yibum*, a situation in which a husband dies childless and the widow is obligated to marry her husband’s brother (Deuteronomy

25:5-10). Maimonides, a 12th century philosopher, commented that the wife was allowed to declare that she was able to tolerate the oral malodor of her husband, but not of his brother (*Hilchot Ishut* 25:13). Although chewing pepper was a remedy for the *kobanim* to work in the Temple, this did not apply to marriage laws because, according to *Rashi*, an 11th century biblical commentator, the husband was always in the presence of his wife so chewing pepper was not adequate to block the smell.

The earliest remedies in the Talmud for bad breath—mastic gum and oil-water mouthwash—reflect the antibacterial approaches used to cure this condition today. Mastic, a hard gum from the *Pistacia lentiscus* tree, has been used since the times of the Talmud as a breath freshener and an antibacterial balm [4]. The *Tosefta Shabbat* (8:7) mentioned that it is prohibited to chew mastic on the Sabbath, but it is permitted when it is used to prevent bad breath. Research today has shown that mastic gum kills an array of microorganisms which reside in the oral cavity [5]. Another ancient remedy for oral malodor is oil-water mouthwash. There is a story in the Talmud about Rabbi Yohanan, who suffered from bleeding gums, which caused bad breath. A Rabbi recommended a combination of leavening water mixed with oil and salt as a remedy (*Yoma* 84a; *Avodah Zara* 28a). In the 1980’s scientists developed a bactericidal oil-water mouthwash. Unaware of the story in the Talmud, the scientists produced this mouthwash that was mentioned in ancient times. This mouthwash contains cetylpyridinium chloride, which performs the same emulsification of the bacteria as does the leavening water [3]. Other Talmudic cures for bad breath included oral fresheners that cover up the odor, such as ginger and cinnamon (*Shabbat* 65a), which are some of the ingredients used in today’s breath sprays.

Clearly, bad breath has been a major issue since Talmudic times from both a medical and social perspective. The remedies for this condition are found in the Talmud and have been modified with modern chemicals to enhance their effectiveness. Halitosis can be controlled through the numerous products on the market, but, more importantly, maintenance of oral hygiene is the key to good breath [2].

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Worth Their Weight in Gold: Prosthodontics in the Talmud

By Talia
Bean

Prosthodontics is one of the primary areas of dentistry that focuses on dental aesthetics, concentrating on cosmetic restoration and replacement of teeth, specifically the placement of dental prostheses. Originating in the 18th century, prosthodontics first used materials such as bone or ivory to replace or repair teeth, as well as minerals like gold, lead, and tin. Progress in this area has been accelerated as new materials such as porcelain powders, various cements, and more recently, acrylic resins, have been developed. [1] Although aesthetic dentistry is a relatively new field, evidence of tooth restoration during the time of the Sages is apparent in the Talmud, dating back to 200 C.E., with significant attention given to the cosmetic appearance of teeth in that era.

In Gemara *Shabbat* 64b-65a, the Mishna discusses the case of a woman who walks into the public domain on Shabbat with various different items on her person. One of the items discussed is a false tooth: “**יוצאה אשה...שן תותבת שן של זהב רבי מתיר וחכמים אוסרים**”

“A woman who goes out with... an artificial tooth, [or] a gold tooth, Rabbi permits, but the sages forbid it.” Rabbi and the sages disagree on the permissibility of walking in the public domain on Shabbat with a false tooth.

Focusing on the two different false teeth mentioned, Rashi comments that here, an artificial tooth (**שן תותבת**) and a gold tooth (**שן של זהב**) are one and the same. In contrast, the majority of commentators explain that these two phrases refer to two different types of false teeth. There are multiple opinions on the definition and origin of the word **תותבת**. **תותבת** can be translated as “foreign,” perhaps referring to a material foreign to the oral cavity, such as wood or ivory. It can also be translated as “cover,” indicating a crown-like structure that sits on top of the tooth. R. Ovadia of Bartenura compares the Aramaic word **תותבת** to the Hebrew word **תושבת**, replacing the letter *taf* with a *shin*. **תושבת** means “to sit” and thus a **שן תותבת** is described by R. Ovadia as something that “rests upon the cheeks in place of the tooth that fell out.” [2] It is clear that the early art of prosthetics existed during this period and was a relevant topic of discussion among the sages.

The commentators also offer a multitude of explanations of the purpose and function of a false or gold tooth. R. Ovadia of Bartenura describes a scenario that would necessitate a gold tooth: a tooth’s appearance is changed due to mold, and is then covered with gold. It seems as if in the time of R. Ovadia, tooth decay was attributed to mold that ate away at the tooth. Rambam offers a slightly

different perspective, explaining that a gold tooth is placed on top of a red or black one. A red tooth refers to a case where dental caries (a cavity) attacks the inner part of the clinical crown, leaving the outside enamel layer intact. Blood vessels in the pulp provide the red color that is visible through the thin layer of enamel, making the tooth appear red. A black tooth denotes a non-vital tooth that has lost its natural color due to the staining of dentin by degraded blood cells following a hemorrhage in the pulp. Rambam explains that the gold tooth is placed on a tooth that has a strange appearance in order to conceal the defect. [3] It is interesting to note these early reasons given for tooth decay, as well as the early development of gold crowns inserted to restore the tooth.

It seems that in the time of the Talmud, the false tooth, whether made of gold or another material, was inserted temporarily and remained in place due to pressure from the surrounding teeth. The missing or decayed tooth was replaced and retained by mechanical forces, held in place by proximal tooth friction. Today we know that this method is ineffective, as the pressure reduces greatly over time. This reduction of pressure explains the transient nature of the false teeth described in the Talmud. [3]

The Gemara *Shabbat* 65a discusses the words of the Mishna, explaining why walking into the public domain with a false tooth may pose a *halachic* issue: “R. Zera said: They taught this only of a gold [tooth], but as for a silver one, all agree that it is permitted. Abaye said: Rabbi, R. Eliezer, and R. Simeon b. Eleazar all hold that whatever detracts from a person[’s appearance], one will not come to display it.” Rashi explains this Gemara, stating that the prohibition of walking in the public domain only applies to a gold tooth. A gold tooth is very valuable, and when walking in the public domain a woman may take it out to display, and then proceed to violate the prohibition of carrying. A silver tooth, on the other hand, is not as valuable and would not pose an issue. Rashi also quotes an additional, dissenting opinion of his teachers. Gold looks different than the other teeth, so the concern is that the woman may remove her false tooth and carry it in her pocket out of fear of being mocked. Silver, on the other hand, has similar coloring to natural teeth, so there is no fear that the woman will remove and carry it in the public domain out of embarrassment.

Both of these opinions are reflected in the words of the Gemara: “whatever detracts from a person’s appearance, one will not come to display it.” According to Rashi’s first opinion, the valuable gold tooth is viewed as something

that cosmetically enhances a person's appearance, and therefore there is concern that the woman would remove it to display it. According to the opinion of Rashi's teachers, the gold tooth does not match the other teeth and would therefore detract from a person's appearance, leading the woman to remove and carry the false tooth. In both cases, a silver tooth would not cause a problem, being both less valuable than gold and similar to the color of a natural tooth. This Gemara clearly displays the rabbis' concern with the aesthetic appearance of the prosthetic tooth and its practical ramifications in *halacha*.

Another mention of aesthetic and prosthetic dentistry in the Talmud is in *Nedarim* 66, where a scenario is recounted in which a man made a *neder* (vow) not to marry a specific woman because she was uncomely. R. Yishmael beautified her and then permitted the man to marry her because the *neder* became invalid once she was beautified. The sages disagree and say the *neder* remains in place. The Gemara asks: how did R. Yishmael beautify her? The answer given is that he replaced an unsightly false tooth with a gold tooth. The Ran explains the logic of R. Yishmael, saying that R. Yishmael follows the opinion of R. Eliezer, who considers a *nolad*—a new occurrence that did not exist at the time the oath was made—basis upon which to annul a *neder*. The beautification of the woman created a scenario of *nolad*—her beauty was a new occurrence that did not exist at the time the oath was made, and the man could not be held to his original vow. The Rosh disagrees with the Ran, saying that R. Yishmael did not agree with the opinion of R. Eliezer regarding *nolad*. Rather, R. Yishmael believed that all Jewish women are inherently beautiful, and all ugliness can be attributed to a state of poverty and external factors. The man made the *neder* on the basis that the woman was inherently ugly. If it was impossible for the woman to be inherently ugly, the *neder* is considered a *neder ta'us*, a vow that was made in error, and is invalid. [4]

It is possible that the Ran may have had a similar opinion to Rashi's commentary on *Shabbat* 64b. According to Rashi's first explanation, a gold tooth is more attractive than a silver or a normal false tooth, and would cause a woman to remove it to display to her peers. R. Yishmael's replacement of the substitute tooth with a gold tooth provided aesthetic enhancement in a completely new way. It was a case of *nolad*, as the tooth caused her to become beautiful after the time the *neder* was made. The Rosh may have agreed with the explanation of Rashi's teachers, that a gold tooth does not cosmetically match the other teeth, and would cause a woman to remove it due to embarrassment. In the case of the Gemara *Nedarim*, the gold tooth was fashioned to cover a gap left by a missing tooth, or to replace a black false tooth. It was not a case of *nolad*. The woman was already beautiful, but the black tooth made her appear unattractive, and by removing it and replacing it with a gold tooth the unsightliness was removed as well. [4] It is remarkable that

the Talmud places such weight on the cosmetic status of the prosthetic, relying on its relative beauty to provide a basis for the *halachic* ruling.

The commentaries continue the discussion of the cosmetic status of the golden tooth. According to Rashi's teachers, a gold tooth was a source of embarrassment and would detract from a person's appearance. Therefore, the Maharsha asks: why was R. Yishmael's act of replacing the woman's fake tooth with a gold tooth an act of beautification or reduction of embarrassment? R. Yaakov Emden proposes two answers, one of which was that the tooth that R. Yishmael placed was not actually made of gold. It was made of silver, but the dental work put into fashioning the tooth was "worth its weight in gold". A silver tooth, as mentioned previously, is not considered a source of embarrassment. The other insight given by R. Yaakov Emden is that the woman's teeth were discolored and stained, and appeared yellow, and thus the gold tooth blended in perfectly. [4]

The commentaries offer further elucidation. The *Teshuvot Shoel Umeishiv* explains that originally the woman had an unsightly wooden tooth which caused her extensive embarrassment. In comparison, the gold tooth, although still not ideal, was an improvement and greatly reduced the embarrassment she felt. The *Teshuvot Rav Pealim* suggests a different resolution to this problem, saying that R. Yishmael fashioned the tooth out of white gold. White gold appears even more natural than silver, because it doesn't tarnish, and matches the natural color of teeth well. This would both beautify the woman and reduce her embarrassment. [5] The sages of the time were sensitive to human nature, realizing the effect the unsightly tooth could have on the woman's psychological well-being. Today, we are aware that improving dental aesthetics can psychologically affect the patient, resulting in improved confidence and self-esteem. [6]

Although prosthodontics is a relatively new field, evidence of aesthetic and cosmetic dentistry is clearly visible in the Talmudic literature, namely in *Shabbat* 65 and *Nedarim* 66. The commentaries show early insights into restorative dentistry, including the development of crowns, the usage of minerals in replacing teeth, and tooth decay. Additionally, the aesthetic nature of prosthodontics is discussed extensively in the Talmud, as the cosmetic status of the false tooth has *halachic* ramifications on various issues. The sages also are in tune with the positive psychological effects of improved cosmetic dentistry. These Talmudic sources provide the field of prosthodontics with important historical context, as well as display a significant contrast to the current advances of aesthetic and cosmetic dentistry.

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Don't Let the Dead Go to Waste: Autopsy and Jewish Law

By Gabriella
Ben Hutta

Inside the New York City Office of Chief Medical Examiner, a Latin inscription behind the reception desk reads: “*Hic locus ubi mors eam gaudet succurrere vitae,*” or “This is a place where the dead are pleased to help the living.” The Office of Chief Medical Examiner is responsible for investigating deaths that are deemed unusual or occur under suspicious circumstances such as crimes, accidents or suicides. Medical examiners provide a crucial service in a city where approximately 5,000 autopsies are performed per year to yield answers and a sense of closure to those affected by a sudden loss.

Post-mortem examination, or autopsy, is defined as the anatomical dissection of a deceased person to determine the manner and cause of death. Other objectives of post-mortem examinations include forensic medicine, study of anatomy and pathology by medical students, advancement of medical knowledge and retrieval of organs for transplantation. The dissection of human bodies for medical studies dates to the fourth century B.C.E. in Alexandria. Hierophilus and Hirsistratus were the first to dissect human bodies under the permission of King Ptolemy [1].

Historically, however, the ancient Greeks and Romans, as well as other ancient civilizations such as those in India, China and Syria, prohibited autopsy for religious reasons [1]. The subject of autopsy continues to draw polarizing views among Jewish thought leaders, citing religious arguments. Judaism argues for preserving the sanctity of the human body, thus the body of a Jew is to be treated with honor and respect even after death [2]. Early sources found in the Talmud deal with the subject of autopsy. More specifically, Jewish law identifies three prohibitions encountered when conducting an autopsy: the prohibition of delaying burial of the dead, the prohibition of *nivul hamet* (defiling the deceased), and the prohibition of deriving *hanaah* (benefit) from the deceased [3]. Even so, Jewish law allows for the performance of an autopsy in certain circumstances.

The need for immediate burial is found in Deuteronomy (21:23), in the case of a man who commits a crime that is punishable by death. After the criminal is executed and hanged, the Torah states, “His body shall not remain all night upon the tree, but thou shalt surely bury him that day” [4]. The Gemara (*Sanhedrin* 46b) deduced that such a requirement concerns all Jewish bodies, not only those executed by court. Furthermore, it is not only a positive commandment to bury the dead immediately, as it states, “Thou shalt surely bury him...,” but also, one who delays

in burial of the dead also transgresses a negative commandment, “His body shall not remain all night” [5]. Therefore, the performance of an autopsy would inevitably delay the burial and would result in an act of desecration that is biblically prohibited. However, under certain circumstances, it is permissible to delay burial if it is deemed that the deceased would have wished so. In other words, an autopsy that could potentially save the life of his/her relative is allowed since it is not considered degrading to the deceased [3].

Nivul hamet, the prohibition of degrading the body of the deceased, is discussed in the Gemara in *Bava Batra*. The Gemara discusses a boy who sold his father’s property and the son died soon after. The son’s inheritors claimed that the deceased had not reached adulthood and therefore the sale should be void, while the buyers argued that the deceased had reached adulthood and therefore the sale was legally binding. Rabbi Akiva was asked by the family of the boy whether it is permitted to exhume the boy’s body to look for physical signs of adulthood and establish the validity of the sale. Rabbi Akiva determined that such act would be *nivul hamet* and even further, that after death, signs of puberty change and an examination of the body would be inconclusive (*Bava Batra* 154 a-b). *Tosafot* explain that Rabbi Akiva provided the latter reason since there are cases in which an examination of the body would be acceptable. If the buyers requested to examine the body because they stand to lose money, an examination of the body would be permissible since their own money is more important to them than the desecration of the boy’s body (*Bava Batra* 154b). In other words, financial loss is a permissible reason to examine the body of a deceased according to *Tosafot* since it is not considered *nivul hamet*.

The prohibition of deriving any kind of *hanaah* from a Jewish body is found in the Gemara (*Avoda Zara* 29b). Routine autopsies are prohibited since no benefit should be derived from the deceased. Others argue that gaining knowledge from viewing, dissecting and analyzing the body of the deceased does not fall under the classic form of *hanaah* since no physical or monetary gain is derived. Furthermore, it is argued that knowledge derived from the performance of an autopsy is not tangible, concluding that routine autopsies are permitted [3].

Violations of the three prohibitions mentioned above would only be acceptable in the case of *pikuach nefesh* (life-saving situations). According to the Gemara, violation of the Torah in order to save the life of another Jew is allowed (*Sanhedrin* 74a). Most *poskim* allow autopsies in

cases of *pikuah nefesh*, such cases include: epidemic/new diseases, familial/genetic illness, experimental therapies, and forensic medicine. Other cases that do not fall under the category of *pikuah nefesh*, such as financial loss for non-family members, the need to identify the deceased to allow a widow to remarry, and for the study of medicine in Israel could also be permissible [3]. In addition, some conclude that procedures routinely performed on live patients are not considered *nivul hamet* and can be performed on the deceased. However, the *Noda Bijebudah (Yoreh Deah 21)*, argued that when there is no *choleh lefanenu* (present patient), it is not a case of *pikuah nefesh*. All in all, it is a common consensus that when an autopsy is deemed necessary, it

must be performed with the utmost dignity and in the appropriate manner.

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The Historical Evolution of the Perceived Liver as Evident in the Bible, Talmud, and Rabbinic Literature

By **Tehilla Berger**

Since the times of Tanakh, the liver has been credited as one of the most essential mammalian organs. Although the term ‘**כבד**, liver,’ only appears 14 times in the Bible, with the first 11 referencing sacrificial offerings, the liver takes on a fascinating and multifaceted connotation. The very word, **כבד**, literally defined as heavy, identifies the organ as the largest one in the body. While we classify skin as an organ, and thus, it surpasses the liver as the largest, the liver remains the biggest internal organ, which, in the average adult, amounts to three pounds. The three scriptures that reference the liver outside the context of offerings seem to indicate that liver’s essential role is in its residence’s emotional and cognitive behaviors. Interestingly, the leading scientific theory as depicted by Galen in the first century CE identified the liver in a synonymous nature to the modern-day symbolism of the heart—delicate, indispensable, and the location from which love stems [1].

The first reference chronologically is in *Mishlei* 7:23, written by King Solomon at the outset of the first Temple period. King Solomon illustrates the capacity of a seductress to seduce, and the negative, catastrophic consequences that their illicit relationship will ensue, namely tormenting heartbreak, and ultimately, death. The euphemism used to highlight this is that of an arrow splitting a liver, which is paramount to a bird scurrying into a trap that will take its life. The liver here connotes the center of emotion, which can torment its host to the extent that it may cost it its life.

כבד is next mentioned toward the end of the first Temple period, entrenched in the poetic prophesies of *Yechezkel*. In *perak* 21, *pasuk* 26, the scripture foretells the destruction, in which the Babylonian King *Nebuchadnezzar* debates whether to attack the Jerusalemites or the Ammonians. As he stands, metaphorically, at the head of a pronged road, he turns to magic to help discern the more successful pathway by asking his idols to help him ‘see in the liver.’ In Mesopotamia, pagans often employed the sorcerous means of inspecting an animal’s liver as a means of divination. The liver, therefore, represented the will of God, and thus, by extension, connotes the cognitive ability of mankind [2].

The last mention of **כבד** in the Bible can be found in *Eicha* (2:12), whose authorship is often attributed to the prophet *Yirmiyahu*, which depicts the torment of the individual who experienced the destruction of the First Temple in 422 BCE. In doing so, it describes an individual whose eyes can bear no more tears, as he senses his liver pouring to the

ground and suffers the horrors destruction that has befallen his nation. Here, the liver is synonymous to the colloquial use of the heart, and is the home of emotion.

As we progress in history to year 500 CE, we find a depiction of the liver in the Talmud, whose scientific nature is remarkably congruous to that of present day science. *Bechorot* 55a states that the liver is the source of the blood. At first glance, it appears that the *Tannaim* mistook the liver for the heart, but upon further investigation, it seems that the Torah scholars of the Sixth Century CE had a deep insight into human anatomy. One of the primary functions of the liver is its ability to break down red blood cells. As a result, at any given moment, the liver holds over thirteen percent of the body’s blood supply. Over a pint of blood passes through the liver every minute [3].

One of the unique, miraculous characteristics of the liver is its ability to regenerate itself. This remarkable quality was first confirmed in 1894 by German scientists, who discovered that even when close to ninety percent of the liver has been removed, it could still metamorphize back into its original size, form, and function [4]. This quickly morphed into the lifesaving hepatectomy procedure, which allows a partial removal of the liver to instigate a complete recovery in a patient. This procedure circumvents many of the medical and pragmatic difficulties which organ donation poses, and was thus revolutionary. Astonishingly, this procedure was not popularized until as recent as the late 1950’s [5]. Remarkably, the Talmudic sources seemed to have ascertained a phenomenal comprehension of the liver’s ability so regenerate over a millennium and a half prior to this discovery. Equally astonishing, our Talmudic scholars had a very accurate understanding of the anatomy of the liver itself, as well as its placement amongst the other bodily organs. The liver is situated underneath the diaphragm, as well as in close proximity to the stomach, duodenum, and right kidney. Significantly, the liver has ligaments connecting it to the diaphragm, as well as bile ducts connecting it to the duodenum [1].

The *Mishna* in *Chullin* 46a deems which types of ailments would constitute an animal a *tereifah*, a classification of animals that are prohibited to consume because the animals are sick, and as a result of their illness or incapacity, will die within a determined period of time. Such animals, perhaps for health reasons, are forbidden to be consumed by Jewish Law. One such animal has an ailment such that it is missing

the entirety of its liver. The requisite of the totality of the liver removed implies that should any piece of the liver remain, the consumption of such an animal is permissible. Hypothetically, even a minuscule amount liver remaining would be enough to regenerate the entirety of the liver, and thus the animal would be Kosher for consumption, as it has a probable chance of survival. The *Gemara* then proceeds to challenge this statement, and provides a stricter classification as to how much of a liver must be present, and concludes that a *kezayit*, the size of an olive, must be present to render the animal permissible. *Rashi*, an eleventh century commentator, explains that it seems that the essential point of contention is how much of the liver must be present to induce its regeneration, immediately inferring this unique quality of the liver that scientists would only discover close to a century later. *Rashi* further explains that *Rabbi Shimon*, who did not require a *kezayit*, essentially believed that even a minuscule remainder of the liver can induce regeneration, while *Rabbi Chiyah* believed a more substantial amount would be necessary. The *Gemara* elaborates and gives credence to *Rabbi Chiyah* who required an olive size portion, a *kezayit*, in two locations: one in the place of the bile, and one in the place of the 'חייה' life.' This location is subjected to alternate explanations by the *Rishonim*. *Rashi* understands that the word choice implying source of life implies that we require a *kezayit* in the place the liver is attached to the body. He offers two hypotheses as to where this might be, the first being the kidney, and the second being the diaphragm, both of which have elements of truth to them. Interestingly, other medieval commentators, such as the *Rambam* (*Shicheta* 8:21), *Beit Yoseph* (*Yoreh Deah* 41:1), *Tur* (*Yoreh Deah* 41:1), and the *Perusha* (*Shicheta* 8:21) pick up on the connection between the diaphragm and the liver, and point out that *Rashi's* interpretation of the kidney is biologically false. The *Rambam* reiterates the necessity of the liver's connection to both the bile and the diaphragm, stating that even in an instance where the entirety of the liver is intact, besides for these two locations, the animal would be considered a *treifah*, thus prohibiting its consumption. Thus, both the *Gemara* and its interpretation by our Scholars highlight a truly remarkable discernment of the liver, especially in contrast to the ancient secular perception of the liver, which was depicted as feeble and delicate [1].

The third context in which early Rabbinic literature has fascinating insights into the anatomy of the liver is in reference to *Brit Milah*, in which, although it makes no direct reference to the liver itself, it relies heavily on modern day medicinal properties related to it. According to Jewish tradition, we perform a circumcision on the eighth day of a male child's life, symbolically marking his inclusion on the covenant between God and the Jewish people. Over the history of the Jewish people, and in particular in recent history, this custom has been subject to much scrutiny, particularly about the morality and safety of performing a

small surgery on a child for religious purposes.

Fascinatingly, the Rabbis were particularly concerned with the health of the child, and as such, even a small concern of an ailment would constitute enough of a reason to push off the *Milah*, until the child's health could be confirmed.

One such concern mentioned already in the Talmud is the color of the baby. Should the baby appear 'greenish,' presumably a condition of infant jaundice, the baby should not be circumcised (*Shabbat* 134a). Newborn jaundice is a condition in which infants appear yellow, due to abnormally high levels of bilirubin. Bilirubin is used when the body regenerates red blood cells, and is processed by the liver and subsequently emitted in stool. Because babies' livers are not completely developed, they may not be sufficiently processing the bilirubin, resulting in a yellow color of some babies' skin [6]. Should a baby display symptoms of this condition, the family must wait until the baby's countenance returned to a natural color, and only then should the circumcision be performed. Interestingly, the rationale proposed for jaundice is that the baby's blood had not yet 'fallen.' Here, the Rabbis illustrated a surreal insight into the origin of the disease, as the yellow color of jaundice is directly correlated to red blood cells.

Interestingly, the *Rishonim* and *Acharonim* interpret the causation of the disease in a facet that diverts from the modern understanding of the liver more than the Talmud itself did. For instance, the most basic commentator on Talmud, *Rashi*, interprets the blood 'having yet to fall' as the blood having yet entered the infant, and as a result of a limited blood supply, the child would be weak and at high risk of death. While *Rashi* may have had an accurate understanding of the dependency of human life on adequate blood supply, his interpretation of jaundice seems to deviate from our modern day understanding of the disease. Similarly, the *Tur* (*Orach Chaim* 263:1) interprets the green appearance of the baby to be a result of the child's blood levels being abnormally high. The *Tur* here reiterates a fundamental *Halachik* principal in Judaism, that any form of skepticism which relates to human lives of human kind override any custom or tradition. While traditions, such as a *Brit Milah*, may be performed at a later point, a lost life can never be returned or replaced, and as such, is of superior significance to all else. It is thus essential that people take all precautions necessary, including pushing off a *Brit Milah* in a case of infant jaundice. In contrast, the *Rosh* understands the green color to be a manifestation of blood that has yet to be absorbed. Interestingly, he provides the same rationale for an infant that is unusually red, while other commentaries view a 'red' baby as one with the inverse condition of infant jaundice. The *Rosh*, a 13th Century *Rishon* from central Europe, (*Shabbat* 134a) relays a tragic incident, in which a woman lost two sons after circumcising them erroneously when they were ill. The third son had a greenish complexion, and the *Rosh* forbid him from being circumcised until his color had reverted to

that of a healthy infant, and thus assumedly saved the child's life.

The *Bach*, a 17th century *Acharon* famous for his commentary on the *Shulchan Aruch*, differentiates between infant jaundice and other life threatening ailments. Should the green color disappear by day eight, the *Bach* claims that even the *Rambam* (*Milab* 1:17) would require that the *Milab* be given on that day. He understands that infant jaundice, while being a serious enough condition to push off a positive commandment if present and visible, is only a temporary ailment, and thus, once the symptoms disappear, the danger has been alleviated. However, in a situation where the infant suffered from a more serious ailment, a grace period of seven days is required before the *Brit Milab* is allowed to be performed. The *Bach* here, while perhaps not giving a sound reason for the green color, depicts an accurate representation of the severity of infant jaundice, noting that once there is no visible evidence of it, the danger has passed. The *Beit Yosef* reiterates this phenomenon, stating that as long as the child is green, a *Brit Milab* should not be performed, implying that as soon as the symptoms are no longer observed, one should not push off the positive commandment.

The *Peirusha* (*Rambam Milab* 1:17), a Polish *Acharon* in the late 16th century, gives a plausible explanation as to how

‘the blood has yet to fall’ translates into a greenish condition that would classify as jaundice. He explains that the pale, lack of color is due to a blood deficiency, as the blood has yet to ‘gather’ on both the insides and outsides of the body. He explains the foil condition, that of an unnaturally red baby, is a situation in which the blood of the baby is in the external layers of the skin, and cannot permeate into the body. True, this explanation may fail to recognize the function of the circulatory system with the heart at its center, but it is noteworthy that this essential medicinal breakthrough only formally discovered by William Harvey in the second quarter of the 17th century. Despite this, however, the *Peirusha*, like so many of our Torah scholars, manages to propose reasoning that, with the lack of knowledge of basic scientific principals and anatomy, far surpasses its era [7].

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A Sound Body is a Sound Mind: A Connection Between Religious Observance and Mental Health

By Jordana
Gross

“Six days shall work be done, but on the seventh day there shall be to you a holy day, a Sabbath of solemn rest (Exodus 35:2).” In this instance, God commanded the Jewish people to rest on the seventh day. Human beings work diligently, whether as students or in the professional world, for six days a week. God knew this and therefore gave us a much-needed respite through the day of rest, otherwise known as Sabbath. Sabbath is a day where Jews are given the opportunity to relax and, quite literally, take a breather from the mental and physical toll of the week. Even more so, it is conceivable that Sabbath could go so far as to improve one’s mental health.

Sabbath begins with the ceremonious lighting of the candles during sunset on Friday evening. As a whole, it is a day dedicated to study, prayer, non-work related thought, and the coming together of family and friends. Those who observe it believe it to be the best day of the week because it is time where everyday problems are pushed aside and is also an opportunity to reflect [1].

Sabbath was recently proven to psychologically benefit religiously observant Jews in a study done in England. The study had a very small sample size, seven males and six females, but, nonetheless, it was most informative about the mental benefits of observing Sabbath. The participants were asked questions about their personal experiences in observing Sabbath, such as if they felt differently during Sabbath as compared to weekdays, if they felt Sabbath benefited their wellbeing, and if it influenced their relationships with their friends and family. The responses overall portrayed a positive correlation between Sabbath observance and emotional well-being [1].

A number of encouraging results emerged from this study. It reinforced that Sabbath is a time where religious Jews are given the opportunity to disconnect in order to connect, so to speak. It is an incredibly special twenty-five hours in which they can remove their focus from their weekday issues and can concentrate on improving their relationship with God. This in turn can enhance one’s mental health. Additionally, if observed to the letter of the law, electronics are prohibited on Sabbath, granting the chance to “think about deeper matters than during the rest of the week” [1]. Lastly, Sabbath is linked to strengthening of familial relationships and friendships. Friends and family come together during this precious time, to eat meals together or

relax together on long afternoons. The topics of discussion vary from the *Torah* (Jewish Bible) to politics. Regardless of the topic, these conversations allow family and friends to talk, share, laugh, and grow closer to one another during this relatively short twenty-five hour period. Sabbath is a ritual that allows for the deepening of relationships and creates an environment and outlet for emotional expression, which is quite rare during the busy week. Sabbath can effectively create a sense of community amongst the people who observe it. All of these factors support that one’s emotional stability can benefit from Sabbath [1].

Sabbath is not the only Jewish custom that has been scientifically proven to boost one’s mental health; a *minyan* can also be seen as a psychological support group. A *minyan* is a Jewish congregational quorum of at least ten males aged thirteen and over, that is required for daily prayer and for other important aspects of public worship. Amongst the prayers is the recitation of *kaddish*, a prayer for the deceased, said by individuals mourning a lost loved one, that praises God’s holiness and His fostering of peace. This *minyan* can be seen as an indirect support system, especially to those in mourning. Suppose there is a young boy who lost his father in the Holocaust. At fourteen, old enough to join a *minyan*, the men in this group would take him under their wing. They would shower him with love and attention that he could no longer get from his father. He is now able to grow up with masculine role models and to develop self-esteem. Without intentionally doing so, this *minyan* became a support system [2].

A *minyan* can be understood as a psychological group because “it combines elements of group dynamics with elements of a support system [2].” Group dynamics are defined by common goals, structure, and shared themes that emerge as the product of interactions between members of the group. A support system is seen as “continuing social aggregate that provide individuals with opportunities for feedback about themselves and for validation of their expectations about others; in such relationships, the person is dealt with as a unique individual. The other people are interested in him in a personalized way. They speak his language. They tell him what is expected of him and guide him in what to do.” A *minyan* exemplifies both of these aspects [2].

Additionally, a *minyan* sustains the mental health of individuals. Like a support group, a *minyan* gives its participants the chance to accept their own individuality, while being a part of group that has a common belief. Also, preliminary research has shown that synagogues have the unique ability to provide “mental health sustenance” to its members [2].

Overall, participating in a *minyan* is beneficial for its members. It provides people with the group support they may not realize that they need and a sense of meaning in life. “In addition to the gratification of social hunger and the countering of loneliness and of isolation, this group experience helps its members maintain an intergenerational sense of personal identity and of self-esteem [2].” The young and the old all come together approximately three times a day and form bonds and relationships with one another. Men aged from as young as thirteen to eighty- five all pray to God as one united voice.

Religious observance affects physical and mental health to the point where scientific mortality rates are defied. Bnei Brak, Israel’s most religious city, has the highest average life expectancy of both men and women in Israel. All the while, Bnei Brak is also the poorest city in Israel, which completely rejects the common notion that wealth and longevity are positively correlated. Despite the fact that many of the men smoke, their diets are poor, and exercise is not common, the residents of Bnei Brak still live long lives. The reason behind this longevity may be due to religious observation and to *Torah* study. The occupations of men in Bnei Brak revolve around Talmudic study. For most of their lives, they learn *Talmud* (the oral law) and *Torah*. They spend their days and nights arguing over the correct way to interpret the oral and written law. This constant mental stimulation provided by *Torah* learning may be the substance maintaining their mental health, which thereby may sustain their physical health as well [3].

Many studies have recently proven that there is a directly proportional positive relationship between religious observance and physical as well mental health. A recent study at Duke University stated that it is less probable for those who attend religious services once a week to have elevated blood levels of interleukin-6, found in many forms of cancer. Additionally, another study found that religious patients who were supported by their observant community were fourteen times more likely to survive their illness. Lastly, it was seen that patients with acute heart disease for whom people prayed, fared better than those who did not have anyone praying on their behalf. Based on these facts, it is quite conceivable that religion and prayer can positively affect one’s physical health, either by its own merit or through the medium of one’s mental health [3].

In the Friday evening Sabbath Prayers it states, “Come my beloved to meet the Sabbath bride” [1]. From this, we learn that we are supposed to treat the holy Sabbath like a bride. How do brides make their grooms feel on that very special day? They feel overjoyed, loved and relieved to have found someone to share the rest of their days. Being married, whether to Sabbath or to an actual person, can improve the quality of one’s mental health and overall happiness. In addition to the observing the Sabbath, being a member of a *minyan* and a religious, observant community can too contribute to enhancing one’s life. “Those who already possess faith will not be surprised that following God’s instructions turns out to be good for you” [3].

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Ancient Maladies: An Exploration of Disease and Pathophysiology in Tanach and in the Talmud

By Ariella Kerendian

Scurvy, a disease caused by the lack of sufficient vitamin C, is characterized by bleeding of the gums. During the 18th century, scurvy surfaced as a pathology affecting poorly nourished sailors who spent many months aboard a ship without a dietary source of vitamin C. Although rare in the United States, scurvy affects the elderly and infants whose diets are deficient of vitamin C rich foods such as fresh fruits and vegetables due to economic or social reasons [1].

Primary symptoms of scurvy include irritability, tenderness, bleeding, fever, and rapid breathing. As the disease progresses, secondary symptoms involve bleeding of the gums and loosened teeth. Treatment for scurvy is relatively easy, as patients are administered vitamin C either orally or by injection. Additionally, vitamin C supplementation pills or eating foods with high concentrations of vitamin C, such as lemons, oranges, guava, broccoli, and bell peppers is also recommended for treatment and maintenance. Interestingly, animal meat also has a high concentration of vitamin C, so consumption of muscle and liver are also used to treat scurvy. However, because cooking destroys vitamin C, lightly cooked meat provides the most health benefit [2].

Scurvy was the most common pathology that affected sailors while traveling long voyages at sea. During the 18th century, scurvy killed more British sailors than their own enemies. Although citric fruits and vegetables were supplied on board the ships, the produce either spoiled due to lack of refrigeration or the supply was insufficient for the long trips. Evidently, the connection between scurvy and the consumption of citric fruits and vegetables was eventually recognized. To provide fruits and vegetables for its sailors, the Portuguese established a stopping point where they planted fruits and vegetables to restock the ships and to send home to those who developed scurvy.

However, the connection between proper nutrition and scurvy was not appreciated by physicians of that time. From the 13th to the 18th century, many physicians did not believe that the cure for scurvy was the consumption of citric fruits and vegetables. Instead, they incorrectly assumed that faulty digestion induced by the hardships of life on the sea was the factor that caused scurvy in sailors.

Evidence that the consumption of citrus fruits and vegetables was a preventative factor to scurvy was established in the 1760s James Cook, a British explorer and navigator. He was able to successfully voyage around the world due to both the cleanliness of his ship and the constant replenishment of fruits and greens, which

prevented his sailors from developing scurvy. Additionally, in the 1790's a Spanish naval officer, Alessandro Malaspina, made a 56-day sea journey without having any of his sailors developing scurvy. Malaspina correlated the lack of scurvy with the consumption of oranges and lemons. Convinced these fruits were essential to prevent scurvy, Malaspina, with assistance from Spain's large empire, created many ports for sailors to acquire fresh fruit [3].

In 1747, Scottish physician, Dr. James Lind experimented and thereby identified an efficient and effective cure for scurvy. He provided 12 patients with garlic, vinegar and lemons. He found that the consumption of garlic had no effect on scurvy, the vinegar yielded a slow recovery from scurvy, but the consumption of lemons worked quickly and efficiently to eliminate scurvy. After this discovery, it was common for sailors to travel with crates of lemons and lemon juice before departure, hence the term 'limey' for British sailors. As mentioned earlier, the British explorer James Cook was most notable for never losing a passenger or a sailor to scurvy [4].

In Talmudic times scurvy was known as *tzafdinah*. Great Rabbis in Jerusalem and Babylonia dealt with this disease, which manifested as abnormalities in connective tissue responsible for a normal build (Avodah Zara 28a). In the Talmud, *tzafdinah* is characterized by bleeding of the gums (Genesis Rabbah 33:2, 96:2). Today, it is known that vitamin C is important for the formation of bone and connective tissue. Successfully, Rabbis were able to identify a cure for this illness, which existed in their villages. In the Talmud, *tzafdinah* is characterized by bleeding of the gums (Genesis Rabbah 33:2, 96:2). Rashi explained that *tzafdinah* is a life threatening disease, which originates in the mouth and terminated in the intestines; in essence it was described as a sickness of the teeth and gums (Avodah Zarah 2:2). Rabbi Judah, one of our sages was affected and suffered by *tzafdinah* for seven years. Another case in the Talmud (Yoma 84a) notes that Rabbi Yochanan too suffered with *tzafdinah*, which was described as a sickness of the teeth. Rav Yochanan agreed to take medicine on Shabbat, proving that the disease was in fact hazardous, and therefore is allowed to be treated on the Shabbat [5].

The Talmud states that the contributing factors for *tzafdinah* include eating cold wheat, hot barley, or fish left overnight. Intriguingly, one of the suggested ways to treat this malady was to ingest a mixture of olive oil or to place

burned, unripe olive seed ashes between one's teeth [5]. Modern scientific research explains this idea from the Talmud by showing that strains of the bacteria, *Mycobacterium tuberculosis* and *Treponema pallidum*, can cause mouth sores, perhaps explaining why the Talmud is concerned about eating fish that has stayed out overnight. For the immune system to work properly, the body needs an adequate supply of vitamin C. If vitamin C is lacking, the body is vulnerable to bacterial infection, which may lead to mouth sores and progress to scurvy. The connection between grain products and *tzfadinah* also may focus on the immune system, as there is a protein in gluten that the immune system recognizes as foreign, causing mouth sores to develop [6]. The Talmud also notes the curative properties of olive oil. Recent research has shown that olive oil contains cyclooxygenase as an anti-inflammatory agent. The mouth sores indicative of scurvy may result from mucous inflammation which can be treated by olive oil or the ashes of burned olives placed in between the teeth, just as the Talmud described [7].

Nevertheless, scurvy should not be viewed as merely a dental issue. Its initial symptoms include weakness, fatigue, and sore legs and arms. However, without vitamin C treatment, a reduction in red blood cells gum disease, loss of teeth, and bleeding from the skin may become apparent. As the condition worsens, poor wound healing and death from infection may ensue [8].

The Mishna Yoma (8:6) discussed life-threatening illnesses and the proper measures for their treatment on Shabbat. The Talmud (Avodah Zara 28a) states that Shabbat can only be violated for an 'internal affection'. The word

'internal' is outlined as "anything from the lips and inwards". Rabbi Matthia ben Cheresch discussed that if one has pain in his throat, he is permitted to take medication on Shabbat because there is a possibility of danger to human life, and every danger to human life overrides the laws of Shabbat. Maimonides (1135-1204) understood this as referring to treating rotting gums, which progressed to rotting of the palate, creating a life threatening illness [5].

Today, we know that in order to protect ourselves from scurvy vitamin C must be consumed every day. Ingestion of vitamin C containing products eliminates the symptoms of scurvy within two or three days. Citric fruits and vegetables are recommended. In the time of the Talmud, a potential source of vitamin C was the consumption of an *esrog* (citron) (Abodah Zarah 76b). An *esrog* was used for medical purposes in the medieval times to prevent seasickness, scurvy, and other disorders. A citron has high vitamin C content, explaining its efficacy for treating scurvy. With the geniuses of the Talmudic sages, experienced sailors, and physicians, scurvy's life threatening gum disease is a thing of the past.

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The Mitochondrial Replacement Theory in Jewish Law

By Tova
Lejtman

The mitochondrion, an organelle found in every cell of the body is widely known as the powerhouse of the cell. The main function of the mitochondrion is to convert glucose into ATP, a form of useable chemical energy, by the process termed aerobic cellular respiration. During this process, molecular oxygen is chemically reduced to water. As ATP is crucial for normal cellular functioning, a lack of oxygen prevents glucose from being transformed into energy and ultimately leads to cellular death. Each cell has hundreds to thousands of mitochondria, with more mitochondria present in cells of muscle tissue and of nervous tissue. During the process of cell division, the parent cell transmits its mitochondria to its two daughter cells. An important feature of the mitochondrion is that it has several copies of its own DNA, called mitochondrial DNA (mtDNA), which has a genome of 37 genes. MtDNA primarily codes for proteins needed for aerobic cellular respiration [1].

Just as mutations occur in nuclear DNA (*i.e.*, the DNA of chromosomes), genic mutations also occur in mtDNA. As a person ages, genic mutations accumulate in mtDNA, and there is increasing evidence that the accumulation of mutations are involved in several chronic age-related diseases, such as diabetes, cardiovascular disease, and Parkinson's disease. Furthermore, accumulation of genic mutations in mtDNA may cause various energy-dependent diseases, which cause symptoms such as deafness, blindness, and muscle weakness [1].

MtDNA-based diseases are said to exhibit maternal inheritance, as mitochondria are derived only from the mother. A sperm cell consists of three basic regions: the tail or flagellum needed for movement, the middle portion containing the mitochondria which synthesizes ATP, which is used as the energy source for movement, and the head region containing the haploid number of chromosomes. Upon fertilization, only the head of the sperm cell penetrates the egg, thereby introducing its 23 chromosomes which find the 23 chromosomes of the egg and restore the diploid number of 46 chromosomes, which is characteristic of human beings. Interestingly, in the process of fertilization, the sperm's middle piece and tail do not penetrate the egg. Therefore, the mitochondria in the fertilized egg, the zygote, are derived only from the mother. Thus, genic defects in mtDNA in the male are not transmitted to his offspring. Mitochondrial-based DNA diseases are transmitted solely from the mother to her children, hence the term "maternal inheritance" used to describe transmission of such diseases [1].

Without some type of intervention, damaged mtDNA in the mother may be transmitted to and adversely affect her children. Thus, various preventions, procedures, and interventions are being researched to help these women to have healthy children. One of the possible protocols considered is mitochondrial replacement therapy. The first step of this therapy is to obtain an egg from a woman donor without a mitochondrial disease and remove its nuclear DNA, leaving the cytoplasm with the healthy mitochondria. An egg is then obtained from the woman with the damaged mitochondrial DNA, and its nucleus, which contains the chromosomal DNA, is transferred to the enucleated donor egg. The reconstructed egg then contains healthy mitochondria (from the egg donor) with the nuclear chromosomal DNA of the mother. The egg is then fertilized with sperm of the husband, placed into a Petri dish to allow for initial development, and implanted into the uterus of the woman destined to be the mother of a child free from an mtDNA-based disease [1].

Outside of the United States, this type of therapy started in 1996 and since then 17 children were born. Genetic testing confirmed that these infants had mtDNA from the donor's enucleated egg and chromosomal nuclear DNA from the woman with the mtDNA-based disease. Obviously, these babies contained chromosomal nuclear DNA from the father. Hence, such babies were called "three-parent babies." In 2002, the Food and Drug Administration banned this procedure in the United States, as there were several genetic side-effects such as Turner Syndrome. In response, a group of scientists in Oregon in 2012 created a dozen human embryos in the laboratory using genetic material from two women and one man and announced that they were waiting for government approval to implant them [2].

This recent discussion of mitochondrial replacement therapy presents several *halachic* and moral issues. Firstly, akin to surrogate motherhood, this "three-parent" procedure questions the maternal identity of the child. After mitochondrial replacement, is the donor of the enucleated egg with its healthy mitochondria the mother of the child or is the donor of the nuclear chromosomal DNA the mother of the child? Perhaps, both are the mothers of the child. Based on *Tosfos's* understanding of *Sotah* 42b, according to Rabbi Yochanon, Goliath was a child with more than two parents. The *Gemara* states, "And a champion [*ish ha-beinayim*] went out from the camp of the Philistines" (*Shmuel I* 12:23). What is the meaning of "*beinayim*?"... Rav Yochanon said, "He was the son of a

hundred fathers and one mother.” *Tosfot* understands that Goliath’s mother consorted promiscuously with a hundred Philistinian men and each one was quite literally Goliath’s father. *Tosfot* further explained that as long as sperm remains in the genital tract, potentially multiple sperm can penetrate a single ovum (polyspermy). Presumably, multiple sperm penetrated the ovum to produce the zygote, which later became Goliath. Goliath’s birth is considered an exception and a phenomenon, as generally one sperm penetrates the ovum. Although polyspermy is known in humans, such fetuses are not viable and are not carried to term. *Tosfot*’s interpretation, however, explores the idea of a child possibly having multiple fathers. If so, there is “no logical reason why such a possibility could not also be entertained with regard to multiple mothers” in the words of Bleich [2].

Although according to *Tosfot*’s explanation of *Sotah* 42b, it is possible to have multiple parents, their statement should not be perceived as an approval of multiple parents. The Talmud’s view is antithetical to that theory; it actually denigrates Goliath’s mother and the Philistine men. Judaism emphasizes the importance of having one mother and one father, and thereby the ability to trace one’s heritage. The Torah (*Bamidbar* 1:18), when enumerating the numbers in each tribe, used the word “*va-yiyaldu*” which means “and they gave birth to themselves.” *Rasbi*, quoting the *Sifri*, explained that they declared their heritage and brought witnesses who testified of their birth and genealogy. Further, the *Mishnah* in *Yevamot* 41a noted that a previously married woman cannot enter a new marriage until three months have passed since the termination of her previous marriage, because at that point it is clear that, if she was pregnant, her previous husband was the father of the child. This waiting period is to avoid ambiguous lineage of the child. *Yevamot* 42a noted that this three month waiting period also applied to a male and a female convert who were married prior to their conversion. Marital relations can be resumed only after this three month period so that it can be ascertained whether she was pregnant prior to conversion. As is evident from these examples, the Torah is very careful to ensure that a person has distinguishable lineage. In this latter case, the question of lineage is not in doubt, but rather whether the child was conceived prior to conversion and born afterwards. These two examples underscore how Judaism stresses the ability to establish and identify with certainty the parental and familial connections. Therefore, although the concept of multiple parenthood is discussed in the Torah, it is definitely neither encouraged nor promoted [2].

In the case of Goliath, who had multiple fathers, the question of lineage was not an issue. However, with mitochondrion replacement therapy, it is necessary to identify who the mother is, as there will be questions regarding the donation of eggs. The *Mishnah* in *Yevamot* 97b

described a gentile woman, who was pregnant with twin boys and had converted mid-pregnancy. The twins were conceived when the woman was a gentile but were born when she was Jewish. Even though the twins were conceived when the woman was a gentile, they are considered maternal Jewish brothers since their mother was Jewish when she gave birth to them. This case in the Mishnah establishes that parturition establishes motherhood. Applying this principle to mitochondrial replacement therapy, the source of the mtDNA or the chromosomal nuclear DNA is not relevant: the women that gave birth to the child is its mother [2].

There is a fascinating *aggadic* proof of this concept. Leah was aware that Yaakov would father twelve sons. Leah had already birthed six sons, while the two maidservants each had birthed two sons, and Rachel was the mother only of one son. Bleich noted that one commentary noted that Leah and Rachel both became pregnant Leah with a male fetus and Rachel with a female fetus. Leah prayed as she did not want Rachel to have less sons than the maidservants. Her prayer was answered and miraculously *in utero* fetal transfer occurred: the female fetus, later named Dina, moved from Rachel’s womb to Leah’s womb and the male fetus, to be named Binyamin, moved from Leah’s womb to Rachel’s womb. Dina was genetically Rachel’s child and Binyamin was genetically Leah’s child. However, emphasizing that the birth mother is the *halachic* mother, in the Torah (*Bereishis* 30:21) Dina is described as the daughter of Leah [2].

Mitochondrial replacement therapy poses significant risk to the potential fetus. Dr. Jaques Cohen stated that such invasive procedures resulted in “pervasive development disorders” [3]. There are numerous legal and social debates about the potential harm to the unborn child caused by this procedure. The *Gemara* in *Yevamot* 64b declared that, “A person should not marry a woman from a family of *nikepin* or a family of *mesora’im*.” The Sages regarded these hereditary diseases, which would be transmitted to offspring, as detrimental. In the discussion of the ethics, Rabbi Bleich added “there is absolutely no obligation to harness use of heroic or artificial measures in the genesis of life” and one cannot justify emotional pain to “impos[e] congenital burdens upon the yet to be born” [2]. However, as technology improves and health risks to the unborn decrease tremendously, mitochondrial replacement trials have begun. Dr. John Loike and Rabbi Dr. Moshe Tendler concluded that *halacha* permitted women to engage in mitochondrial replacement clinical trials to have healthy offspring [4].

Through participating in these trials, Jewish women take upon themselves a social responsibility. Furthermore, through these clinical trials, Jewish women carrying defective mtDNA have the chance to produce healthy offspring. Mitochondrial replacement therapy is a procedure

that is constantly developing and evolving. As the research progresses, many *halachic* views may arise regarding this issue, necessitating consultation with a *posek* on an individual basis.

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In Genesis 2:7, it states, “And God formed the man of dust from the ground, and He blew into his nostrils the soul of life; and man became a living being.” Though man was formed from mundane, earthly matter, The Zohar, a work of Jewish mysticism, explains that the breath blown into man was blown from God Himself, thereby endowing Man with God’s divine essence. It is this soul that makes Man a living being, which Onkelos, a second century commentary on the Hebrew Bible, defines as a *speaking spirit*. Onkelos continues by explaining that a rational soul, which includes the ability to form intelligent speech, is uniquely human and is the defining factor that separates man from animal. Onkelos views this ability as a responsibility and sees it as an individual’s duty to use this intelligence in the service of God [1].

Prayer is a daily part of Jewish practice that involves the correct usage of speech, specifically when reciting the original biblical Hebrew. Rav Shimshon Pincus, a contemporary author of Jewish thought, explains that *lashon haKodesh*, the language of Hebrew, is regarded as extremely holy, so much so that every letter expresses worlds and reveals the depths of its subject matter [2]. Though speech may appear transient, Jewish theology describes its nature as something of unequivocal importance, and it is as such that there are rules regarding articulation of specific prayers. By understanding some of the *halachic* sources, sources of Jewish law, that involve proper articulation and how it relates to clinical phonetics, one can attain an appreciation for the wisdom inherent in the various texts and prayers.

In Maseches Megillah (24b), the Gemara, a work of rabbinic literature that often deals with the intricacies of Jewish practice, describes the blemishes that disqualify a Kohen, a Jewish priest, from blessing the people. These blemishes include those that can be found on one’s face, hands, or feet, as well as dialectal manner of articulation:

We do not send down before the ark to lead the prayers men from Beis She’an, or men from Haifa, or men from Tivonim because they pronounce and *alef* as an *ayin* and an *ayin* as an *alef*, and thus confuse the words of prayer.

Because part of the Northern Israeli dialect included interchangeable pronunciation of the vowels *alef* and *ayin*, Kohanim from such areas were disqualified. Such mispronunciation would change the meaning of critical words in the Priestly Blessing. Even though there are some individuals, particularly those of the Sephardic tradition, who maintain the difference in articulation, the Beur Halachah (53), Rabbi Meir Yisroel Kagan’s tangential commentary to the Mishna Berura, explains that today, most people do not produce these two sounds differently, and that, practically, such men may lead prayers [3]. Such

individuals pronounce the *alef* as /a/, the low back unrounded vowel, and *ayin*, in a similar fashion, but with an emphasis on glottal articulation, produced by building pressure behind the vocal folds before releasing air [4]. Though perhaps this exact pronunciation is no longer immediately relevant, nevertheless, the Gemara pays careful attention to nuances in and the importance of the manner of articulation.

Further, the Mishna Berura, a work of halacha written by Rabbi Ysroel Meir Kagan which deals with daily aspects of laws regarding Jewish life, clearly explains the *halachos*, laws, involved in the recitation of the prayer of *Shema* and cites common phonological errors that would likely occur with hasty speech. Simplification processes occur regularly in conversational speech and the Mishna Berura cautions those who speak in that way to be aware of this. The *halachos* of the recitation of *Shema*, an important Jewish prayer, include rules that mandate at which point in the recitation of *Shema* that one must pause so as not to change the meaning of certain words. Such examples include the mandated pause between the words *nishba* and *ad-onai*, so that the final consonant in the first word will not be deleted, and between the words *khara* and *af*, so that elision, which is the deletion of a weak syllable within a word or word combination, does not occur. In these cases, such simplifications would alter the meaning of the text to the point that, in some cases, one may unintentionally recite something heretical. Careful attention is also paid to the voicing of specific consonants as well, such as the /z/ in the word *tizkeru*; if devoiced and replaced with an /s/, the word pronounced would be *tiskeru*, which changes the meaning of the word from the imperative to remember to the imperative to lie or, alternatively, to be rewarded [5].

In a world that is constantly increasing its pace, Jewish theology reminds those who practice it to slow down and focus on detail. Dialects change over time and words can be slurred together in speech while still being intelligible, but there is value in proper articulation and pronunciation. The Jewish sages have left behind a legacy that reminds humanity of the elevated status it was endowed by the power of speech and the ability to use that speech to converse with the divine. Such a privilege is to be taken with utmost care and clarity.

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According to Biblical accounts, the Jewish Priesthood, known as *Cobanim*, was established about 3,300 years ago when the Israelites were traversing the desert towards Israel. Traditionally, *Cobanim* are direct descendants of Aaron, the brother of Moses, and are from the Tribe of Levi. The Jewish Priesthood continues today as a patriarchal lineage, as it says in Numbers, 25:13, "And it shall be to him [Aaron] and to his descendants after him a covenant of everlasting Priesthood." While it has always been tradition that the *Cobanic* title is passed from father to son, there is no specific physical distinction that distinguishes a *Coben* from a Levite or an Israelite. This lack of physical variation from one Jewish male to another has led to the conduction of DNA studies to confirm this ancient Biblical tradition.

Dr. Karl Skorecki, a *Coben* of Eastern European descent, stumbled upon the realization that there is a possible DNA relation between all *Cobanim*. Dr. Skorecki noticed that another *Coben* had joined morning services; a man of Sephardic descent with acutely contrasting physical features to his own. He realized then that there must be some underlying hidden trait that connects him to this man and in turn both of them back to Aaron. Dr. Skorecki hypothesized that since the title of Priesthood is passed from father to son, perhaps the connection between him and this Sephardic Jew is something that is only passed from father to son, the Y chromosome. [1]

The somatic, or body, cells of humans contain 46 chromosomes: 22 pairs of autosomes and one pair of sex chromosomes. In males, the sex chromosomes consist of a large X chromosome and a smaller Y chromosome, whereas in human females, the sex chromosomes consist of a pair of X chromosomes. Unlike most other chromosomes found in the human genome, the Y chromosome is transmitted only from father to son. The Y chromosome mainly contains non-coding protein regions with little homology with the X chromosome; thus, during gametogenesis there is little genetic recombination between the Y and the X chromosome. Because the Y chromosome remains essentially unchanged, any minor mutation within the non-coding sections of the chromosome persists generationally from father to son. One of the most significant mutations, unique-event polymorphism (UEP), is an allelic mutation that happens so infrequently that it can be used as a genetic marker. UEPs are usually found in a haplogroup, a combination of alleles that are linked and tend to be inherited together as a unit. Because UEPs are so infrequent and are typically inherited together, once the mutation occurs in one generation, it endures in the same family lineage for centuries. Therefore, if there is a specific UEP found on a Y-chromosome in the non-coding region, it is likely that

the mutation occurred in a past ancestor, and if other people worldwide have the same UEP, then they must have also descended from that same ancestor. [1]

To determine whether there is a commonality amongst all *Cobanim*, Dr. Skorecki, along with Professor Michael Hammer of University of Alabama, conducted a study to test their hypothesis. An experimental group of 188 Jewish males was composed, consisting of Israelites, Levites, and *Cobanim* from Ashkenazic or Sephardic descent. Of this sample population, 68 individuals were *Cobanim*. All subjects underwent a Y chromosome analysis through buccal cell DNA extraction. The scientists focused on two Y chromosome markers, one of which was the YAP sequence, to determine genetic commonalities between the experimental subjects. YAP in particular is a fairly new mutation sequence in human evolution and can therefore determine the historical ancestry of both an individual and population based on whether they are YAP+ or YAP-. [1]

The results of the buccal swab samples revealed that less than 2% of the *Cobanim* were YAP+, while more than 18% of the other Jews in the sample exhibited YAP+. The results were also studied based on participant geographical origins; whether they were considered Ashkenazi or Sephardi. Both Ashkenazi and Sephardi Jews displayed a 15-20% presence of YAP+, but neither Ashkenazi nor Sephardi *Cobanim* showed a YAP+ result. These results signified that the Y chromosome DNA of *Cobanim* is distinct from all other Jewish males. [1]

Dr. Skorecki and his fellow colleagues conducted another study in order to obtain more conclusive data for the distinction of the *Cobanic* Y chromosome. Dr. Skorecki, Neil Bradman, and David B. Goldstein increased the sample size of Jewish males to 306, in which 106 were *Cobanim*. The number of Y chromosomal markers tested was also increased from two to twelve. The data analysis revealed that 97 of the 106 *Cobanim* shared the same array of six chromosomal markers. This selection of markers was termed the Cohen modal haplotype (CMH), which became the genetic signature of Jewish Priesthood. [2]

The approximate date the polymorphisms occurred on the Y chromosome was also studied to determine the genealogical ancestry of *Cobanic* lineage. Differences amongst *Cobanic* DNA at microsatellites, DNA sequences that are repeated numerous times within the DNA, were investigated due to their ability to fluctuate from one generation to the next. If all *Cobanic* DNA has a similar amount of microsatellites, the polymorphism must have occurred recently in human evolution. However, if the number of microsatellites differ greatly amongst *Cobanic* DNA, then the *Cobanic* Y chromosome must have been established a long time ago. Based on mathematical

calculations derived from the number of microsatellites mutations of the *Cobanic* DNA samples, Dr. Skorecki and colleagues determined that the *Cobanic* Y-chromosome was established about 2,100 to 3,250 years ago - about the time Jews traditionally believe Aaron and his family were given the privilege of the Jewish Priesthood. [2]

However, despite the discovery of CMH, other researchers identified faults in Dr. Skorecki's results. It was determined through other studies that some of the UEPs that characterize the CMH are found in low resolution in certain non-Jewish populations, that the specific markers of the CMH do not provide the phylogenetic resolution needed to determine the geographic genesis of the CMH line, and past results do not acknowledge the possibility that the *Cobanic* lineage could be a compiled lineage from numerous *Cobanic* ancestors. [3]

To resolve these quandaries, another study was conducted by M.F. Hammer and D.M. Cehar using buccal samples from a total of 3,674 individuals of whom were Israelite, Levite, and Cohanim, with a total of 215 *Cobanim*. Seventy-five binary markers of the Y chromosome were researched, yielding a total of thirty-seven haplogroups. A unique paragroup from haplogroup J, termed J-P58, predominated in *Cobanic* DNA with a frequency of 51.6% in Ashkenazi *Cobanim* and 38.7% in Non-Ashkenazi *Cobanim*. In contrast, the most a single haplogroup presented uniformly in Israelite samples was never higher than a frequency of 14%. [3]

The study then researched the six markers that composed the original CMH with the 99 *Cobanim* that exhibited the J-P58 paragroup. From the *Cobanic* sample, 87 individuals carried the CMH, with 10 *Cobanim* carrying a haplotype that was one-step removed from the original CMH, and 2 *Cobanim* carrying a haplotype that was two or more steps removed from the original CMH. The study then increased the original CMH to encompass a total of twelve markers. This twelve-locus haplotype was present in 43 of the 99 *Cobanim* who had the original CMH. This new twelve marker CMH haplotype was termed "the extended CMH." The extended CMH also showcased two varying haplotypes with one-step mutations at two hypermutable point mutation sites. The extended CMH and the two varying haplotypes were found in a total of 64.6% of Ashkenazi and Non-Ashkenazi *Cobanim*. [3]

While the original CMH is carried by other Jews at a frequency of 5-8% and by other non-Jewish populations, like Jordanians, at a frequency of 7%, the extended CMH and its two varied haplotypes were observed in *Cobanim* with a frequency of 29.8% and in other Jews with a frequency of 1.5%. Even though CMH is found mainly in *Cobanim*, the J-P58 paragroup is found at high frequencies amongst populations found in the Near East region of the Middle East. This is supported by a high frequency of J-

P58 in Yemenites (67%) and Jordanians (55%). The frequency of this paragroup considerably lowers when the population sample moves outside of the Near East, thus proving that ancient *Cobanim* were geographically from the Middle East.

To estimate the date of the original polymorphic CMH J-P58 lineage, an additional ten markers were added to the twelve markers that compose the extended CMH. By employing a Bayesian-based coalescence analysis using BATWING, it was determined that the *Cobanic* lineage originated approximately 4,415 years ago. Due to the high frequency of the extended CMH and the J-P58 paragroups amongst Ashkenazi and non-Ashkenazi *Cobanim*, and the determination of the ancestral date and geographical location of the first CMH mutation, the analysis confirms the notion that the CMH and Jewish priesthood began from a single patrilineal lineage in an era before the Jewish diaspora in the Middle East. [3]

Due to the promising results of *Cobanic* DNA analysis, this method of *Cobanic* determination was employed to search for lost Jews. One tribe in Africa in particular, the Lemba tribe, has an oral tradition that they are Jewish descendants that left Judea and relocated to Senna, North Africa, about 2500 years ago. To determine the legitimacy of their claim, a research study was conducted to determine if the male lineage of their clan holds the CMH haplotype. 399 Y chromosomes from the Lemba tribe were analyzed based on the CMH six mutation markers and six microsatellites. The buccal samples yielded high frequencies of YAP-sequencing and CMH haplotypes. This discovery helps sustain the Lemba oral tradition of them being descendants of the ancient Hebrews and introduces the possibility of the existence of other lost Jewish tribes with a genetic correlation to other Jewish populations. [4]

Genetics has not only been a useful proof for an ancient paternal *Cobanic* lineage, but it has also been helpful in reconstructing the genealogical and geographical history of the Jewish people. Despite large geographical distances between multiple Jewish communities, similar genetic profiles have remained consistent for generations in Jewish heredity. Not only are there genetic commonalities found amongst European, North African, Near Eastern, and Arabian Peninsula Jews, but there are also genetic similarities between Ashkenazi and Sephardi Jews and the Middle Eastern populace. This proves that both Ashkenazi and Sephardi Jews are originally from the Middle East, debunking the theory that Ashkenazi Jews originated from the pre-tenth century Kuzar tribe of the Turko-Asian empire. [5]

As researchers continue to analyze the genetic variations amongst Jews and further investigate the genealogical ancestry of the Jewish people, it mustn't be forgotten that the basis of these studies originates from Biblical tradition.

As it says in Leviticus, 20:26, "And you are to be holy to me; for I the G-d am holy and I have separated you from the nations to be Mine." Whether there be a genetic, theological, or practical distinction between Jews and non-Jews, according to tradition, the Jewish people will always be separated from all others as the Chosen People of G-d. [6]

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Eye Opening Observation: the Connection between Yeshiva Students and Myopia

By **Daniella Marcus**

The Jewish people are referred to as “the people of the book.” This, most probably, is due to the tremendous importance given to the study of Torah and of the Jewish laws and customs. There is a commandment in the Torah to set aside time to study Torah and Jewish laws. In *Devarim* 5:1 Moshe speaks on behalf of G-d to the Jewish people saying, “שמע ישראל את ה' אחד ואת המשפטים אשר אנכי ”: “Hear, O Israel, the statutes and ordinances which I speak in your ears this day, and learn them, and observe [them] to do them.” The obligation to study the Torah is essential for teaching and passing down the Jewish traditions to the next generation. Maimonides writes “Every Jew is obligated to study Torah, whether he is poor or rich, healthy or ill, young or old. Even if he is a pauper who derives his livelihood from charity, or if he has family obligations to his wife and children, he must still establish fixed times for Torah study both day and night, as it says (Joshua 1:8), ‘You shall think about it day and night.’” [1] It is common for orthodox males, especially in the ultra-orthodox community, to attend *yeshivot*, Orthodox Jewish schools in which most of the day is devoted to Torah study. Many boys start to learn the texts around the age of 9, and gradually spend more time studying them for up to 10-16 hours a day. However, in recent years there has been a strong prevalence of myopia in the Orthodox community, especial in males. This paper will address some of the possible reason as to this trend.

Myopia, a common vision condition, limits a person’s ability to clearly see images at a far distance. Myopia can occur either when the eyeball is elongated or if the cornea is too curved, causing the light entering the retina not to focus properly. The light gathers at an area in front of the retina, rather than on the retina itself, which does not allow the image to be seen clearly. One of the most common ways that myopia is treated is with glasses or contact lenses. [2] Both treatments employ a lens to bend incoming light so that all the rays properly focus on the retina to produce a clearer image.

There have been several reports over the past few years regarding the high prevalence of myopia in Jewish Orthodox males who are *yeshiva* students in Israel. The male high school *yeshiva* students had a significantly higher prevalence of myopia compared to male high school students in a secular school, with numbers being 81.3% and 27.4%, respectively. The yeshiva students also had the highest average myopic correction power when compared to females in orthodox high schools, as well as to males

and females in a secular high school: $-3.78 \pm .17D$, $-2.70 \pm .15D$, $-2.10 \pm .26D$, and $-.90 \pm 1.70D$, respectively. The greater prevalence of myopia in male orthodox yeshiva students was due to their study habits when studying Torah. Most of the Jewish texts studied have varying size print, which could cause a strain on the eyes, especially after spending many hours a day reading up close. In many Jewish works, the main text is in larger print and the commentaries, on the side of the page, are written in much smaller print. [3]

Environmental risk factors for myopia at a young age include varying positions when reading, less time spent outdoors, and many hours of close- up activity. In one study, a group of 11,590 second graders were tested for myopia. Their parents were given a questionnaire about the lifestyle habits of their children, regarding the number of hours a week that their children read, watched television, and were involved in both near-work and outdoor activities. 36% of the subjects were myopic with a correction of $-.50$ or higher. Based on the questionnaire and the results from the eye examinations, the main risk factors were the amount of time spent on near-work activity every day, a shorter distance when doing near-work activity, and attendance in an after-school study program. It was found that resting after 30 minutes of near-work activity and spending more time involved in outdoor activities were significantly associated with a lower risk of myopia [4].

One other possible factor which might be associated with the high prevalence of myopia in yeshiva students is the traditional back and forth rocking movement of the upper torso, known in Yiddish as *shuckeling* [3]. *Shuckeling* is practiced by many yeshiva students during prayer and Torah study. There are several mystical and religious reasons behind this study habit. One answer given by several commentators, and noted in the Mishna *Brurah*, is based on the verse in Psalms 35:10, “*kol atzmosai tomamah Hashem mi kamocha*,” “All my bones shall say: ‘G-d, who is like You.’” According to this verse, one’s whole body should be involved in the Torah study and prayer. [5,6] A second explanation given by Rabbi Shimon Schwab is that the movement of rocking forward and backward represents the dichotomy of loving and of fearing G-d. Bending forward represents the ideas of coming close to G-d out of love, while leaning backward represents the recognition of the awesomeness of G-d and retraction out of fear. These are two thoughts that generally come to a person’s mind while involved in prayer or Torah study. [5,7]

For many hours of the day, yeshiva students usually maintain a close work distance to the text and are not involved in much outdoor activity. Even though the mechanism as to why close work causes myopia is not conclusive, some researchers have proposed possible mechanisms. One possibility is that when one is focusing on near-work, the ciliary muscles in the eye will contract to accommodate and allow for better focus. After a long period of time, this constant accommodation of the eyes causes an increased refractive power on the lens in the eye. [8] It seems that the swaying movements of yeshiva students do not allow the eye to properly accommodate to the constant change of distance. This may lead to defocusing of the retina, therefore causing strain on the eye and subsequent elongation of the eyeball, which would lead to myopia.

It has been found that one significant way to slow the progression of myopia is through increasing one's outdoor activity, because taking a break from near-work gives the eye a chance to rest from the stress of constant focus. In an outdoor environment, objects are usually at an optimal distance to allow light to enter the eyes and properly refocus the image on the retina. [9]

A study compared two elementary school classes with students of similar age and socioeconomic class. During recess, one class had a special outdoors program, in which the students were encouraged to be involved. The other class had the same amount of recess, but had no special outdoor activities. The parents of both classes were given a questionnaire that asked them to record the amount of time and the type of near-work activities and outdoor activities that their children were involved in. The eye refraction data were measured at the start of the study and one year later. A significantly fewer number of new cases of myopia cases were noted. Additionally, among the students who were

already myopic, there were fewer accounts of further myopic progression in the group of students with outdoor activities. [10]

Overall, the main factors that cause myopia in *yeshiva* students are the many hours of near-sighted work, the different size prints in the Jewish texts, the rocking motion while learning, and the limited time spent outdoors. As stated above, there may be benefits to incorporating outside activity into their daily routine, since outdoor activity has been found to prevent myopia. Time outdoors would be useful to the students because they spend most of their time in an indoor environment with numerous risk factors for development of myopia. While a yeshiva student is taking a break from studying, it will give him a chance to rest their eyes. This break time should not be considered *bitul Torah*, a disruption to Torah study. Rather it can be used as a time for productive purposes, such as contemplation and meditation. Maimonides writes that "When one eats, drinks, sleeps...rests, his only aim should be his health. But let the goal of being healthy is to remain robust and well enough to acquire the knowledge and the personal and intellectual virtues that one needs to reach his goal [of achieving piety and drawing close to G-d]." [11] By taking a break, one is allowing the body, especially the eyes, to have a little rest, which will hopefully reinvigorate the student to learn at a greater level, while knowing that he is serving G-d with his whole body in a healthy way.

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In the United States, about 60-70 million people are afflicted by some kind of digestive disease, making it one of the most common health issues today [1]. The gastrointestinal illnesses suffered in our time, however, are no less familiar to those who lived during ancient times. Various diseases, their effects and even those who treated them have been recorded in ancient Jewish scriptures such as the Talmud and the Bible. This paper will seek to explore the work of Ben Achiya, the first gastroenterologist in ancient Israel as well as the gastrointestinal diagnostic tests performed by the Talmudic sage, Shmuel.

Ben Achiya: The First Gastroenterologist of Ancient Israel:

Approximately 2,500 years ago in ancient Jerusalem, there lived a Second Temple official named Ben Achiya, who specialized in treating the gastrointestinal ailments of Jewish priests. He was an expert in herbal medicine and provided ailing priests with continuous medical care. Although specialists in digestive diseases probably existed since the dawn of history as evidenced by 4,900 years old records from ancient Egypt, Ben Achiya is the first documented gastroenterologist to practice in ancient Israel.

Priesthood in Jewish tradition is a hereditary right assumed by male members of selected families from the tribe of Levi. The specific duties and conditions under which priests needed to fulfill their roles often caused them to develop various digestive issues. According to the Talmud, one reason that priests were predisposed to gastrointestinal diseases stemmed from their unusual work requirements. For example, priests could not wear shoes or other footwear in the Temple area and so they stood barefoot on the cold stone floor, which chilled their feet. Additionally, Maimonides, a 12th century rabbi and physician, explained that priests suffered from gastrointestinal diseases perhaps because they were inadequately clothed for their outdoor religious activities. Common priests could wear only four garments during ritual services; and of the four, only the coat provided some degree of protection. Maimonides added: "Because of this lifestyle, the physical constitution of priests was weakened and the performance of their internal organs suffered" [2].

Another major factor that contributed to the priests' digestive difficulties was their diet, as they consumed large amounts of sacrificial meats in return for their labor. These priests could cook the meat in any way they preferred, however, they were often under pressure to consume the food within a specific time frame, for example, on the same day as the sacrifice, and within restricted locations such as the Temple courtyard. Unfortunately, the Talmud does not describe what gastrointestinal symptoms resulted from the priests' steady meat diet. Current medical literature notes that ingestion of improperly handled meat

can cause epidemics of infectious diarrhea such as shigellosis and *Campylobacter* enteritis. Nevertheless, one can only speculate as to whether such food contaminations affected Jewish priests several thousand years ago. In addition to the difficulties of a high-meat diet, priests were prohibited from drinking wine on Temple grounds. Apparently, certain wines have the capacity to facilitate the digestion of meats, perhaps preventing gastrointestinal issues, however, priests were only allowed to drink water during their sacrificial duties [2].

Ben Achiya's purpose was to treat "intestinal disorders" of the priests, according to the Talmud. Interestingly, the Talmud does not officially refer to Ben Achiya with the title "physician," but does note that he had an expertise in herbal medicine by knowing "which wines were beneficial for the intestines and which wines were detrimental to the bowels." In antiquity, wines were used to treat gastrointestinal problems as described by the classical texts of Celsus, a Greek philosopher, and Galen, a Greek physician. The Talmud also advises that aged wine is beneficial for the intestines, whereas fresh wine causes bowel difficulties [2].

Some of these proposed beneficial effects of wine on the digestive processes could have resulted, in part, from the fact that ethanol in moderate concentrations (about 10%) stimulates gastric secretions. Stronger alcoholic beverages, on the other hand, may inhibit gastric secretion or can irritate gastric mucosa. Certain plant pigments found in wine, such as anthocyanins, appear to have antiseptic activity towards some pathogenic microorganisms. It is for this reason that some modern writers have proposed that wine be used in the treatment of different intestinal infections. Ben Achiya's knowledge of herbal medicine enabled him to use certain wines cautiously to manage intestinal conditions of priests [2].

Modern medicine agrees with the Talmudic teachings that alcohol-containing beverages help prevent gastrointestinal infections. Recently, wine has been shown to be an effective inhibitor of a trio of fearsome bacteria, *Escherichia coli*, *Salmonella* and *Shigella*. Researchers suspect that the operative benefactor is one or more of wine's polyphenols. A study was performed which demonstrated that when wine was consumed with oysters that had been contaminated with the hepatitis A virus, there was a reduced risk of infection. Additionally, studies have shown that drinking wine would help eliminate *Helicobacter pylori*, a deadly bacterium known to cause chronic gastritis, peptic ulcers and stomach cancers [3].

The Gastrointestinal Diagnostic Tests of the Talmudic Sage Shmuel:

In the Talmud there are thousands of pages that contain

the oral traditions of the Jewish religion. Within those texts are not only the basis for Jewish law, practice and morals, but also insights into other fields, including medicine. One of the most quoted sages, both in general and in regard to medical matters, is Shmuel. Born in the Babylonian town of Nehardea around the year 180 CE, Shmuel was educated in the rabbinical academy of Netzivim, and it was probably in this town where he was instructed in medicine [4].

There is a fascinating passage in the Talmud regarding Shmuel's involvement in the field of gastroenterology,

What is a *turmita* egg? Shmuel said: The slave who can prepare one is worth a thousand denarii. For it must be placed a thousand times in hot water and a thousand times in cold water, until small enough to be swallowed whole. If there is a sore, it clings to it, and when it passes out, the doctor knows what medicine is required and how to treat him. Shmuel used to examine himself by swallowing a *kulkeba* [a stalk], which weakened him so that his household tore their hair.

This passage is absolutely remarkable for several reasons. Firstly, it provides two of the earliest examples of diagnostic testing of the digestive tract – the *turmita* egg and *kulkeba* stalk, or soft egg. Amazingly, these items were swallowed whole and passed through the digestive tract. Tests similar to these were not found in any of the writings of the ancient Egyptians, Mesopotamians, Hippocrates or Galen. While their texts often describe symptoms of illness and their treatments, cases of active investigation of internal organs are not found. Secondly, what is astounding is that Shmuel himself underwent the procedure, which suggests his dedication and profound belief in the benefits of this practice [4].

It is not clear from the text what gastrointestinal disease could be diagnosed by the tests conducted by Shmuel,

although a “sore” is mentioned. Whether this refers to peptic ulcer disease, inflammatory bowel disease, or another condition is not clear. Also, it is not recorded how the test objects were interpreted after the expulsion, or what therapy was given based on the results. Given the modern understanding of gastroenterology today, it is hard to imagine how these tests could be used successfully. Nevertheless, the basic concept, of swallowing an object, passing it through the bowels, and then examining the object for diagnostic purposes is remarkably similar to a modern diagnostic technique, namely wireless capsule endoscopy [4].

Wireless endoscopy entails swallowing a camera contained within a pill-sized capsule, passage of the camera through the patient's digestive tract and examination of the images obtained from the camera. In a very short time, this technique became a standard practice in the diagnostic work-up of obscure gastrointestinal bleeding and in the identification of small bowel lesions. While the images are transmitted to a data recorder and the actual capsule is not recovered and examined, this procedure maintains an eerie similarity to the ancient practices of Shmuel. This case raises an important issue when discussing medical literature of antiquity. Many passages contain clearly inaccurate and invalid statements based on a lack of understanding of the human body. However, does this mean the works are useless? Using the *turmita* egg and *kulkeba* stalk of Shmuel as examples, there appears much that modern medicine can learn in these writings that can be applied to developing new diagnostic and therapeutic tools to better treat patients in the modern world [4].

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Lycanthropy from Nebuchadnezzar to Modern Times

By **Batsheva Reich**

The book of Daniel tells the story of King Nebuchadnezzar II, who reigned over the Neo-Babylonian Empire from 605 BCE to 562 BCE. After King Nebuchadnezzar II destroyed the temple in Jerusalem, the prophet Daniel was exiled to serve him in Babylon. When the king dreamed of a strong tree being cut down, he asked Daniel to interpret its meaning. Daniel explained that the tree represented the king's great power, and that due to his arrogance and lack of appreciation of God, the king will be cut down, his power stripped, and his lot will be amongst the animals for "seven periods." He will be banished from civilization and eat grass and dew. The text records that the prophecy came true. After this time ended, he declared that, "my understanding has been returned to me" [1].

The commentaries take a range of approaches to understand this passage. The Midrashim, as is their style, explain that the king literally transformed into an animal [2]. Most other commentaries, however, take a less literal view. Rav Saadia Gaon saw a parallel to the case of King Saul of Israel, who suffered from depression that was described as an "evil spirit." According to this analysis, King Nebuchadnezzar suffered from a much more severe case of depression that caused him to wander away from civilization and to eat grass to survive, like an animal [3]. The Malbim saw a progression of events. Once the king became mentally ill, he damaged all that surrounded him and tried to escape to the outdoors. His servants locked him up in chains. When the royal doctors saw his animalistic ways, they gave him grass to eat in his house. Eventually, they let him go and he ran to the desert to be with the animals [4]. The Ibn Ezra concurred with these explanations, stating that King Nebuchadnezzar thought he was an animal and went to live amongst them. The Ibn Ezra thought this explanation was likely because he heard a reputable report of someone who lost his mind, thought he was a ram, lived on an island amongst rams, and crawled using his arms and legs for many years [5]. Similar stories have been propagating for hundreds of years.

The medical term clinical lycanthropy, defined as the delusion that one has transformed into a non-human animal, dates back to Ancient Greece. The word itself comes from the Greek word, "lycos," (wolf), but has been extended to incorporate a wide range of animal delusions.

The Ancient Greek historian Herotodus described lycanthropy in the 5th century BCE, as did the Roman poet Virgil in the 1st century BCE [6]. By the second century CE, lycanthropy found its way into medical literature through Marcellus of Side. References to this delusion continued to be found in medieval literature, explaining it as a product of the "evil eye" [7]. By the sixteenth and seventeenth centuries, the masses believed that lycanthropy was caused by Satan, witches, and even poison, and manifested in seemingly natural diseases. In some cultures, rituals were performed to transform people into animals. The chosen animal is generally one that is feared in the individual's society. An African ritual indicates that the transformation was desired for healing purposes. They believed that an animal cannot suffer from human diseases, so turning a person into an animal would save them. Later, in the Age of Enlightenment, professionals sought scientific explanations to the medical phenomenon, replacing those with the previously believed demonic causes [8].

Dozens of case reports of clinical lycanthropy have been published over the past half a century. Patients ranged in gender, age, location, personal circumstances, diagnosis, and treatment, but all imagined themselves to be animals for some duration of time. The most common opinion amongst investigators seems to be that lycanthropy is a secondary symptom to the diagnosis of a mental disorder, and not a disorder by itself. In an article examining reported case studies from 1966-2002, thirty cases were described. Patients imagined themselves as wolves, dogs, cats, horses, tigers, birds, and more. Most of these patients were suffering from an affective disorder or schizophrenia, though some cases were associated with alcohol or drug consumption. Affected individuals generally lived in isolated rural areas and had this delusion for a short period of time [8].

Over the past thirty years, eight cases of lycanthropy were reported in the area around Babylon, Iraq. The majority diagnosis was severe depressive disorder with psychotic symptoms, and all but one patient imagined changing into a dog (with the exception believing that he was a cow). Most of these patients lived on farms, where they often interacted with dogs, so it is fitting that this was the animal they imagined. All of the patients in this study experienced

threatening life events before the delusion came about, causing the researchers to believe that there are small populations with a genetic predisposition given certain evolutionary factors. Dangerous circumstances trigger the mind to hone its primitive origins as a coping mechanism. Most of these patients were extremely aggressive and had feelings of guilt, so it is possible that the mind is trying to assuage the guilt, and convince the person that, "I am not the aggressor, and the animal took over my mind" [9].

Guilt, in a religious context or not, seems to play a key role in lycanthropic symptoms. A thirty-two-year-old man was admitted to Kerman Psychiatric Hospital in Kerman, Iran, claiming that due to his sins during his human life, God punished and killed him. He also concluded that he and his wife were dogs, and that his daughters were transformed into sheep. This is the first known case of lycanthropy and Cotard's syndrome together. Cotard's syndrome includes a skewed vision of mortality, where the patient denies his existence, though paradoxically, there is a sense of immortality. Immortality thus plays a role in both conditions, as turning into an animal is seen as a way of escaping danger and death. The patient's history included a sexual relationship with a sheep in his adolescence, and he described guilt about the incident. The patient explained to medical professionals that dogs protect sheep, so his hallucinations seem to indicate a sense of guilt and desire to protect his daughters, stemming from his reported sexual sin [10].

Another case report sees consumption of ecstasy as the trigger for lycanthropy. This was a variant of the "typical" form lycanthropy takes, as he believed that the people around him turned into animals. The twenty-eight year old Iranian man believed his father became a boar and attacked

him, his brother a horse who kicked him, and that his mother had become a donkey and brayed continuously. He also believed that there was a chicken in his head, taking over his body. The individual had no history of psychiatric symptoms and the delusions began after regularly taking ecstasy pills. Researchers found that even occasional consumption of the drug triggered his symptoms. This led them to conclude that the individual had a predisposition which, combined with ecstasy, caused the delusions. His underlying diagnosis was schizophrenia, and tests led his doctors to determine that consumption of ecstasy can not only change symptoms, bringing on the lycanthropy, but that it can also trigger them in an individual who was not yet showing any symptoms [11].

Attributing modern neurological diagnoses to biblical figures lends an additional nuanced insight into the character's life. When Nebuchadnezzar II lost his power, he retreated into the most basic animalistic version of himself. He was overtaken by a severe depression, forcing him to hone his most primitive defense mechanism. The predisposition to this form of delusion brought on by a mental disorder may have already been in his ancestors, or he may have been the first to exhibit it. The gene may have been passed down in Babylonian lineage, causing the overwhelming majority of modern-day case studies of clinical lycanthropy to occur in the very place Nebuchadnezzar II ruled 2000 years earlier.

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The first recorded commandment in the Torah appears towards the end of the creation narrative. G-d instructs Adam to “be fruitful and multiply, fill the earth and subdue it” (Genesis 1:28). Jewish tradition considers this as the first of many commandments, or *mitzvot*, that G-d gave the Jewish people. The *gemarab* in *Nida* 31a teaches that there are three individuals involved in the creation of a child: G-d, the father, and the mother. This principle has held true for thousands of years, but the emergence of modern biotechnology challenges this doctrine. As medical innovations continue to arise and combat the challenges of infertility, a new parental model has manifested to include several other figures. Instead of consisting of only three figures, the team necessary to create a child has become much larger, and can now include the doctor, the scientist, and even several donors in addition to the model described by the *gemarab*. While these revolutionary procedures have opened new doors for infertile couples, it has also restructured the prototypical parental model.

In vitro fertilization (IVF) is a revolutionary technique that has changed the lives of those who have had difficulties conceiving. This technique has provided couples who have spent years struggling with infertility with a miraculous solution, allowing them to finally realize their dream of parenthood. Despite its major beneficial contribution to society, IVF has also opened new doors of discussion and conflict within ethical, social, and religious realms.

The process of IVF begins by procuring eggs from the mother and sperm from the father and combining them in a Petri dish, allowing for the egg to be fertilized by the sperm. The fertilized egg, or zygote, is allowed to undergo a few mitotic divisions and is then implanted into uterus of the perspective mother, and after a nine month gestation period, the baby is born [3]. While this appears to be a simple process, numerous complications, both scientific and ethical in nature, arise in light of this new technique and other therapies that have stemmed from IVF.

One such example of a therapy derived from IVF is Mitochondrial Replacement Therapy (MRT), an innovation that combines reproductive medicine with genetic bioengineering. Mitochondria are cellular organelles vital for survival of an organism. Each cell has numerous mitochondria, which serve as the power source of the cell by converting glucose into energy through the process of aerobic cellular respiration. Oxygen is mandatory for this process and a lack of oxygen would prevent the cell from properly converting nutrients to energy and a lack of energy would ultimately result in death [1].

The mitochondria are significant in questions of inheritance because they have their own DNA. The origin

of mitochondrial DNA has been linked to an early endosymbiotic relationship between prokaryotes. Over millions of years, a smaller prokaryote, while still retaining its DNA, became completely incorporated into a larger prokaryote, with the smaller prokaryote evolving into a mitochondrion. The mitochondrial genome has important implications in issues of inheritance. When a sperm fertilizes an egg, only its head, which contains its DNA, penetrates into the egg. The middle piece containing paternal mitochondria and the flagella tail do not penetrate the egg [1]. Similar to nuclear chromosomal DNA, mitochondrial DNA is subject to mutation. In the United States alone, about 12,000 women have genetic mutations of their mitochondrial DNA. These mutations have been linked to numerous mitochondrial diseases including heart disease, liver disease, muscular dystrophy, respiratory problems, and sometimes death [2]. Mitochondrial mutations tend to affect tissues that have the highest metabolic demands. There are no curative treatments currently available to treat mitochondrial diseases and without medical intervention, all children born to a woman with a mutated mitochondrial genome may inherit this genetic aberration [5].

Mitochondrial Replacement Therapy was designed to prevent children from inheriting these devastating diseases arising from defective mitochondrial DNA. The accepted protocol, known as spindle nuclear transfer, allows for the replacement of all defected mitochondria in the zygote. The mother’s egg is first fertilized with the father’s sperm. Before the zygote has a chance to divide, the fertilized egg is enucleated. This isolated nucleus is implanted into a donor cytoplasm from an enucleated egg of a healthy woman. The modified zygote is then implanted into the mother who carries it full term. These genetically modified embryos are born of three parents: the original couple who contributed to the child’s nuclear DNA and the cytoplasmic donor who contributed her mitochondria and consequentially her mitochondrial DNA [1].

It is important to note that this procedure is no longer within the sphere of possibility, but rather has reached the realm of actuality. In April 2016, the first child was successfully conceived using the spindle-transfer technique by researchers at the New Hope Fertility Center in New York City. The baby boy was born to Jordanian parents who sought medical help after previously losing two children. The mother was a carrier for a rare mitochondrial disease called Leigh syndrome, which is a neurological disorder [4]. This birth provided the validity of MRT as a legitimate treatment to infertility resulting from mitochondrial diseases and opens the floodgates to numerous questions concerning its implications.

Issues arising from Jewish Law, or *halakha*, have emerged as a result of MRT and the resulting three parent model of inheritance. *Halakhic* authorities originally questioned whether the mitochondrial DNA donor had any significant parental status. Much debate emerged concerning the importance of the donor mitochondria within the genetic development of the child, for as discussed above, mitochondria contain their own unique DNA. However, many questioned the true weight of the donor's contribution because the mitochondrial DNA only contributes 37 genes of the approximately 20,000 present in the human genome. Despite this, authorities concluded that it is a question of quality and not quantity. Without these mitochondrial genes the embryo cannot develop, and so the third donor does maintain a position of consequence [2].

The authoritative conclusion to give the mitochondrial donor the status of motherhood brings in several important questions regarding the child's standing in *halakha*. Firstly, Judaism is transmitted through the mother, and so if the donor of mitochondrial DNA is not Jewish how does that affect the child's status? Is it enough for just one DNA donor to be Jewish? Furthermore, *halakha* has specific prohibitions against marrying family members. Is this child allowed to marry a direct family member of his or her mitochondrial DNA donor? [2].

Additionally, these issues of maternity can be applied to ethical and legal questions as well. What is the parental status of the mitochondrial donor if she one day decides to claim custody? In the event of a sudden and tragic death of the child's parents, is his or her mitochondrial DNA donor considered the next of kin? Many ethicists are also concerned that this MRT may be used for non-therapeutic purposes such as genetic enhancement of an offspring. Many worry that this pursuit of genetic superiority will allow humanity to "play God" [6]. This issue of inherited status plays a critical role in understanding a new onslaught of both ethical and *halakhic* questions that have arisen in response to IVF and its related therapies.

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Yoga is an ancient practice dating back more than five millennia, whose history is vast in time and space and whose dogma has evolved as it converged with various religions, cultures, and peoples. In recent years, yoga has proliferated throughout the world as a common exercise, meditation, and health tool. There are countless yoga studios dotted across Manhattan and even some religious Jewish ones as well. Although difficult to define, yoga is an all-encompassing term for a large collection of values, attitudes and techniques that have developed over time and today is practiced in hundreds of forms.

Traditionally, from its beginnings, yoga was a means to create maximum spiritual and physical performance through a focus on discipline and control. One of the first sightings of the word 'yoga' is found in the *Rig-Veda*, an ancient Hindu text from 3-4000 B.C.E, and is said to mean "to bind together" or "to yoke." In this sense, 'binding' or 'yoking' refers to binding of the consciousness to achieve transcendence [1]. This multifactor body and mind control was practiced in order to attain spiritual development and connection to a higher being. This was expressed through the use of specific physical postures, breathing, and attention and mind awareness.

However, in Western areas today, the dogma and religious structure of yoga is not necessarily discussed or used, and yoga is often practiced for nonreligious reasons. Yoga is widely accepted as an alternative treatment for various psychological and physical issues. It has been shown to be effective in controlling various diseases, including diabetes, obesity, stress, hypertension, multiple sclerosis, coronary heart disease, and male infertility [2,3]. Psychological uses and applications of yoga began in 1971, and today yoga is used to relieve symptoms of anxiety, depression and schizophrenia [4,5].

Although many people may not consider yoga as a specifically religious practice, groups have protested against the inclusion of yoga on religious grounds. An article titled "Malaysia's top Islamic Body bans Yoga, as it can Destroy Muslim Faith" appeared in the November 2008 edition of *The Jerusalem Post*, when the National Fatwa Council ruled that yoga involved "not just physical exercise but also Hindu spiritual elements, chanting and worship." Council chairman Abdul Shukor Husin Abdul said that the purpose of practicing yoga is to "be one with a god of a different religion" [6]. Evidently, there is some discomfort regarding yoga's religious aspects.

In addition, protest has arisen regarding the use of yoga in schools or other public institutions, as it may override the separation of church and state. In Encinitas, California, a first grade yoga class drew strong objection from vocal

parents, who claimed that the classes represented a violation of the First Amendment. One parent said that she was uncomfortable with the program because the classes were "rooted in the deeply religious practice of Ashtanga yoga, in which physical actions are inextricable from the spiritual beliefs underlying them" [7]. Another more recent case occurred in Georgia in March 2016 when parents were "offended by the Far East religion of yoga, and committed to ridding the school of their yoga classes" [8]. This situation also revealed a general feeling of discomfort regarding the connection between yoga and religion throughout many cultures and poses.

Since yoga has become so widespread, it is very surprising that there has not been a larger discussion regarding the *halachic* considerations in yoga, especially considering its strong ties to Hinduism, Buddhism, Jainism, and other idolatrous practices. When using yoga in the fullest sense of the term, it may refer to the "union of the individual consciousness with the supreme consciousness." Yoga experts say that through yoga, an individual can reach "complete physical, social, mental, and spiritual well-being and harmony with nature" [9]. This union between the subject's consciousness and the 'supreme consciousness' resembles idolatrous worship, and today is still used in certain *avodah zarah* (idol worship) practices. For many people today, especially those who practice yoga, an investigation into the *halachic* aspects of yoga is very important and seems to have been largely overlooked.

One of the main issues that yoga presents is the *mitzvah* that we are commanded to not follow in the ways of other religions. The Torah writes "After the doings of the land of Egypt, where you lived, you should not do; and after the doings of the land of Canaan, where I bring you, you should not do; neither should you walk in their statutes" (*Vayikra* 18:3). This *passuk* serves as the source for the *mitzvah* of '*chukas hagoyim*', the commandment that Jews should not replicate the customs of the nations.

There is a disagreement in the Talmud (*Avodah Zarah* 11a) on what exactly is the definition of this *mitzvah* of *chukas hagoyim*. Tosfos commented that this *passuk* in *Vayikra* is specifying two categories of *chukas hagoyim*: one, customs of the idol worshippers for the purpose of idol worship, and second, customs of the idol worshippers that have **no apparent purpose**, that are "*hevel v'shtus*," "meaningless and nothingness." According to Tosfos, whether the practice is a form of idol worship or not, it is prohibited because it is the practice of other nations.

The Ran (*Avodah Zarah* 11a and *Sanbedrin* 52) and the Maharik (*Shoresh* 88) further define *chukas hagoyim*. The Maharik wrote that one definition of *chukas hagoyim* is a

practice of the idol worshippers which does not have an apparent logical purpose or reason, which the Tosfos mentioned as his second answer. If a Jew performs this practice, then we assume that it **must be** because he wants to be like the idol worshippers. According to the Maharik's explanation, it would seem that yoga is permissible. Today, no one would think he wants to be like an idol worshipper, and therefore that would not be considered *chukas bagoyim*.

The Rema cited the Maharik when explaining *chukas bagoyim* (*Yoreh Deah* 178a). He agreed with the Maharik on his definition of *chukas bagoyim* but not on the reason behind it. He wrote that idol worshippers' practices that have no logical reasons are classified as *chukas bagoyim* because we assume that **it has its roots in avodah zarah** (the Maharik said the reason is because we assume one is trying to be like an idol worshipper). However, if something has a logical reason, it would be permissible. For example, the practice of doctors wearing white coats does not have to be viewed as *chukas bagoyim*, because its reason is logical. Doctors need to wear white coats so that they can be recognized as doctors and maintain cleanliness.

This seems to pose a very difficult Halachic problem in regards to the practice of yoga. According to the Rema, if a practice has no reason, then we assume it stems from *avodah zarah*. Therefore, one can deduce from this statement that if one **knows** for certain the practice is from *avodah zarah*, then it would definitely be prohibited! There is a debate about the technicality of whether yoga preceded Hinduism or came after it. However, even if yoga preceded Hinduism, many Hindu practices and ideas have been absorbed by yoga, and therefore it would seem that, according to the Rema, yoga is prohibited.

Rav Moshe Feinstein noted this difference in the Maharik and Rema in a *teshuvah* (*Yoreh Deah* 1:81). He was asked the question: Can Polish Chassidic immigrants wear western style clothing? Rav Moshe wrote that according to Rema, it would appear to be permissible because the clothing source clearly is not from *avodah zarah*, but the Maharik would say it is prohibited because it would appear that the wearer is just trying to be like the non-Jews. (Rav Moshe decided on this case that wearing the western clothing is fine, because it was clothing made for anyone, not specifically for idol worshippers.)

However, in a different source, it appears that Rav Moshe claimed that yoga is permissible. The *Rishumai Aharon*, written by Rabbi Aharon Felder (a *talmid muvhak* of Rav Moshe) wrote that he heard in the name of Rav Moshe that yoga was just a preparation for *avodah zarah* and not *avodah zarah* itself, so it would not be a problem of *chukas bagoyim*. This is a possibility that will allow a *beter*, although texts are not clear on whether yoga was in fact a preparation for *avodah zarah* or the worship itself.

The Lubavitcher Rebbe, in his writings from 1977, is one of

the few *poskim* who mentioned yoga. The Rebbe first discusses the giving of the *mitzvat* on Shavuot. He writes that is unfortunate that a Jew would have to search after "greener pastures" when he could be delving into Torah. He includes yoga in this discussion of 'greener pastures' and wrote that "the above (greener pastures) includes **yoga and similar cults** even if it is not connected to anything pertaining to *avodah zarah*" [10]. He continued by saying that most cults are connected to *avodah zarah*, and if a cult which presents itself does not appear to be connected with *avodah zarah*, an expert *posek* must be asked regarding its legitimacy. The Rebbe does not specifically *paskeen* whether yoga should be considered *avodah zarah* or not, but he looked upon yoga disapprovingly, as a cult. However, consideration must also be given to the time in which the Rebbe was writing, during which yoga may have been seen as related to the mystical cults to which Jews were straying, whereas the situation today appears very different.

There remains one other question to consider regarding yoga, and that is the usage of names of *avodah zarah*. In yoga there is the use of mantras, which are terms from the ancient Sanskrit, a language of Hinduism and Buddhism. In Mishpatim, *Shemos* 23:13, the Torah states "*V'shem Elohim acherim lo tazkiru, lo yishma al picha*"—"and make no mention of the name of other gods, neither let it be heard out of your mouth..." The Maharam, Rambam and Sefer HaChinuch all counted this statement as two negative commandments. First, one shall not swear by the name of an *avodah zarah*, and second, one should not lead Jews to *avodah zarah*. The Talmud in Sanhedrin 63, wrote in reference to this *passuk* that one cannot use *avodah zarah* as a landmark when talking with your friend, or refer to a city of *avodah zarah* unless its name is mentioned in the Torah. The Talmud took this farther, noting that one can also not cause others to mention the *avodah zarah*.

The Rash wrote on this Gemara that some interpret this to mean that one cannot use the name of *avodah zarah* for his own purpose. However, it follows from this that mentioning a name of *avodah zarah* for no specific purpose would be permissible. The Rash and the Tur (*Yoreh Deah* 147) disagreed with this opinion, and write that one can never mention the name of *avodah zarah*, purpose or no purpose. Therefore, the Shulchan Aruch wrote, in *Yoreh Deah* 147a, that is prohibited to mention the name of an *avodah zarah* whether or not there is a specific purpose for doing so.

The complicated history of yoga and its connections to various idolatrous religions poses many serious *halachic* questions regarding yoga practice. Today, there are several Jewish yoga studios, which have removed the mantras, chanting, and definitely any icons from the yoga practice. One should be very aware of these considerations when choosing to practice yoga, and be careful to choose a safe place for this relaxing and healing practice.

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Jewish society was agrarian for centuries, necessitating the need for animal care, coupled with the Torah's high regard for animal welfare and the complex specifications for kosher meat it is not surprising that there are numerous mentions of veterinary medicine in the Talmud. There are references to experts, veterinary procedures, and significant medical knowledge which vastly predates modern science. The breadth of information on this topic found in the Talmud is extensive and astounding.

One of the 613 Torah commandments is *Tzar Baalei Chayim*, the prohibition to cause unnecessary harm to animals. Some Torah laws which fall in the category of *Tzar Baalei Chayim* are feeding animals before one eats, not leaving an animal with a heavy burden for no reason, and the prohibition of preventing an animal from eating while working. This tremendous regard for the quality of animal life is echoed in the Talmud. For example, in *Masechet Shabbos* (54b), it is noted to place a collar on a donkey to prevent irritating a wound, placing bands above the hooves of an animal that takes short strides to prevent it from injuring itself, supporting a ram's tail with a wagonette to protect it from lacerations, and covering a cow's udder to prevent vermin and leeches from sucking its milk. It also mentions putting *chanunos* on a ewe; two possible interpretations are given for *chanunos*. One, a compress to keep a sheep warm, or, two, the wood of a *chanun* tree that induces sneezing so the sheep will expel parasites. However, the Talmud points out that no matter what *chanunos* are, the word it stems from is *chanun*, mercy. The message of this *Mishna* is the importance of treating every animal with compassion.

Interestingly, included in the commandment of *Tzar Baalei Chayim* is the need to slaughter with a perfectly smooth blade, which the *Sefer HaChinuch* (Chapter 451) says is to spare unnecessary pain to the animal. In fact, all the laws of *shechita* (kosher slaughtering) endeavor to cause the least amount of pain to the animal being slaughtered. For example, for an animal to be deemed kosher, it must be slaughtered according to ritual tradition and it must also undergo a full, postmortem external and internal examination, called a *bedika*, to ensure there are no abnormalities (*treifos*). These very detailed and extensive laws demand full knowledge of animal anatomy. In fact, Rabbi David Vital, in his work *Keter Torah* (1536) was able to construct a detailed and accurate diagram of bovine anatomy solely based on discussions in the Talmud [1]. Because of the Torah's deep regard for animal welfare and the demand for extensive knowledge of zoological anatomy and abnormalities, it is no surprise that many of the Talmudic sages were experts in veterinary science.

Rabbi Shimon ben Chalafta is one of the veterinary personalities mentioned most often in the Talmud. He was

one of the last *tanaim* who lived in the second century and was considered a naturalist, expert botanist, and animal specialist [2]. The Talmud recounts a story of a hen with a dislocated thigh. Rabbi Chalafta set the limb, fashioned a splint, and the hen's leg healed. Additionally, there was a belief that once a bird lost its down, it would be unable to regrow it and would consequently die. Rabbi Chalafta disproved this theory by giving supportive care to a hen who had lost all its feathers, resulting in the feathers' regrowth and the hen's survival (*Chullin* 57b).

One incredible example of the breadth of knowledge possessed by the *tanaim* is found in the Talmud *Bavli, Masechet Chullin* 46a. There it is stated that if an animal is found to have an abnormality, it is able to retain its kosher status if it can be determined that the abnormality is not life threatening. An animal with a damaged liver, for example, is considered kosher as long as at least an olive sized portion of the liver remains intact. *Rashi*, famous French commentator of the 11th century, explains that this amount is enough "*kidei lehalos refuah*," to produce healing. Dr. J. L. Kazenelson, a Russian physician, writer, and scholar of the latter half of the nineteenth century [7], points out in *Hatalmud Vechochmas Harefuah* that the specific wording of "producing healing," rather than, "enough to continue living," or "to heal," implies that the remaining liver will not only heal but will also be able to regenerate until the entire liver is completely restored. Modern science did not discover this unique and incredible ability of the liver until 1894, fifteen hundred years after written in the Talmud [3]!

Furthermore, the Talmud accurately records the identifying characteristics of rabies in *Masechet Yuma* 83b and impressively offers a cure for a person bitten by a rabid dog. The Talmud suggests that eating from the liver of the infected dog could cure an infected person. Even though dogs are not kosher animals some Rabbis of the Talmud permit this practice since it was considered a legitimate cure. Legend has it that Rabbi Dr. Yisrael Michael Rabinowitz, a 19th century European scholar [8], was translating this part of the Talmud into French and showed it to his good friend Louis Pasteur, French chemist and microbiologist. The story is told that seeing this most unorthodox cure in the Talmud influenced Pasteur to begin his experiments that eventually led to his discovery of preventative vaccines, which have saved millions of lives [4].

Other examples of veterinary medicine in the Talmud are found in *Masechet Bechoros* (38a-b) which records that during the times of the *Beis HaMikdash* (Temple), an expert would be called to examine all the animals before they were sacrificed to ensure there were no abnormalities. *Illa*, an animal expert from Yavneh, was used for this and would

charge for his services. In addition to inspecting animals to see if they were fit for sacrifice, he also charged for his expertise in animal care in general (*Bechoros* 39a). In *Bava Metz'iah* (38b) there is a discussion regarding the uses of objects thought to be worthless. For example, soured honey is quoted as a salve for soreness or chafing of a camel's back. In regards to *treifos*, specific abnormalities or injuries that render an animal non-kosher, Rav Ashi (fourth century) would assemble all the butchers and animal experts for consultations when he had a complicated case (*Sanhedrin* 7b). There is also a reference to caesarean sections performed on animals ("one who is born from the side") and the resulting status of that animal (*Mishna Para* 2:3), hysterectomies, which are specifically mentioned in regard to any cow leaving Egypt, (*Bechoros* 4:4), and obstetrics which was reserved as "shepherds' work" not the work of a veterinarian (*Chullin* 4:3).

A most notable example is an instance of intubation mentioned in the Talmud. R' Yose ben Nahorai performed surgery on a ewe whose trachea had a puncture the size of

an Italian *issar* (an ancient coin). He inserted the outer layer of a reed, "*keromis shel kaneh*," and the ewe survived (*Chullin* 57b). According to Eli Tratner in an article written in the *The Israel Journal of the History of Medicine and Science*, this is the "first primitive kind of intubation in medical history" [5].

The numerous mentions of veterinary medicine in the Talmud show the high regard Torah Judaism has for animal welfare. These examples encompass much medicine and even include scientific discoveries which predate modern science.

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Until Yaakov Avinu's time, death came unexpectedly at the completion of one's predestined number of days (*Baba Metz'ia* 87a) in the form of a sneeze that would expel the person's soul through his nostrils (*Sanhedrin* 107b). Yaakov prayed for a warning preceding his death, which would enable him to conclude his business and spiritual endeavors and part from his family with a final message. G-d answered Yaakov's request at the end of Bereishes, "Now it came to pass after these incidents that [someone] said to Joseph, 'Behold, your father is ill.' So he took his two sons with him, Manasseh and Ephraim" (*Bereishis* 48:1) [1]. News of Yaakov's strange death spread. "All of the peoples of the world heard of this and were amazed, since nothing like this had happened since heaven and earth were created" (*Mishnah Brurab, Orach Chaim, siman 230, seif katan 7*) [5]. Yaakov Avinu was the first person in history to die from illness.

The link between sneezing and life originally appears with the creation of man. "And *HaShem* (G-d) formed the man of dust from the ground and He blew into his nostrils the soul of life and man became a living being" (*Bereishis* 2:7). Adam's life came in through the nose. Later in Bereishis, Noach surveys the damage of the flood and describes the scene, "All in whose nostrils was the breath of the spirit of life, of everything that was on dry land, died" (*Bereishis* 7:22) [1]. From this observation Rashi, a medieval Tanach and Talmudi commentator, derives that the final determination of death requires a cessation of breath at the nostrils and not at the heart (*Baba Metz'ia* 87a). This has practical ramifications in *halacha* [10]. Rambam, a twelfth century physician and Torah scholar, states that if one examines a body on Shabbos and cannot detect a breath from the nostrils, that person is considered dead and the body becomes *muktzeh* and may not be moved until after Shabbos [*Mishneh Torah* (Code of Maimonides), *Hilchot Shabbat* (Laws of Sabbath), 2:19]. The Shulchan Aruch, a universally accepted code of Jewish law, says that if a person is covered by debris, his discoverer must dig until he reaches the nose, and proclaim the person dead if he cannot sense breath from the nostrils, regardless of whether he uncovered the head or the feet first (*Orach Chaim* 329:4) [10]. We see that the nose is associated with both life and death. The same way the soul enters through the nostrils to create life, it also departs in a sneeze which brings death.

Across the globe, Jews and non-Jews in every region and nation have the custom to acknowledge a sneeze with distinct sayings that originate from the culture's ancient beliefs. Ilana Angel, a writer for the Jewish Journal, describes her experience on the London train which demonstrates how people almost instinctively respond to a sneeze no matter how distracted. "Everyone ignores

everyone else on the train... and no matter who sneezes, everyone in the vicinity of that person says 'bless you'. It is quite fascinating. It is as if a sneeze snaps them out of their trance long enough to say bless you, then the trance is immediately back on" [2]. No matter where one is in the world, typically indifferent bystanders almost always acknowledge another's sneeze. Some cultures think sneezing is a good omen. In Germany, it is proper to wish "Gesundheit," "to health," in response to a sneeze. According to the old German legends, if a person sneezed three times before breakfast, it meant that he would receive a present. Others believe a sneeze is a sign that the individual is cursed. In India, a minority of people believe sneezing is a sign of bad luck. Those who witness a sneeze exclaim, "live," to which the sneezer responds, "live with you." Some cultures even have a ritual which the sneezer must perform to circumvent a terrible fate. An old Chinese superstition stated that sneezing on New Year's Eve was a portent of future troubles. To avert misfortune, the sneezer needed to obtain and eat a small tortoise-shaped cake from three different families before midnight. Another common response of "God bless you," started as a blessing by Pope Gregory the Great (540-604 BCE) who called for heavenly interference to protect individuals from the Bubonic plague. The phrase was also used to prevent demons from entering a weakened body [3]. Jews wish a sneezer, "to health," since historically the sneeze signified death. In Hebrew, "labriut," in Yiddish "Zai gezunt," and in Aramaic, "asusa," all mean "to health [1]." There may be a basis for the belief that sneezing causes bad luck. Though generally considered to be harmless, sneezes have occasionally led to other more serious conditions including strokes, detachment of the retina, miscarriages, car accidents, and more [8]. It is interesting that these cultures all have unique, long standing traditions to verbally acknowledge a sneeze.

What causes all humans to sneeze? Sneezing, also known as sternutation, is an irrepressible reflex that takes place suddenly. Sneezing is the body's automatic response to irritants in the nose and mouth [8]. The nose plays a crucial role in body protection by purifying inhaled air of dirt and bacteria. These particles become trapped in the mucous membranes of the nasal cavity and are later digested along with the mucous in the stomach, effectively deactivating all potential pathogens. Sometimes, particles entering the nose cause irritation in the mucous membranes. When this happens, the membranes send an afferent signal that travels along the maxillary and ophthalmic pathways of the trigeminal nerve which communicates the discomfort to the brain [12]. Once interpreted at the brain, an efferent signal is sent to the mucous glands and the diaphragm. The mucous glands secrete mucous and the diaphragm contracts, thus producing the sneeze. The sneeze can be

divided into two stages, corresponding to the two parts of the onomatopoeia “ah-choo” [8]. The first stage of the sneeze, which includes the inhalation breath, corresponds to “ah” while the second stage, which features the explosive exhalation and the final relief is represented by “choo.” Without the ability to sneeze, a person has a harder time expelling those pathogens and therefore feels significant discomfort. Lateral medullary syndrome (results from a stroke in the lateral medulla, a region of the brainstem that is believed to contain the sneeze center) has, in some cases, led to difficulty in sneezing. The individual feels an itch and a need to sneeze, but is unable to produce the sneeze and therefore cannot gain relief [4]. Today, scientists have a clear knowledge of the physiology, triggers, and phases of a sneeze.

There is a less understood, genetically determined cause for sneezing. Autosomal Dominant Compelling Helio-Ophthalmic Outburst Syndrome (A.C.H.O.O.), also known as photo-reflexive sneezing or “sun sneezing,” is a genetic condition in which an effected individual sneezes when looking at a bright light. Though the exact gene has not been identified, it is known that the gene is not related to the X or Y chromosome specifically, meaning that there is a fifty percent chance that a child will inherit the gene if either parent has the condition. Approximately 18-35% of Americans are affected by this syndrome [11]. On average, an effected individual sneezes two or three times when looking at a bright light, but it may reach as many as forty sneezes when moving from a dark space to a bright area [7]. The photo-reflexive sneeze is not considered to be dangerous, and as of date, not much research has been conducted on the subject.

The reason behind photo-reflexive sneezing has been hypothesized for two thousand years. Aristotle philosophized that the sneeze is produced due to heat on one’s nose, but this idea was disproven by Francis Bacon who did not sneeze when he stood in direct sunlight with his eyes closed. Bacon thought that sunlight in the eyes stimulates the tear glands. When the moisture seeps into the nose it causes irritation and triggers the sneeze. Scientists today have shown this theory to be impossible since the sneeze occurs too soon after the initial exposure to light to be attributed to moisture traveling down the tear ducts. Neurologists believe the photic sneeze is a reflex controlled by the crossed wires in the brain. A normal sneeze is initiated by the irritation of the trigeminal nerve at the mucous glands in the nose. The photo reflexive sneeze results from a misdirected signal by the optic nerve to the trigeminal nerve. In the presence of a lot of light, the optic nerve sends an electric impulse to the brain which sends a command to the sphincter muscle of the iris to constrict the pupils, thereby decreasing the amount of light that can enter the eye. One theory regarding the origin of photo reflexive sneezing is that some of this electric signal is misdirected and stimulates the trigeminal nerve, bringing about the

sneezes [9]. The little that is known about A.C.H.O.O. creates a foundation for potential research projects; scientists have yet to find the gene and confirm the mechanisms that control the photic sneeze reflex.

Recently, scientists have discussed interest in learning more about sneezing, and hope to apply this knowledge to more serious conditions. Certain types of epileptic seizures are triggered by exposure to bright light and some migraines are caused by photophobia. Louis Ptacek, a neurologist at the University of California in San Francisco and an investigator at the Howard Hughes Medical Institute, studies epilepsy and migraines and focuses on the photo reflexive effect. He believes that if the gene for photo reflexive sneezing were found, then scientists may also be able to better understand these other light sensitive reflexes [9].

Lydia Bourouiba, a mathematician, fluid dynamicist, and head of a research lab at the Massachusetts Institute of Technology in Cambridge, measures the velocities and distances traveled by saliva and mucous expelled by a sneeze using cameras that record thousands of frames per second. This information helps her learn about the way airborne viruses and pathogens spread. Bourouiba hopes that her research can serve as a scientifically proven basis for developing health codes in public areas to prevent contagion. She looks at the sizes of sneeze and cough particles, which tells her how many particles are present, and the most likely trajectory of the particles. With this information, there may be a way to manipulate environmental conditions such as temperature and airflow to reduce the likelihood of contamination. This understanding would also help health practitioners determine which people are more likely to spread disease and which environments are most conducive to airborne contagion [6].

Just as the ability to sneeze is important for one’s physical health, it is also good for one’s religious wellbeing. The Talmud and Midrash state that sneezing is a positive sign in a sick person, signifying diminished severity in the person’s ailment (*Berachos* 57b; *Bereishit Rabbah* 20:10). In *Berachos* (24b) the Talmud states, “If a person sneezes while praying, it is a good sign for him. Just as he is given satisfaction below, so is He given satisfaction Above.” Interestingly the connection between the nose and holiness is even found in the Zohar in which G-d is called “the Master of the nose (*Zohar* 3:130a) [5].” The kabbalists considered scent to be a heavenly sense (*Maamar Zo’r Channukas HaMizbe’ach*, in the appendix to *Ohr HaTorah, Bamidbar; tes al*). Spices were burned daily in the Holy Temple, and on the holiest day of the year, Yom Kippur, the high priest entered the Holy of Holies to perform the annual offering involving the incense to please G-d [5]. Some *halachos* of sneezing still apply today. If a person sneezes while eating a meal, the others present should not respond “asusa,” since talking at the

time of a meal may be a choking hazard (*Ta'anis* 5b). It would also be inappropriate to speak about any non-Torah related topic, even to say “bless you,” in a *beis midresh* (a room designated for Torah study) because such conversation distracts from the learning (*Berachos* 53a).

The subject of sneezing has been relevant throughout history and is ever relevant today appearing in religious texts, halacha, medicine, worldwide etiquette, and in current research.

“Ah, Ah, Achoo!”

“Labriut.”

“To health” indeed. The sneeze has been a necessary part of the individual’s immune system since the beginning of man, but continued research may lead to new

health protocols that will increase overall well-being on a larger scale, reaching many more people.

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Since ancient times, bloodletting has been the panacea to cure and to avert nearly all illnesses. A similar solution to removing unwanted blood in the body is the use of medicinal leeches. Both medical processes were widely accepted during Talmudic times to prevent illnesses and to treat disease [1, 2].

The Talmud states, “For the life of the flesh is in the blood, for it is the life of all flesh” (*Vayikera* 17:11). The blood circulates in the arteries and veins delivering oxygen and other essential elements to the organism, making it a crucial component in our body. Blood consists of four constituents: (1) liquid plasma, which contains water, electrolytes, nutrients, and waste products, (2) white blood corpuscles, which defend the body from infections and immunize the body from foreign elements, (3) platelets, cell fragments that accelerate the clotting of blood to avoid hemorrhage, and (4) red blood cells (erythrocytes), which deliver oxygen to the body and account for its red color. The Hebrew word “*dam*” (blood) is derived from the word, “*adom*,” which is translated as red [3].

All of these constituents function together to preserve and protect the organism by transporting nutrients, maintaining homeostasis among organs of the body, and responding to detrimental processes in the body such as fever, internal hemorrhaging, and even the common cold.

The act of bloodletting is to withdraw blood from an ill patient for the purpose of removing the illness or maintaining a proper physiologic balance of blood within the body. The bloodletter, now more commonly known as a phlebotomist, was not a physician but was an expert in bloodletting. It was an obligation for a city to have a bloodletter dwelling in its town, as without a bloodletter, a rabbinic scholar would not recognize it as a residence [1].

Bloodletting was done by making a slit through the veins with an instrument described by the Talmud as a “*kasulta*,” a lancet or a surgical knife. The Rambam, a physician, philosopher, *Talmudist* and *Halachist* during the Middle Ages, considered venesection essential but hazardous and therefore he established rules for pre- and post-bloodletting. Before the bloodletter extracted blood, the patient was examined for facial appearance and was required to be between the ages of 14 to 70 [1]. The *bracha*, “May it be your will Hashem my God, that this business be healing for me, for you are a compassionate healer” (Shulchan Aruch; Orach Chaim 230:4) was recited by the bloodletter prior to the act. There are numerous Talmudic statements regarding dietary restrictions one was recommended to obey. The consumption of vinegar and small fish, as well as cress, was considered dangerous (*Abodah Zara* 29a). There are dietary restrictions to be followed after bloodletting as well. It was suggested that the patient eat a light meal post-bloodletting to get the

proper nourishment. According to Rav, red meat, red wine, and a blood-rich spleen were recommended as food. “One who was bloodlet should not eat milk, cheese, or onions since they are too irritating for the stomach” [1].

The time and day was also an important factor for bloodletting. It is stated: “bloodletting was not done on a cloudy day and on days when certain wind directions prevail, which are dangerous for bloodletting” (*Shabbat* 129b; *Yebamot* 72a). The correct days for bloodletting were Sundays, Wednesdays, or Fridays (*Shabbat* 129b). It was prohibited on *erev chag*, *Shabbat* and *chagim*. It was permitted to be bloodlet *erev Shabbat* but not *erev chag* because the patient was required to celebrate the festivities of the *chag* and would not have the proper amount of energy if he/she was bloodlet before *chag*. However, just like on *Shabbat*, it was permissible if the patient was seriously ill, and thus would fall under a life-threatening situation, which overrides the laws of *Shabbat* (*Mishna Yoma* 8:6).

Further prohibitions for after bloodletting included any forceful activities, particularly exercising, travelling and cohabitation (*Gittin* 70a). Rabbi Shimon bar Yochai said that one may not have intercourse after bloodletting as the result would be children born cachectic (with a wasting syndrome); and if both man and wife had been bloodlet and performed intercourse, their children would suffer from leprosy.

The blood initially extracted from the body by bloodletting is unlike subsequent blood. Depending upon the illness, the extracted blood is significantly distinguishable from healthy blood. However, it is not distinguishable to the untrained eye, only the bloodletter would recognize the differences in the venesected blood (*Niddah* 20a). Bloodletting came with severe side effects, such as muscle spasms, insomnia, dyspnea, anxiety, diarrhea, or colitis. Venesection was known to be harmful if performed excessively but useful if performed in an adequate amount. The Talmudic *chacham*-physician Mar Samuel recommended that blood should be let at 30-day intervals [1]. The Talmud also stated that the minimum amount of blood necessary to sustain human life is one-quarter *log* (*Shabbat* 31b). Therefore, it is considered dangerous to bleed down to this limit because then even a minor stimulus such as a chill, which ordinarily is not harmful, might bring the person’s life to an end (*Shabbat* 129a). In modern day, bloodletting has limited scientific merit. A modern disease for which bloodletting can be utilized is polycythemia vera - an excess of red blood cells [3].

A similar solution to modern day illness is the use of medicinal leeches. The leech is a free-living worm in fresh water. It feeds on the blood of a vertebrate and can ingest five times its body weight in blood in 30 minutes. It excretes the majority of the water ingested with the blood and stores the

red blood cells as nutrients. The Hebrew word for leech is *aluka*, a parasitic worm, which lives in rivers and sucks blood from an animal until its whole body is filled with blood (*Mishlei* 30:15). The Talmudic interpretation for the word leech is *nima*, literally a water leech [2]. The Talmud warned against drinking water directly from rivers and pools since the person may ingest a leech (*Avodah Zarah* 12b). Leeches were medically recognized in America during the 18th century when used on President George Washington just before his death [6]. Subsequently, however, physicians questioned the medicinal efficacy of leeches and usage dropped at the end of the 19th century. Since then, usage of medicinal leeches has resurfaced and it is a method that is currently being used [4]. As with bloodletting, the application of medicinal leeches can be life threatening. The *Shulchan Aruch*, written by Rav Yosef Karo in the 1560's is a compilation of all the Jewish *halachot*. It states that swallowing a leech may lead to an internal wound. The Rambam recommended that before drinking water at night, one should strain it to avoid the risk of swallowing a leech (*Mishneh Torah, Berachot* 11:4).

The Talmud was a proponent of the practice of medicinal leeches and suggested they be used to treat a swollen spleen (*Gittin* 69b). The Talmud suggested the remedy is to take seven water leeches and drink two or three with wine every day. There are different ways to apply the leech. While in ancient times it was recommended to swallow it, today, physicians recommend the patient apply the leech on an external wound. Some physicians cut the leeches in half, causing them to regenerate and suck blood for a longer period of time [2].

The central concern of the *Talmudic Rabbeim* of the Middle Ages was the practice of using medicinal leeches on *Shabbat* when there was no medical rationale for their usage. Bloodletting was considered wounding the person, which is not a productive action, thereby making it a prohibition on *Shabbat*. Rabbi Yaakov Yitzchak Weiss, a Talmudic scholar, permitted its use on *Shabbat* for medicinal purpose only [2]. Most *Talmudic Rabbeim* disagreed unless a patient's condition is life threatening.

In more recent times, leeches are used for various procedures: they reduce venous congestion or edema in individual patients with occipital hematoma, periorbital edema, severe postoperative macroglossia, purpura fulminans, and thumb paronychia. These are a syndromes that build up excess fluid around an affected area, which can cause venous congestion and vascular collapse. Arthritis has recently been treated by leech application to the knee [2]. The most common current use of medicinal leeches is in plastic surgery, to rescue skin flaps compromised by venous congestion after surgery. With the correct use of medicinal leeches, the process can be quite successful. Physician Ronald M. Friedman, a plastic surgeon working at the Texas Health Presbyterian Hospital in Plano, Texas stated, "Don't waste time. Despite our advanced surgical techniques and therapies, there's still nothing better than leeches to solve the problem of venous congestion. I have a lot of respect for the little guys" [5].

The use of both bloodletting and medicinal leeching were widely used in ancient times in the treatment of various ailments and diseases. The Talmud recognizes the value of both practices but provides strict guidelines for their use. While bloodletting has not been as well received by modern medicine, it led to the discovery of the field of hematology. Medicinal leeching, however, still remains popular today for the treatment of excess fluid.

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The first *pasuk* in the *Torah*, as well as all the *pesukim* that follow, have much to teach beyond their plain words. In fact, there are at least three examples of considerably "scientific" *divrei Torah* just from the first couple of words. The three explanations that this article will address are related to mathematics, invention, and the laws of nature.

King Ptolemy II (283-246 BCE) wanted a Greek translation of the *Torah* (the Septuagint). He gathered 72 elders of Israel and sequestered them in 72 different houses (*Megillah* 9a). He visited each of them and said, "Translate for me the book of Moses your teacher." The Jewish elders felt that if they gave Ptolemy Gd's literal words to Moses - Ptolemy might be misled or use it against the Jewish people. So, the Sages each miraculously altered the first verse of the *Torah*. Instead of writing " - - בראשית *Bereshit*, (In) the beginning, created Gd..." they wrote "—אלקים *Elokim* (Gd) created, (in) the beginning," thus beginning the *Torah* with the letter - א *aleph* instead of the letter - ב *bet*. But, why is it that *Torah* begins with a 'bet'? Would not the first letter of the *aleph bet*, the *aleph*, be more appropriate for a beginning?

There is a mathematical phenomenon that can be demonstrated based on the first letter of the *Torah*. As when constructing a protein sequence from the genetic code, ribosomes translate every three nucleotides found in DNA into an amino acid. Each set of three nucleotides is known as a codon. Applying this technique to the *Torah*, one could count the subsequent 3 numerical sequences (codons). When starting with the number 1 and adding every 3 consecutive numbers, the sum will always add up to 6.

For example:

$$1 + 2 + 3 = 6$$

$$4 + 5 + 6 = 15; 1 + 5 = 6$$

$$7 + 8 + 9 = 24; 2 + 4 = 6$$

And so on. However, when starting with the number 2, what is known in protein translation as "frameshift mutation" occurs, and the sum of every three consecutive numbers will always add to 9.

$$2 + 3 + 4 = 9$$

$$5 + 6 + 7 = 18; 1 + 8 = 9$$

$$8 + 9 + 10 = 27; 2 + 7 = 9$$

The mathematical reason for this is that adding three consecutive numbers could be represented by the following form: $n + (n+1) + (n+2) = 3n + 3$. When we start counting from 1, $n = 1 + 3x$. When the counting starts from 2, $n = 2 + 3x$. Therefore, when beginning the consecutive count from the number 1, all possible combinations are represented by the following equation: $3(1+3x) + 3 = 6 + 9x$; and when beginning the consecutive count from the number 2, all possible combinations are represented by 3

$(2+3x) + 3 = 9 + 9x$, where x is an integer that represents how many "codons" away from 1 you currently are.

When starting with 2, the consecutive numbers add up to a multiple of 9, which, as a rule, when added together always add up to 9. When starting with 1, we do not end up with a multiple of 9, instead, the number 6 is involved.

The significance of this phenomenon is understood after taking the numerical values for the Hebrew words *sheker*, falsehood, and *emet*, truth. The *gematria* of these values is found by adding the numerical worth of each letter in each word:

$$1 = א$$

$$40 = ט$$

$$400 = ת$$

Adding to a total of 441.

$$300 = ש$$

$$100 = ק$$

$$200 = ר$$

Adding to a total of 600.

It is then observed that $4 + 4 + 1 = 9$ (representing *emet*), $6 + 0 + 0 = 6$ (representing *sheker*). Thus, one of the lessons derived from the fact that the *Torah* starts with a *bet* and not an *aleph* is that the *Torah* is always based on truth, and not on falsehoods. In this example, mathematics can be used to demonstrate an answer to why the *Torah* starts with a *bet* and not an *aleph* [1].

Another answer to this question is given by Rabbi Lord Jonathan Sacks, former Chief Rabbi of the United Hebrew Congregations of the Commonwealth. He notes that while the *Torah* begins with a *bet*, the Ten Commandments, which begin with "*Anochi Hashem*," start with the letter *aleph*. This teaches that first, with an *aleph*, we must establish that *Hashem* makes the rules of the world. Only then, with the *bet*, we are able to begin creating and building the world. *Chochmah* is defined as acquired knowledge, and the *Torah* is revealed knowledge. *Anochi Hashem*, the revelation of *Torah*'s true knowledge, must always come before creation and the acquiring of knowledge. We must know our limits within our own creations. The *bet* of creation is secondary and must always be regulated by the *aleph* in *Hashem*'s "*Anochi*." When it comes to invention, our power does not lay in what we can do, but rather what we may do.

Rabbi Sacks related this to assisted reproductive technologies. Our power comes not from how much technology we can invent, but rather from our knowledge of when to stop. For example, technology in this field can possibly allow us to clone human beings, have a child with three

parents, or even produce human chimeras. It is up to humankind to decide, from the given Torah knowledge, what type of knowledge should be desirable to acquire, and which knowledge we may not acquire [2].

A similar message is found from the fact that the Torah discusses the building of the *Mishkan*, the Tabernacle, in a consecutive five *parshiot*, in great detail of its dimensions. This question is more perplexing due to the fact that the *Mishkan* was not a permanent structure, but simply a temporary, portable place of worship for *Bnei Yisrael* while they were in the desert. Rabbi Sacks explained, “G-d creates order in the natural universe. We are charged with creating order in the human universe. That means painstaking care in what we say, what we do, and what we must restrain ourselves from doing. There is a precise choreography to the moral and spiritual life as there is a precise architecture to the tabernacle. Being good, specifically being holy, is not a matter of acting as the spirit moves us. It is a matter of aligning ourselves to the Will that made the world.”

This leads to a third idea that comes from the first *pasuk* of Torah, which relates to nature. “*Elokim*” is the Divine name used in the first *pasuk*. The *gematria* value of this name is 86. The Hebrew word *HaTeva* (the nature) also has a value of 86. Baal Haturim, Rabbi Jacob ben Asher, the 13th century Biblical commentator and author of the *Tur*, connected these two values and noted that the connection teaches us the lesson that nature exhibits the Divine will. No aspects of nature would occur if *Hashem* was not making it happen. This emphasizes that **this** name of G-d is bound up with the laws of nature. “*Elokim*” is that aspect which is active in the world, that aspect which directs the world through the laws of nature and that aspect which gives everything in the world its life and powers. One can also simply look at the vastness of nature to come to this realization. The occurrences of nature are, otherwise, impossible to be random [4, 5].

A wonderful example of this is the golden ratio, a ratio found in many “random” places in nature. The golden

ratio is a number, approximately equal to 1.618033 (an irrational number which continues forever), which repeatedly shows up in nature and natural occurrences. The Fibonacci sequence, discovered by Italian mathematician Leonardo of Pisa, was first written about in 1202. It is a sequence in which each next number is the sum of the two preceding ones: 1, 1, 2, 3, 5, 8, 13, 21...

This sequence is just one example where the golden ratio shows up in nature. The golden ratio, where $\phi=1.61803\dots$, is calculated by dividing each number in the Fibonacci sequence by its preceding number, each division yields a number close to ϕ . As the sequence continues, ϕ becomes more accurate. Today, its emergent patterns and ratios can be seen from the microscale to the macroscale, and right through to biological systems and inanimate objects. While the Golden Ratio does not account for *every* structure or pattern in the universe, it is certainly a major player. “The basic idea is that there is a connection between everything, and through these connections, one becomes especially conscious of the deliberate order with which nature is created” [6]. An example is the tightly packed seeds of a sunflower. The seeds rotate based on the ϕ ratio and they can therefore be as tightly packed as possible. Even the ratio of our DNA’s double helix turn is close to ϕ [7].

As demonstrated in the above examples, the first *pasuk* of the Torah has much to teach us. The Torah is based on truth, we are not free to manipulate the world as we wish, and Hashem controls nature and is behind the miracles that occur each day.

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BRCA and the Jewish Community: What You Need to Know

By Amira
Tepler

"You shall not marry them, you shall not give your daughter to their son, and you shall not take his daughter for your son" (Deut. 7:3). The biblical commandment against intermarriage has created a Jewish people that is both a nation and a race. Marrying within our faith allows us to multiply and flourish into a community built on mutual values, beliefs, and goals. Our racial identity has enabled us to trace back many characteristics relating us to our ancestors, who lived centuries ago. The genetic marker found on the Y-chromosome of many Kohanim, for example, indicates a link in our lineage, one kept clear through the tight-knit nature of our community. *BRCA1* and *BRCA2* genes, linked with breast cancer, are no different. Approximately 400-500 years ago, the most common *BRCA1* and *BRCA2* mutations entered the genetic pool of Eastern and Central European Jewry. The founder effect nature of Ashkenazi Jewry allowed for a rapid and widespread distribution of the mutation. Approximately 10 million Ashkenazi people living today descend from these ancestors [1].

It was at that time in the late medieval period that, according to a 2014 study, a bottleneck, or - a rapid growth from a small amount of people - occurred in a community within the Ashkenazi population which was approximately a mere 350 people. The study looked at the entire genome of a group of modern descendants of the bottleneck and compared long segments of shared DNA common to the group, including the *BRCA1* mutation [2].

The mutation poses a real threat to Ashkenazi women. The most common mutations are two in *BRCA1*, gene c.68_69delAG and c.5266dupC, and one in *BRCA2*, c.5946delT. 2.6%, or 1/40, of Ashkenazi Jews carry these mutations (1%, 0.13% and 1.52% respectively). Carriers of this mutation face an over 60% chance of a breast cancer diagnosis and their lifetime risk for ovarian cancer can be as high as 33% [1].

Approximately 12% of the general population of women will develop breast cancer in their lifetime. The National Cancer Institute (NCI) estimated that with the *BRCA1* or *BRCA2* mutation, the chances go up to 55-65% and 45% respectively. The NCI strongly encourages *BRCA1/BRCA2* screening for Ashkenazi Jewish women [3].

Dr. Daniel Eisenberg, an Assistant Professor of Diagnostic Imaging at Thomas Jefferson University School of Medicine, a practicing radiologist in the Department of Radiology at the Albert Einstein Medical Center in Philadelphia, and an expert in Jewish medical ethics, presents some *halachik* implications that arise when deciding if and when to get *BRCA1/BRCA2* screening. Is

the almost 3% carrier frequency in the Ashkenazi Jewish population enough to be considered a "risk to life" that constitutes a necessity for screening by *halacha*? Carrying the mutated *BRCA* gene does not guarantee the development of cancer but rather predisposes one to cancer. Would the predisposition be sufficient to *halachikly* require surgery? Developing cancer is only a statistical risk and not an absolute, Eisenberg argued, and it is therefore much harder to argue in favor of obligatory testing. However, continued Eisenberg, if a woman does get tested and finds she does carry the mutated gene, "she would almost certainly be required to tell her prospective spouse of her results." Rav Moshe Feinstein ז"ל, was asked if a man with Marfan Syndrome (a debilitating genetic disease) was required to marry and he answered yes. However, if his wife was not informed of his condition before marriage, she could have the marriage annulled [4].

Rav Moshe Dovid Tendler *shlit"a*, son-in-law of Rav Moshe Feinstein and Rosh Yeshiva at REITS, appropriately called *BRCA* screening, the "tyranny of knowledge." We usually ascribe a certain power to knowledge. Screening is a powerful tool; one that enables women to take preventative measures against cancer. Surgical procedures such as mastectomies (removal of the breast tissue) and oophorectomy (removal of ovarian tissue) reduce a woman's risk of getting cancer to 5%, lower than the average non-*BRCA* carrier's chances. Rabbi Akiva Tatz, a prominent South African Orthodox **Rabbi**, inspirational speaker and author writes in his book, *Dangerous Disease and Dangerous Therapy in Jewish Medical Ethics*, quoting Rabbi Yitzchok Zilberstein *shlit"a*, another prominent Orthodox **rabbi**, posek and expert in medical ethics, as saying, a woman who is a known *BRCA* mutation carrier can have a surgical procedure to prevent cancer due to the risk to her life [5].

Although many argue that *BRCA* only increase one's predisposition to developing breast and ovarian cancer, it is important for a woman to be aware of all of her testing options as well as the *halachik* and ethical implications of pursuing these informative measures.

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Kidneys Cannot Talk, But the Body Surely Hears Them

By **Kelley Tripp**

Among a list of many organs with their moral or psychological functions, the Talmud repeatedly noted that “the kidneys give advice,” or “*kelayot yo’azot*.” Dr. Samuel Kottek elucidated this phrase to mean that the kidneys are the “counselors of the heart.” In fact, the kidneys are the counselors of the whole body [1]. It is learned from King David’s Psalms about a type of advice the kidneys provide: “My kidneys also admonish me during the night” (Psalms 16:7). Kottek explained this verse to mean that the kidneys are active during the night while not being “influenced [by] the outside world,” thereby providing counsel that is unfaltering [1]. Kottek noted that Rabbi Shimon bar Yohai, in the Midrash Rabba (Numbers 10:21), described that Avraham learned his Torah knowledge from his G-d inspired kidneys; in essence, the kidneys were talking to the brain of Avraham. With the advance of science, there is an elucidation of the mysterious counsel which the kidneys provide on a physiological level.

Overall, kidneys maintain homeostasis in the body, thereby serving as the top advisor not only to each person about their health, but even more so, to the body itself. Kidneys maintain homeostasis by controlling blood pressure, by producing the right number of erythrocytes, and by clearing toxins from the body; therefore, kidneys truly maintain the whole body function.

When discussing the type of advice provided by kidneys as referenced in ancient Jewish texts, Kottek noted that “it was known in antiquity that kidneys were in some way related to the formation of urine,” indicating that when these moral and psychological statements about kidneys were being made, there was also an understanding of the connection between kidneys, urine, and their important physiological role in the body [1]. Indeed, it is now understood that kidneys do not simply exist independently, but rather, they function as an integral part of the body, excreting metabolic wastes generated by the individual. The health and the ability of the kidneys to work properly ensures that the entire process of dispelling deadly toxins is accomplished correctly [2]. As noted by Kottek, in ancient times urine was referred to as water, and water was a “symbol of learning” [1]. As in a municipality the water systems work at night, so too the kidneys work at night, providing advice on a continuous and on an unconscious level.

On a physiological level, urine in fact can provide immeasurable information about the body’s status, thereby providing advice about how to handle one’s health and future. The kidneys filter the entire blood volume over 20 times a day and remove undesirable chemicals from export

through urine. Jane Brody, a science writer for the NY Times, noted that urine “holds clues... to how well the body is functioning.” Urine, based on its clarity, color, and substances found in it, can indicate if a person has an infection, cancer, diabetes or more. Urine can indicate if one’s salt intake is too high, or based on its color, can indicate one’s hydration level. Brody noted that, for example, if one’s urine is pale yellow or clear, it indicates normal hydration levels due to the decreased level of the production of the yellow pigment urochrome. However, dark urine can indicate either dehydration or hepatitis, a liver disease. In another example, urine that is constantly foamy may indicate the excretion of protein, a sign of kidney disease. Clarity and volume of urine also are indicative of various diseases. *Escherichia coli* in the urine implies a urinary tract infection [3]. Overall, by gleaned advice from urine, one is in essence gleaned advice from the kidneys themselves, because urine production reflects kidney function. In their waste products, kidneys provide profound and detailed advice about one’s state of health.

Interestingly, not only are kidneys the source of advice about one’s health status through their production of urine, but also, kidneys themselves directly influence one’s cognition. The kidneys produce erythropoietin, a hormone involved in the synthesis of hemoglobin, the protein which carries oxygen to the body. When not functioning properly, the kidneys cannot produce erythropoietin, leading to anemia and fatigue of muscles and the brain. As a result, one cannot concentrate fully, nor remember, study, learn, or use her brain to its fullest capacity [4]. Thus, one’s intellectual abilities are dependent on the kidney, and in that relationship of dependence, is another way the “kidneys give advice.” Counsel, or one’s ability to reason with their mind, requires a clear, functioning brain; the kidneys, when functioning properly and providing erythropoietin, give proper brain function, and therefore, “give advice.”

Through the advance of scientific research, one can better appreciate the kidney’s invaluable relationship to health and the Torah’s genius in recognizing this relationship.

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The Infectious Opposition to HPV Vaccination in the Jewish Community

By Maia Wiesenfeld

Since the advent of vaccinations, the rates of contracting lethal infectious diseases have significantly decreased. Diseases such as smallpox, diphtheria, polio, and measles have been completely or almost completely eradicated from our society, greatly reducing the rate of childhood mortality. Yet, despite the widespread success of vaccines, there are still many people who refuse to vaccinate themselves and their children. In contrast with the smallpox vaccine, which prompted global campaigns and brought the ultimate eradication of smallpox in 1980, other vaccines for common illnesses are met with fierce opposition. One such disease is human papillomavirus, or HPV, a class of microorganisms that are often sexually transmitted and affect over 79 million Americans each year. It is the most common infection in the United States, and over 80% of sexually active people will contract at least one strain of HPV during their lifetime. The HPV vaccines prevent against the acquisition of specific strains of HPV and are available for administration. These vaccines are controversial in the anti-vaccination movement and in the Jewish community as well. A look into rabbinical sources helps shed light on the issue of vaccination in Jewish law and gives insight into how the Jewish community should respond to the HPV vaccine.

From a physiological perspective, aside from the consequences of carrying and transmitting a disease and suffering from its symptoms, certain strains of HPV can also lead to precancerous and cancerous tissue development. Serotypes, or strains of HPV are classified as “high-risk” or “low-risk” based on the probability of carcinogenesis, and they typically present with different clinical manifestations. Papillomas, wart-like growths, are typically caused by infections with low-risk HPV serotypes. Certain strains such as HPV6 and HPV11 are the most common causes of genital warts [1]. Other strains cause non-genital warts that can emerge in various body regions, such as the hands and mouth. Most commonly, an HPV infection will not present any symptoms and a person may not be aware of its presence. Symptoms that do arise, however, can manifest years or even decades after the initial contraction of the virus. Infections with high-risk HPVs are commonly asymptomatic until precancerous tissue is identified, usually after persistent infection. HPV-attributable cancers include anal, vaginal, vulvar, penile, oropharyngeal, and, most frequently, cervical malignancies, often associated with HPV strains 16 and 18 [2]. The virus contains eight genes, two of which are the oncogenes, E6 and E7. When integrated into their host cell’s DNA, E6 and E7 oncoproteins are produced and lead to the development of cervical tumors [3].

To prevent contraction of certain high-risk and low-risk strains of HPV, physicians recommend administration of the Gardasil® vaccine to females and males of ages 9 through 26. In general, vaccines contain a weakened form of a pathogen that, though not potent enough to cause infection, still triggers an immune response. This allows the body to recognize the pathogen and react accordingly, producing the necessary protection mechanisms that can be activated upon future infection [4]. According to the Centers for Disease Control and Prevention (CDC), preteens should be vaccinated “so they are protected before ever being exposed to the virus.” It is preferable to vaccinate a child early, as studies have shown that younger teens produce a better immune response to the vaccine than do older adolescents. The CDC also noted that the HPV vaccine poses “no serious safety concerns.” Mild side effects include pain at the site of injection, fever, dizziness, and nausea [5]. With this in mind, it is worthwhile to receive the vaccine, as the CDC reported that “every year in the United States, HPV causes 30,700 cancers in men and women. HPV vaccination can prevent most of the cancers (about 28,000) from occurring” [6].

To understand the various *halachic* rulings on vaccination as a means of preventing harm to one’s health, it is useful to delve into the Rabbinic responses to putting oneself at risk of danger and protecting oneself from harm. The Torah commands us, “*venishmartem me’od lenafshoteichem*” (*Devarim* 4:15), to keep watch over one’s health. Further, the Talmud comments on the words “*verapo yerapeh*” (*Shemot* 21:19), explaining that doctors are given permission to heal (*Brachot* 70a, *Bava Kamma* 85a). In his book *Nishmat Avraham*, Dr. Avraham S. Avraham rules based on the Rambam, Maimonides, that a doctor’s role is to maintain patients’ health, which includes preventing loss of such health [7].

The Shulchan Aruch ruled on various verses in the Talmud that we are obligated to remove danger from among us. This specifically refers to putting up a *maakeh* (*Devarim* 22:8), or railing on a rooftop, but can be extended to apply to any dangerous activity. The Rabbis did not specify the extent of the danger required to forbid an activity, however this prohibition seems to apply to activities or situations that are commonly considered as risky. Delving further into the sources suggested that in a majority of cases the dangerous activities to be avoided are not seriously threatening. For example, there is a prohibition of drinking *mayim megulim*, water left uncovered that may have been contaminated with snake venom. Rav Moshe Feinstein, a leading halachic authority of the 20th century, commented on this *issur* that even though the risk of contamination is

very remote, the Sages ruled that this was enough of a concern to fall under the category of *pikuach nefesh*. Additionally, the Talmud forbade owning certain types of vicious dogs, even if they have not, as of yet, caused harm, indicating that one must take actions to avoid danger even before it occurs. Similarly, the Rema, a world-renowned scholar of the 1500's commented on the Shulchan Aruch that in times of plague, one should immediately flee from the city at the start of the plague rather than delay, in order to avoid the disease as best as possible [8]. During the smallpox epidemic, many Rabbis ruled on the issue of vaccination. *Poskim* declared that parents are obligated remove their children from the more dangerous regions, and those who do not follow this are guilty of sinning. Rabbi Yisrael Lifshitz, a commentator on the Mishna, among others, insisted that the benefits of the vaccine outweighed the risks, therefore deeming the vaccine permissible. More recently, 20th century *posek* Rabbi Shlomo Zalman Auerbach ruled that vaccination is allowed even on Shabbat in the event that the opportunity may not arise again for a few years. In a similar circumstance, Rabbi Eliezer Waldenberg, a famous halachic authority, ruled that the tetanus vaccine may be administered on Shabbat [9]. From this it is clear that *poskim* viewed vaccines as an important enough preventative measure that one may, in certain cases, violate Shabbat to protect himself from illness. Seemingly this would indicate that parents must go to great lengths to save their children from contracting communicable diseases, such as those that can be prevented with vaccines.

Though it is clear that in times of serious epidemics vaccination is mandatory, there is debate over the obligation in times with no such epidemic. Some hold that parents cannot be forced to vaccinate healthy children, even if the parent is refusing purely because of an "irrational fear" (*Nishmat Avraham, Choshen Mishpat* 426b and 427a). Others such as Rav Elyashiv, a 20th century scholar, ruled that since vaccinations are the normal and standard practice, it is a parent's duty to provide them for one's children [10]. The Rambam explained that living a healthy lifestyle falls under the commandment of serving G-d properly. Healthy eating, sleeping, and exercising are necessary; the extent of these activities is based on the trusted medical knowledge of each generation (Rambam, *Hilchot Deot* (4)). Thus, it is clear from this how Rav Elyashiv understood the necessity to vaccinate one's child as falling under the category of a recommended, common practice of our time.

The *halachic* debate regarding vaccinations included discussion of school rules mandating vaccines and the factors of herd immunity and endangering the lives of others. Because the spread of HPV is limited to sexual contact, these issues are less applicable and are beyond the scope of this article.

Many Jews who oppose vaccines do so out of wariness of vaccine safety rather than from religious concern. The HPV vaccine, however, poses an additional, religious issue in the Jewish community, as some consider the immunization as promoting sexual promiscuity amongst youth. An article published in Haaretz newspaper described the opposition of the ultra-orthodox towards the HPV vaccine in response to the Israeli Ministry of Health recommendation to offer the vaccine to eighth grade girls in school. Upon being approached by parents seeking advice, Rabbi Baruch Efrati, an Orthodox rabbi in Efrat, issued the following statement that "there is certainly no place for such a vaccination in a religious school, since it rests on the fundamental assumption that the girls are steeped in the sins of Western culture..."[11]. In response to similar claims, studies were conducted to determine the correlation between receiving the HPV vaccine and sexual promiscuity. Results showed that "No association was found between HPV vaccination and risky sexual behavior" [12]. In addition to the claim that protecting against HPV may encourage sexual promiscuity, another reason for opposition to the HPV vaccine is the low incidence of cervical cancer amongst Jewish women. Braithwaite was the first to note, in 1901, that the rate of cervical cancer in Jewish women was significantly lower than in the gentile populations [13]. *Brit Mila*, endogamy, *Niddah*, and other conservative sexual practices have been proposed as factors contributing to this statistic. Those who refuse to vaccinate their children often cite these studies in their reasoning and claim that the risk of their Jewish daughter developing cancer is low, and therefore HPV vaccination is not necessary.

There are also those in the religious community who support the vaccine, regardless of its connotations. In a response to a question about whether to vaccinate religious teenagers against HPV, the Nishmat Women's Health and *Halacha* service "Ask the Yoetzel" recommended the vaccine, explaining, "One never knows exactly whom one is going to be sexually involved with over time (for example, marrying someone with previous sexual experience, or G-d forbid in a case of rape). A child's lifestyle may also turn out to not be the one we hoped for" [14]. This is reason to vaccinate based on common sense and practicality, and applies to Orthodox communities as well as secular.

As technology progresses, the world is blessed with innovative solutions to problems previously unsolvable. In the world of medicine, countless diseases have been eradicated, increasing life expectancy and improving quality of life. With the invention of vaccines, mankind has been given the incredible ability to be protected from various life-threatening conditions. Yet, many still remain uneducated on the benefit of vaccines and are quick to spread fear and inaccurate assumptions. The anti-vaccination movement has picked up speed, especially in Jewish religious communities. Individuals consult with religious leaders to

help make medical decisions. Based on various Talmudic sources and rabbinic rulings, it is clear that vaccination is an acceptable practice for Jews. Regarding the HPV vaccine, however, there is still *machloket*. The different issues presented above set the HPV vaccine apart as requiring deeper thought and perhaps more *halachic* attention. The correlation with cervical and other cancers and their prevention with the HPV vaccine should be enough to convince people to vaccinate their children, however this issue still needs more work. Hopefully, as medicine continues to progress and education on health-related topics is improved, we will see a time when sexually transmitted diseases reach an all-time low.

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There are a variety of skin diseases nowadays known to mankind, but Jewish law mainly focuses its studies on tzara'at, which is usually referred to as leprosy. Leprosy, which is also known as Hansen's disease, was discovered by Gerhard Henrik Hansen in 1872, and can be identified by skin sores/lesions caused by the bacteria *Mycobacterium leprae* [1]. Although tzara'at is similar in some of its symptoms to leprosy, there are enough contradictory or differing symptoms to suggest otherwise. For instance, unlike tzara'at, leprosy affects only people but not their property, causes hair loss but not loss of pigment, develops slowly and does not change much in a period of a week or two [2]. In addition, the diagnostic techniques and the treatments are entirely different; the Bible abstains from elaborating on any hideous body deformities or the loss of feeling due to nerve damage with which leprosy is associated [3]. Moreover, based on historical and archeological testing, the original cases of leprosy in the Middle East were between 324 and 325 BCE [4]. Given the fact that there is not enough supporting evidence (other than the Greek translation of the work tzara'at, which is *leprae*), it can be concluded that tzara'at is not the biblical version of leprosy.

There are many scholars who question which presently known disease/s can be compared to tzara'at. Dr. Chaim Trachtman, a Clinical Professor of Pediatrics, has a fascinating answer. In his paper on the website, "The Torah: A Historical and Contextual Approach," he compares tzara'at to melanoma, a very dangerous type of skin cancer. The main reasons for his hypothesis are the hot climate in the Middle East with constant direct exposure to the sun, and the fact that medicine today can cure almost all cancers, even metastatic melanomas, without surgery or scarring (unlike leprosy). Since this can be achieved, although through immunotherapy and not by the biblical cleansing rituals, it shows that there might be a connection between these two diseases.

To analyze this further, Dr. Trachtman explains how the symptoms of melanoma can be compared to the ones of tzara'at. He uses an acronym, ABCDE, which stands for Asymmetric, Border, Color, Diameter, Enlarge, Evolve or Elevate [5]. Melanoma is identified through its asymmetric lesion shape, unusual border (undefined or strangely shaped border), if it is multicolored, has exceeded 6.6mm in diameter, or generally has grown from its original size. Dr. Trachtman shows that the symptoms of tzara'at correspond to the ABCDE acronym by translating the peshat in the book of Vayikra (chapters 13 and 14) into English. The lesion types, mentioned in chapter 14 verse 56, are depigmented (*baheret*), hypo-pigmented and raised (*se'et*), or scabbed (*sapachat*), where *se'et* and *sapachat* could represent asymmetric lesions. The borders are

irregular if following the definition of *tzarev'et ha mechuve*, in Chapter 13 verse 28, which means the scar of a burn. As for the color, it is said to be as white (*levana*; 13: 4) or a little reddish (*adamemet*; 13:19). The loss of hair pigment, due to tzara'at, from black to yellow to white can be associated with melanocyte (a mature melanin-forming cell) being the cell from which the lesion originates. Stem cells, which are precursors of melanocytes, reside at the base of hair follicles and produce hair pigment. When melanocytes go through malignant transformation it is the physio-pathological basis of melanoma. There is no information about the diameter criterion in chapters 13 or 14. However, after the tzara'at has moved on to the house or clothes, the Kohen would measure it after one week to see if there are any changes in its size, which would indicate if the disease was cured or not. That examination is referred to as the evaluation period [5].

Moreover, Dr. Trachtman explains why a quarantine was required for the *metzora* (a person suffering from tzara'at). Nowadays if a person has a contagious disease, he will be quarantined in order to keep the people around him, who are not infected, safe. Hence, the need to quarantine the *metzora* while his tzara'at is being examined, and his banishment from the camp if the case was very severe, might be mistaken as evidence in support of the comparison to leprosy or other infectious diseases. Melanoma, like all cancers, is not contagious and does not require the patient to be isolated. Still, the need for quarantine might not be out of fear for the community's safety (just like it is not mentioned that the Kohen seems to be concerned about himself when he examines the person's skin; he takes no precautions), but rather, it may be relying on the idea that the *metzora* was considered tame' (*נמו*) and that his presence would therefore disturb the *kedusha* (holiness) of the city [5].

Furthermore, Dr. Trachtman points out that the Kohen's medical approach to the tzara'at is similar to a physician's approach to melanoma. He writes, "It is worth noting that under no circumstances does the Kohen excise the lesion. This is significant since surgery is not appropriate for patients with advanced metastatic disease." Instead of surgically removing the lesion, the Kohen monitors it and offers hope for forgiveness and cure in the future (this is based on the text in the book of Vayikra). This is similar to the current care methods for patients with metastatic melanoma, mainly working on preserving the immune system since a variety of conditions can have sudden remissions. As stated by Dr. Trachtman, "If the immune system is responsible for controlling melanoma and checkpoint inhibitor therapy potentiates the response, it is plausible, albeit rare, that melanoma could regress on its

own, which is the best that could have been expected in ancient times” [5]. This makes sense because in Biblical times the Kohen was not a practicing oncologist or an infectious disease specialist, thus the metzora had to depend on a miracle from Hashem.

Another way of understanding Hashem’s role comes from referring to tzara’at as a form of cancer. Cancer is a prevalent disease and in some cases, especially when diagnosed early on, can be cured. However, since it attacks the human body from within unusual cell proliferation instead of external sources like contagious bacteria, it can inspire contemplation and dependence on Hashem. Rambam, one of the most influential Torah scholars of the Middle Ages, referred to tzara’at as a “sign (ot) and wonder

(pele’).” As stated by Professor James Diamond, a professor of Jewish Studies at the University of Waterloo, Rambam often uses the term pele’ in legal contexts simply to imply a rare, yet entirely possible, occurrence within nature’s boundaries (Mishneh Torah, Laws of Leprosy 16:10) [6]. Hence it is important to maintain a relationship with Hashem.

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Dinosaurs and Woolly Mammoths - is there a Torah Viewpoint?

By Harvey
Babich, Ph.D.

Dinosaurs and, to a lesser extent, woolly mammoths are exciting and appealing to children and stimulate the imagination of young minds. The Museum of Natural History in Manhattan is visited by many Jewish day schools, yeshivas, and seminaries. In the spring of 2016, the Museum introduced a new exhibit: the Titanosaur, a gigantic dinosaur with a length of 122 feet and neck length of 39 feet [1]. What is the Orthodox Jewish viewpoint towards these long extinct creatures? In the “Ask the Rabbi” section of the on-line site, Ohr Somayach [2], the following question was asked. “A friend recently asked me how Orthodox Judaism deals with the issue of scientific proof of dinosaurs’ existence. Is there an explanation to be found in Torah? Your answer or explanation would be greatly appreciated as we are both teachers in a Hebrew day school and the children argue amongst themselves about whether dinosaurs did or did not really exist.” This article discusses, within a Torah framework, the occurrence of these creatures. In the Torah, there is no mention of these creatures, nor should there be, as these animals are extinct (*i.e.*, *kasbrus* is not an issue), have no relevance to *halachic* Judaism and the performance of *mitzvos*, and their mention could not have been understood by earlier generations, as the fossilized skeletons of these gigantic creatures were found only within the past 200 years.

Current scientific thinking is that dinosaurs appeared on this planet about 230 million years ago, were the dominant animal life form for 135 million years, and abruptly disappeared about 66 million years ago. [Note, there are no anti-Torah comments in this article and the number of years noted above do not refer to life on our present world, which began 5,777 years ago, but rather to life on a prior, earlier form of this planet. Do not panic; be patient, as this will be explained, as it is based on a *midrash*.] Dinosaurs inhabited every continent (terrestrial dinosaurs), the air (flying dinosaurs), and the oceans (marine dinosaurs); some were herbivores and others were carnivores. Biologically, dinosaurs are classified as reptiles, exhibiting egg laying and nest building. Some dinosaurs were bipedal, others were quadrupeds, and still others were able to shift between these stances. Size varied as well: some dinosaurs were very small, about 20 inches in length, and others were huge, reaching lengths of 130 feet and heights of 59 feet [3].

Dinosaurs, and most other species of that epoch, suddenly and abruptly disappeared and became extinct. The dominant hypothesis, known as the “impact theory,” is that a mass extinction was triggered by a giant, extremely

bright meteorite (*i.e.*, a fireball), 5 to 15 kilometers in diameter, impacting upon the planet in the vicinity of the Yucatan Peninsula in southeastern Mexico, creating the Chicxulub Crater, approximately 180 kilometers in diameter. Death was caused by extreme heat followed by extreme cold. First, impactation of the meteorite directly generated an unusual heat wave. Secondly, impactation caused the ejection of much particulate matter into the atmosphere, which reflected thermal solar radiation and led to a world-wide rapid cooling. Dinosaur extinction was quick, occurring within hours [3]. Recently, it was suggested that dinosaurs were already suffering from climate changes triggered by volcanic eruptions and impactation by the meteorite was the *coup de grace* leading to their mass extinction [4].

Yet planet Earth, although affected by volcanic eruptions and impactation of a giant asteroid, was still intact, albeit greatly modified. *HaShem* was preparing this planet eventually for mammalian inhabitation and thereafter for human inhabitation. As long as dinosaurs dominated the Earth, there was no possibility for large mammals or human beings to exist. Only after the dinosaurs were wiped out could mammals flourish to become the dominant species. Dr. Luis Alvarez, who proposed the impact theory, stated, “From our human point of view, that impact was one of the most important events in the history of our planet. Had it not taken place, the largest mammals alive today might still be the rat-like creatures that were then scurrying around trying to avoid being devoured by dinosaurs” [5].

Following the extinction of dinosaurs, large mammals became the dominant species. Of interest to this article are the mammoths, close relatives of modern-day elephants. Mammoths are quite large, reaching heights of 13 feet, with extremely long tusks that have a characteristic curve; the tusk length was usually the same length as the mammoth’s height. During the last ice age, mammoths lived in northern Eurasia and North America. One of the last species of mammoth was the woolly mammoth, adapted to live in cold climates by a layer of fur covering all parts of the body. The last habitats of woolly mammoths included Siberia and Alaska. Interestingly, many frozen specimens of woolly mammoths have been discovered. Cave paintings depicting woolly mammoths were found and attributed to prehistoric man. Whereas dinosaurs and prehistoric men were not together in the same epoch, there is evidence that woolly mammoths and prehistoric men were contemporaries [6, 7].

Mammoths existed about 55 million years ago and became

extinct over 10,000 years ago. The reasons accounting for extinction of mammoths vary and include a warming trend, accompanied by glacial retreat and rising sea levels, shrinkage of habitat, susceptibility to infectious disease, and drowning (*e.g.*, in Siberia, while traveling to the Northern River, many mammoths broke through the ice and drowned). Lastly, mammoths may have been hunted by Neanderthal prehistoric men [6, 7].

Our knowledge of dinosaurs and mammoths comes from findings of their remains, which for dinosaurs include their fossilized skeletons, eggs, and footprints and for mammoths include their fossilized skeletons, tusks, and frozen specimens. A brief discussion of fossil formation is needed, as it will help elucidate the concept of the existence of worlds prior to our present world. Fossils are found in the outermost and thinnest layer of the Earth, termed the crust. The Earth's crust is composed primarily of sedimentary rock, formed when sand and silt collect and harden. Over geological time, thick layers of sedimentary rock are formed, termed strata. Let's assume that many, many years ago a dinosaur died in an environment that had a lot of moving sediment. The soft tissues of the dinosaur decomposed, leaving the harder parts, such as the skeleton. The organic constituents of the skeleton eventually decomposed, leaving the inorganic constituents composed primarily of calcium salts. Water carried iron and calcium phosphate into the dinosaur's porous and fragile bones, causing some minerals to precipitate. Gradually, the dinosaur bone became rocklike. Over the course of time, sediment around these reinforced bones became sedimentary rock, thereby preserving the fossilized skeleton. Sedimentary rock may also hold "trace fossils," or evidence that a creature once existed. Dinosaur footprints are a type of trace fossil, formed when the animal left its prints in soft, but sturdy, soil, creating a mold. Sediment filled the mold and, over geological time, both the mold and its filling hardened. When erosion removed the upper layers of rock, the preserved footprint was revealed [8]. Animals living in a common era would be found in common strata. None of the thousands of locations in which dinosaur fossils and footprints have been found have ever included human fossils or the remains of human civilizations. Similarly, none of the countless archeological excavations of ancient human civilization have ever included traces or records of dinosaurs. Dinosaurs clearly lived in a different era than humans [9].

No fossils of mammoths have ever been found in the same strata as the dinosaurs. It is clear that there was an age of dinosaurs distinct from an age of mammoths [9]. Preserved mammoths have been found in tar, *e.g.*, the La Brea Tar Pits in Los Angeles, CA. No remnants of dinosaurs are found in the Tar Pits. Another form of fossilization applicable to mammoths is freezing, a process which can preserve the entire body. Well-preserved mammoths, still with their hair, skin, and intact organs, have been found in frozen tundra

and icy crevasses of Siberia [8]. As an aside, it is interesting to note that the bodies of mammoths found in the permafrost are well preserved, with identifiable cell nuclei. Currently, competing scientific teams in Japan, South Korea, and Russia are engaged in research to clone a mammoth [10].

Essentially, there are three major theories to explain the past occurrence of dinosaurs and mammoths on this planet. Based on the findings of fossilized bones of dinosaurs, Rabbi Menachem Schneersohn, the past Lubavitch Rebbe, presented two thoughts. Perhaps, dinosaurs existed over the past 5,776 years, died, and because of environmental conditions that differ from today, their skeletal remains underwent a rapid fossilization process. The second thought is that living dinosaurs never existed. Perhaps, "G-d created ready fossils, bones, or skeletons (for reasons best known to Him)." If so, "why did G-d have to create fossils in the first place? The answer is simple: we cannot know the reason why G-d chose this manner of creation in preference to another, and whatever theory of creation is accepted, the question will always remain unanswered. The question, Why create a fossil? Is no more valid than the question, Why create an atom?" [11].

Rabbi Naftali Berlin (Netziv) in *parshas* Noach (HaAmeik Davar; 7:23) suggested that dinosaurs roamed the world in the pre-*mabul* period. According to *Chazal*, animals in the antediluvian pre-*mabul* era mated outside their species, leading to the birth of different types of hybrid creatures, including the dinosaurs. The flood waters destroyed the dinosaurs and it was *HaShem's* intent that their bones remain buried for centuries, as a warning to future generations not to mate with different species. Rabbi Meir Leibush ben Yechiel Michel (Malbim commentary to Genesis 7:23) also suggested that dinosaurs lived in the era prior to the flood. Accordingly, although "they (*i.e.*, the dinosaurs) may have survived the action of the water, they were nevertheless eliminated from the face of the earth by the strong currents which carried them into the chasms that had been formed when the ground was split. They were absorbed and deposited thousands of cubits deep - and so completely that when Noach later left the ark, he found no traces of any animal remains, not even of those giant creatures which existed before the Flood." A weakness with the theory presented by the Netziv and the Malbim is that if dinosaurs died along with other animals and with human beings, then fossilized bones of dinosaurs would be found in the same sedimentary rock layers as fossils of other creatures. The fact that we do not find this is a strong indication that dinosaurs, large mammals, and human beings lived in different epochs [9]. Rabbi Brown [12] noted that the *mabul* cannot explain the numerous geological strata, each containing its unique blend of fossilized animals. As pointed out by Rabbi Slifkin [9], both the Malbim (1809-1879) and the Netziv (1817-1893) lived when fossilized dinosaur bones were just being discovered. If

they were alive today, with the abundance of fossilized dinosaur bones found, perhaps they would have presented a different explanation for the occurrence of dinosaurs on this planet.

The third approach is based on a *midrash* (Bereshis Rabbah, 3:7; 9:2; Koheles Rabbah 3:1.11;

Yalkut Shimoni Koheles Rabbah 968:3) that, according to Rabbi Avahu, prior to this world, *HaShem* created many other worlds and destroyed them, saying, “This one pleases Me, those did not please Me.” According to this thought, dinosaurs and woolly mammoths lived, independent of each other, in two of these prior worlds. The concept of prior worlds eliminates a controversy between Torah and science of the age of the universe. The Torah’s viewpoint is that, as of September 2016, our world is 5,776 years old, calculated from the creation of *Adam HaRishon*. However, according to the scientific viewpoint, our universe dates back 13.8 billion years, calculated from *Bereshis* (i.e., the Big Bang) and progressing through all the prior worlds that were created and destroyed (*boneh olamos umachrivon*) subsequent to the world that we now inhabit. Thus, depending upon your point of reference, both calculations are correct.

The concept of *boneh olamos umachrivon* was promulgated by Rabbi Israel Lipschitz (author of the commentary *Teferes Yisrael* on the Mishnah) in his *D’rush Or HaHayyim*, printed in the *Yachin u-Boaz* edition of the Mishnah, after Sanhedrin. Rabbi Joseph B. Soloveitchik [13], Rabbi Isaac Elchanan Theological Seminary, Yeshiva University, Rabbi Shlomo Aviner [14], Yeshivat Ateret Yerushalayim, Rabbi Yisroel Belsky [15], Mesivta Torah Vodaath, Rabbi Dovid Brown [12], Ner Yisrael, and, as cited by Rabbi Natan Slifkin [9], Rabbi Shalom Mordechai Schwadron (the Maharsham), Rabbi Samson Raphael Hirsch, and Rabbi Yehudah Yudel Rosenberg (author of the Talmudic work, *Yados Nedarim*) agreed with the approach of *boneh olamos umachrivon*.

Every Orthodox Jewish child is aware of the initial two verses in the Torah: “In the beginning G-d created the heaven and the earth. The earth was without form and empty...” Although there are some variations, basically most biblical commentators begin with this statement. However, Targum Onkelos, who comprised an Aramaic translation of the Torah, added the word “*b’kadmon*” (translated as “previously” or “earlier”) to the beginning of the sentence. Perhaps, Targum Onkelos’ addition of “*b’kadmon*” was a subtle hint to the *midrash* of Rabbi Avahu. Based on this Targum Onkelos, Rabbi Joseph B. Soloveitchik [13], translated the initial sentences of the Torah as follows. In the very beginning, long, long, long ago, *HaShem* created matter *yesh mei’ayin*, and from this He made many worlds and destroyed them. These worlds had physical and spiritual life (*shamayim va’aretz*), but then there was *tohu va’vohu* - desolation and confusion - when these worlds were destroyed and other worlds were created. After this introductory statement, the Torah then continued with the creation and description of our present world.

It should be noted, however, that not all Torah scholars concur with the above-noted interpretation of the *midrash*. For example, the Netziv (HaAmek Davar; Bereishis 7:23) concluded that dinosaurs could not have roamed in prior worlds, as according to his interpretation of the *midrash*, these prior worlds were totally destroyed, leaving no remnants. Thus, according to the Netziv, the fossilized dinosaur bones must have been from creatures that lived in our current world. Rabbi Slifkin [9] cited Rabbi Yaakov Yisrael Kanievsky, who suggested that, perhaps, the prior worlds were entirely spiritual in nature and even if they were physical, there would be no remnant in our universe. Rabbi Chaim Eliezar Shapira (the Rebbe of Munkatch) noted that *D’rush Or HaHayyim* contained statements that were “damaging views that tend towards heresy,” and suggested that this essay was forged by the son of Rabbi Lipschitz, yet published in his name. Citing Shemos Rabbah 1:2, “... that He created worlds and looked at them and they were not endearing to him, and He returned them to chaos and emptiness,” the Netziv stated that if neither vestige nor trace remained from these worlds, then dinosaur fossils could not be remnants from prior worlds.

The article will follow the thoughts of *Teferes Yisrael* and the concept of *boneh olamos umachrivon* as elucidated by Rabbi Belsky [15]. An English translation of the document composed by Rabbi Lipschitz is printed in “Immortality, Resurrection, and the Age of the Universe: a Kabbalistic View,” authored by Rabbi Aryeh Kaplan [16]. According to Rabbi Lipschitz, the scientific discoveries of fossilized dinosaur bones and of frozen mammoths were confirmatory of Jewish tradition, as these discoveries were proofs of the existence of the prior worlds that were created and destroyed. It is worthwhile to quote a few paragraphs authored by *Teferes Yisrael*.

“The spirit in man which yearns, which desires to uncover all hidden matters, to search out, like a weasel, the innards of the earth in the high mountains - the Pyrenees and the Carpathians, the Rocky Mountains in America, the Himalayas on the border of China - discovering that these mountains were formed by gigantic layers of rock which lie helter-skelter on one another with great and terrible force, hanging cliff-like one on another by a hairsbreadth, to the point at which it is impossible to imagine that this could come to pass except by a world-overturning revolution which once occurred by His hand, may He be blessed, Who reproves the earth and turns it over in a moment.

“Not satisfied with this, they dug several hundreds of fathoms into the deeps of the earth. They found four layers of earth, each above the other, each made up of a different sort of mineral, and between these layers they found fossils which indicate that the earth has been overturned and changed its surface four times. The creatures found between these layers are arranged in such a way that those which lie farthest from the surface are fashioned in a larger measure than those which lie in the next layer, and so to

those which lie in the second layer are larger than those which are to be found in the upper, most recent, layer, Moreover the diminution in size corresponds to a greater degree of perfection in the structures of the creatures found in the upper layers as compared to those in the lower layers. Natural scientists also write that evidence exists that the earth received a terrible blow from the southwest to the northeast, and that by this blow the earth was blasted and made desolate (*i.e.*, the impact theory).

“Likewise, in the year 1807, according to their reckoning, they found in Siberia, in the northern part of the earth, under the terrible ice which is ever present there, a great elephant [the wooly mammoth] (Fig. 1, 2), three or four times the size of those found today, and whose skeleton now stands in the Zoological Museum in Petersburg. Moreover, inasmuch as elephants cannot live in the extreme cold which dominates that region, this carcass indicates that by the blow which the earth received and by which it was blasted and disordered, this elephant, which once lived in a warm climate that could support elephant life, was carried to its current location by the mighty waves (*i.e.*, a cosmic upheaval), or that at one time the climate there was warm enough to support such animals. So too they have found in the depths of the highest mountains on earth, creatures of the sea which have fossilized and become stone.



Fig. 1. A wooly mammoth, illustration

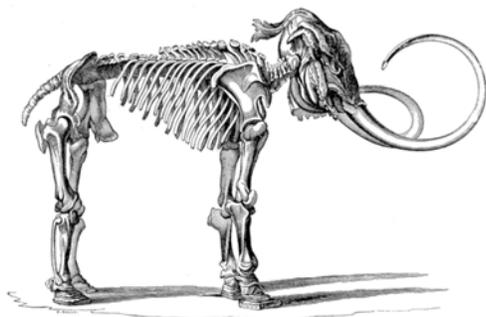


Fig. 2. Mammoth, skeleton

“We already know of the bones of a giant creature found in the depths of the earth around the city of Baltimore in

America, whose length is 17 feet, and whose height from the soles of its forelegs to its shoulders is 11 feet, and from its hindlegs to its back is 9 feet. Bones of this creature have been found in Europe too, and in the Harz Mountains scattered all around. This species has been named a mammoth.

“They have also found fossilized remnants of a creature they call iguanodon (Fig. 3), whose height was 15 feet and whose length was as much as 90 feet; from the character of its limbs, scientists have judged that it ate only grass. There is yet another species of animal called a megalosaurus (Fig. 4), which was only a little smaller than the iguanodon, but which was a hunter and carnivorous.

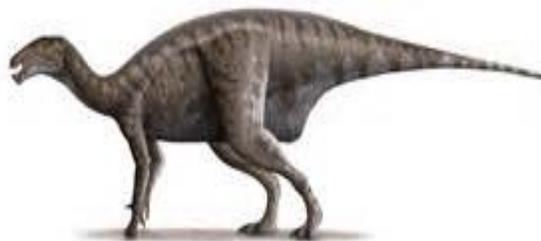


Fig 3. An iguanodon, illustration

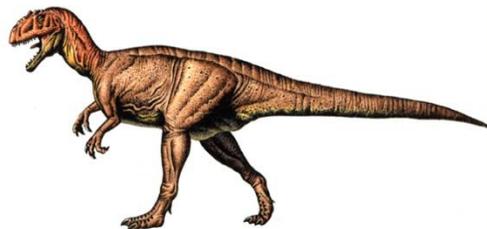


Fig. 4. A megalosaurus, illustration

“From all this it is clear that the teaching of the Kabbalists hundreds of years old, that the world has been destroyed and renewed over and over again, as many as four times, each time in a more perfect form, is shown in our own times to be just and true. We are now in the fourth world.” (Note, many paleontologists consider there to have been four eras, the Precambrian (unicellular organisms; simple multicellular organisms), Paleozoic (plants; amphibians, insects; reptiles), Mesozoic (dinosaurs, small mammals), and Cenozoic (wooly mammoths (ice age occurs); mammals; humans) [2]).

It is interesting to note that in the epoch just prior to our world, scientific research has indicated that there was an overlap between mammoths and prehistoric man (Neanderthals). These findings were unknown to the *Teferes Yisrael*. Yet, the *Teferes Yisrael* noted that prehistoric man (“pre-Adamites”) lived in epoch immediately prior to our

own world, specifically during the 974 pre-*Adam HaRishon* generations noted in the Talmud (Chagigah 13b, 14a; Shabbas 88b). He explained that these pre-Adamites “behaved egregiously” and were “banished from the world like thorns in the vineyard.” Thereafter, “the world was recreated in a more perfect fashion, it was fitting that the Torah be given to Adam of this cycle, for the world had matured to that point.”

Although the concept of *boneh olamos umachrivon* is accepted by past and present Torah scholars, there is little elucidation of the ramifications of that concept. Rabbi Belsky, however, provided several examples to elucidate the meaning of what was meant that *HaShem* built and destroyed many worlds prior to this one [15]. He noted that according both to Ramban (Bereishis 1:1) and to current scientific thought, the universe originated from an infinitesimally small speck, called “*tobu*,” consisting of an unimaginable concentration of pure potential energy, maintained at an extremely high temperature. The speck contained all the potential, formless elements of *shamayim va’aretz*, Heaven and earth. *HaShem* further imbued the primordial speck with an elemental structure, called “*bohu*.” This primeval fireball, suddenly appeared out of nothing (*yesh mei’ayin*) and marked the beginning of the universe, as before its appearance, nothing at all existed. Ramban referred to this primary substance as “*hule*” and it represented creation *ex nihilo*. Ramban explained that “*HaShem* brought into being, absolute nihility, an exceedingly fine primary essence with practically no substance. But this essence had the potential for bringing forth other things, ready to receive form and to emerge from the potential to the actual. After this ‘*hule*’ *HaShem* did not create anything out of nothing. Rather, He formed and made things, for He brought all things into being from this *hule*, endowed them with forms and perfected them.”

The connection between this intense concentrated form of potential energy and the formation of the universe is represented by Einstein’s formula, $E = mc^2$, to explain his Theory of Relativity. *E* denotes energy, *m* denotes matter, and *c* denotes the speed of light. Accordingly, energy can be converted to matter. Although this conversion required a vast amount of energy to produce a small amount of matter, the potential energy content in this primeval fireball was so huge that it would be the source of all matter that now exists in the entire universe. Subsequent explosion of this primordial speck of energy, *i.e.*, “*Bereishis*” or the so-called Big Bang, created plasma (particles having either positive or negative electric charges) mixed with the light of the fireball. Rapid cooling of the universe allowed the charged particles of the plasma to form atoms - *i.e.*, the basic constituents of matter [5]. Giant clouds of these primordial atoms subsequently coalesced through gravity to form stars and galaxies. Massive stars, called Red Giants, thousands of times larger than our Sun, eventually depleted their fuel and collapsed, to form massive nuclear fireballs, termed

supernova, which produced all the types of atomic elements, including oxygen and carbon. Rabbi Belsky explained that these destructions followed by creations ultimately lead to the creation of our universe and are examples of *boneh olamos umachrivon*. The end-product of these processes was the formation of our universe and, in particular, of planet Earth, earmarked for Torah and for *B’nei Yisrael* to perform *mitzvos* (*kiyum hamitzvos*) [15].

With regard to the Earth and under the rubric of *boneh olamos umachrivon*, Rabbi Belsky noted that this planet was remodeled and rebuilt several times [15]. Specifically, he noted the ice age, when vast sheets of ice covered large regions of the Earth, with their accompanying geological movements which ultimately made this planet more suitable for human habitation. For example, the slow advancement and retreat of the ice sheets and glaciers pulverized the rocky surfaces beneath them into a fine powder that formed the basis for soil of today. The ice age is interesting in itself, as supposedly we are now in the midst of an ice age, despite the rhetoric of global warming. Ice ages are times when the entire Earth experiences colder climate conditions. During an ice age, the polar regions are cold, there are large differences in temperature from the pole to the equator, and large, continental-size glaciers cover enormous areas of the Earth. Our climate today is actually a warm interval between these many periods of glaciations. During our present ice age, glaciers have advanced and retreated over 20 times [17]. It is the destructive movements of glaciers that affected the topology of the Earth and that enhanced the planet for human inhabitation. Examples of ice age benefits from the destructive movements of glaciers include: (a) nutrient rich silt brought to the plains by ice fields; (b) wind-blown dust delivered nutrients to the plains; (c) melting glaciers watered the plains; (d) formation of lakes and connecting rivers transformed barren deserts into productive land regions; (e) retreating ice sheets formed land bridges warm enough to facilitate human migration; (f) glacial retreat formed many safe harbors; and (g) retreating ice sheets, ice fields, and glaciers made possible enhanced abundance of plants and animals during warm interglacial episodes [18].

Another example of *boneh olamos umachrivon* presented by Rabbi Belsky is the origin of fossil fuels, including oil, natural gas, and coal. Apparently, specific regions of the Earth were covered with massive forests, which captured solar energy by photosynthesis. According to the impact theory, a large meteorite impacted upon the Earth, destroying most life forms. Over time, this dead biotic matter underwent anaerobic decomposition as it was compressed into deep subterranean layers. Subsequently, fossil fuels formed from the fossilized remains of these dead plants by their exposure to heat and pressure in the Earth’s crust [19]. Both soil formation during the ice age and fossil fuel formation are examples of *boneh olamos umachrivon* for the purpose of remodeling planet Earth.

From these examples, the following generalizations can be developed: (a) at times, destruction means a total oblivion (e.g., the Big Bang) and at other times it means the remodeling of a prior world (e.g., the ice age); (b) after a specific destruction/remodeling event, *HaShem* continued in the subsequent world from where He left off in the prior world (e.g., if a meteorite impact led to the extinction of 90% of the existing species, thereafter life continued through proliferation of the remaining 10%); and (c) every destruction/remodeling event ultimately was positive, in that, it gradually led to an enhancement, culminating in our present world. Rabbi Aryeh Kaplan [16], citing Rabbenu Bachya, noted that after each remodeling event, the world was in a greater state of perfection than in the preceding world. Each prior world was a preparation for the following world and each world was more highly perfected than the one before. Rabbi Belsky cited the first Rashi that the word *Bereishis* was understood by *Chazal* as “*Beis reishis*” - the world was created for two “firsts,” for the Torah and for *B’nei Yisrael*. The universe and the planet Earth were designed and redesigned to allow *B’nei Yisrael* to observe the Torah and fulfill the commandments (*kiyum hamitzvos*) [15].

The Malbim (Bereishis 1:4) wrote that the destruction of earlier creations and their replacement by more advanced successors was described as “good” by the Torah. Everywhere in the creation narrative, it concludes with, “And G-d saw that it was good.” This was meant to emphasize that although each successive stage of creation was “*yesh mijesh*,” i.e., it came about at the expense of the destruction of what had been before, yet “it was good.” All annihilation is negative for that which was annihilated, nevertheless, since its purpose was to affect a positive improvement, a higher stage in Creation, it was seen by G-d as good.

The remodeling concept apparently coincides with a *gemora* (Chagigah 16a) and a *midrash* (Bereishis Rabbah 1:5): If a human king built a palace on a site that previously served as a rubbish heap, anybody who mentions the prior use of the site of the palace insults the king. The same is true of this world (i.e., the concept of *boneh olamos umachrivon*). Whoever reveals the fact that this world was built on *tohu* and *bovu* insults its Creator. The Mishnah (Chagigah 11b) even goes so far as to state that whoever scrutinizes what existed in the past, prior to Creation, has no heed for the honor of his Creator and it would have been better for him that he had never come into the world.

If so, how can one delve into the prior worlds that were created and destroyed? It appears that Rabbi Belsky [15] was hesitant to discuss *Maaseh Bereishis*, noting that “our Sages therefore warn us that the human mind does not have the ability to fully grasp the depth of this area of knowledge.” He continued, “We have witnessed an unprecedented explosion of scientific research and discovery over the last two hundred years. Much of this

new research focuses on the universe and its formation, or more specifically on the development of our world... Anyone who is well versed in Torah can attest to the fact that every facet of our physical universe is discussed by our Sages. The explanations given by scientists for natural phenomena can help us understand the relevant passages in *Chazal* more deeply. In the interest of Torah, therefore, all empirical data relating to the origins of the world should be examined in light of the knowledge of *Maaseh Bereishis* that our Sages have revealed to us. This information, and sometimes even the theories based upon it, may be used to help provide a clearer understanding of the pertinent *maamarei Chazal*.” After these introductory remarks, Rabbi Belsky then proceeded to elucidate Rabbi Avahu’s *midrash* that *HaShem* created and destroyed worlds prior to our current world, designated for the Torah and for *Klal Yisrael* to use this world for *kiyum hamitzvos*.

The question of whether one can delve into *Maaseh Bereishis* was tackled differently by Rabbi Dovid Brown [12]. He also connected the Rabbi Avahu’s *midrash* (Bereishis Rabbah 3:7) to the concept of *boneh olamos umachrivon*, but expounded that today, it is necessary for the “honor of the Creator” to reveal this secret. To quote Rabbi Brown, “We live today at a time when the theory of evolution is accepted as obvious and indisputable. The basic evidence for the theory of evolution is the finding by geologists in the bowels of the earth of fossils of creatures that do not exist in life today. These fossils are disposed in various strata of rock, which themselves are jumbled, distorted, and broken. Fossils of certain types tend to be found in certain strata of rock and fossils of other types occur in other strata. This led those who desired to show that “There is no Divine judge; we may do what we wish,” to conclude that species were not directly created but evolved from other species over millions of years.” Rabbi Brown continued that “the creatures represented by the fossils existed in a world that refused the Torah, and their world was turned upside down from the *t’homos*” Similar upheavals occurred during the many remodeling events of planet Earth, explaining the occurrence of shellfish fossils even on the highest mountains, which were, at one time, under water.

Concerning Rabbi Avahu’s *midrash* that *HaShem* created many worlds and destroyed them, Rabbi Soloveitchik [13] posed the obvious question, “How could *HaShem* not get it right the first time? G-d ‘is omnipotent, omniscient. The *Ein Sof*, did He have to experiment...?’ Why did He have to create worlds and destroy worlds, create worlds that disintegrated into nihility until He created this world?” The Rav answered that the purpose was to present a moral challenge to *B’nei Yisrael*, to be creative and not to feel anything is impossible to accomplish. He presented some examples, such as education of Jewish children not affiliated with or not knowledgeable of Orthodox Judaism. Or, the seemingly impossibility of a Holocaust survivor to rebuild a family, of Rabbi Akiva to reestablish a vibrant

Torah community after the death of his students, or of a business man to restart a business after bankruptcy. To quote, “The message of creating and destroying worlds: strength: to start again - in life, business, and Torah.”

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