

Derech HaTeva



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A Publication of Yeshiva University, Stern College for Women

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We thank you for making this opportunity possible.

Elana Apfelbaum

Tehilla Berger

Hannah Piskun

Dedication

We would like to dedicate the 22nd volume of *Derech HaTeva: A Journal of Torah and Science* to the soldiers of the Israel Defence Forces (IDF). Formed from the ashes of the Holocaust, the Israeli army represents the enduring strength and bravery of the Jewish people. The soldiers of the IDF have risked their lives to protect the Jewish nation from adversaries in every generation in wars such as the Six-Day War and the Yom Kippur War. Despite the constant barrage of attacks throughout the years, the Jewish people have been able to prevail and strengthen themselves, due to the noble efforts of the IDF.

At a young age of 18, Israeli men and women are drafted and sworn into the Israeli army, declaring an oath that was written in 1948 when the IDF was founded:

I swear and commit to maintain allegiance to the State of Israel, its laws, and its authorities, to accept upon myself unconditionally the discipline of the Israel Defense Forces, to obey all the orders and instructions given by authorized commanders, and to devote all my energies, and even sacrifice my life, for the protection of the homeland and the liberty of Israel (<https://www.facebook.com/notes/avi-mayer/the-idf-oath-of-allegiance/10150799554558717/>).

With every day that the soldiers put on their uniform, they protect not only the Jewish homeland, but also the greater Jewish nation. Faced with scrutiny from the world, the soldiers publicize and maintain the Jewish code of ethics, trying to spare as many innocent lives as possible. Therefore, we would like to thank the Israeli soldiers for protecting us, inspiring us, and sacrificing their lives for us in order to maintain the place that we can call home.

For all the land which thou seest,
to thee will I give it, and to thy
seed for ever.

(Bereshis 13:15)

כִּי אֶת-כָּל-הָאָרֶץ אֲשֶׁר-אַתָּה רֹאֶה,
לְךָ אֶתְּנֶנָּה, וּלְזֶרְעֶךָ, עַד-עוֹלָם:

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Acupuncture: Jewish Connections and Halachic Ramifications

By Gabriella Englander

Traditional Chinese medicine (TCM) is known to be the third oldest recorded form of medicine; it originated between 300 -100 B.C.E., and was predated only by Egyptian and Babylonian medicine [1]. The survival of this two-thousand-year-old practice in the modern era, which is an age of scientific and technological advancement, is a testament to its value as a form of healthcare. TCM uses herbal medicines and various mind and body practices such as acupuncture, tai chi, qi-gong, tui na and shiatsu to prevent and treat health ailments. Before China re-entered the international community in 1972, TCM was relatively unknown in Western civilization; today, however, advertisements on Manhattan streets boast a wide array of Chinese medicine and acupuncture clinics. In New York State alone, there are exactly 3,661 licensed acupuncturists recorded as of January 1, 2018 [2]. TCM has even entered into the Jewish community, introducing a host of *halachic* questions on its origin and permissibility, specifically regarding the practice of acupuncture.

According to the metaphysical concept of Traditional Chinese medicine, the total fabric of the universe, called the Tao, is infused by a pervasive energy, referred to as Qi (pronounced *Chi*). Since it is a part of the Tao, the human body possesses Qi, which flows throughout the body in twelve central meridians and manipulates the organs. Most illnesses and disorders stem from an excess or a deficiency of Qi flowing in the meridians. Fine needles are inserted into certain acupuncture points along the meridians that correspond to different organ systems to break up energy obstructions and coax the Qi to flow smoothly again [1].

It would seem that Chinese medicine and Judaism have very little, if anything, in common. However, there are direct commonalities between Chinese acupuncture and the ancient Jewish prayer object *tefillin*. *Tefillin* consists of two small leather boxes, each attached to two long leather straps. One box is placed on the head, with its straps wrapping around the head from the forehead to the base of the skull, while the other box is placed on the biceps of the wearer's weaker arm, its straps winding along that arm in a specific manner. According to the research of Dr.

Steven Schram, a Jewish acupuncturist and chiropractor in New York City, the specific points where the *tefillin* are wound around the head and arm directly correspond to the Chinese acupuncture points for heightened spirituality and sanctified thought. For instance, if one aims to elevate a person's spirit and clear their mind, they would insert acupuncture needles along the Governing vessel (Du Mai), a meridian that runs along the spine into the brain, and is stimulated to influence the mind and treat psychiatric disorders. This is exactly how the Jewish practice of *tefillin* is intended to function, as a visual reminder to its wearer to dedicate their minds, hearts and actions to G-d (Shulchan Aruch, *Orach Chaim* 27). Consequently, the first box and its attached straps are placed around the head along the same points which form the Governing vessel [3]. These similar practices suggest a correlation between Judaism and Chinese medicine.

The concept behind another healing practice, auriculotherapy, which is based on Chinese medical principles, was already known to the Jewish Sages. Auriculotherapy is commonly referred to as "ear acupuncture" since it is thought that each part of the body is linked to a specific point of the ear, and, therefore, treatment of the ear can influence its corresponding body part. Auricular therapists use electrical stimulation, lasers, needles or massage to stimulate the targeted ear point. While the discovery of auriculotherapy is attributed to the French acupuncturist Dr. Paul Nogier who proved that the ear is a microcosm of the body in 1951, *Chazal* mention this concept nearly a millennium earlier [4]. They write in the Midrash Rabbah that "the ear is to the body like a clothesline is to clothes: Just as all of the clothes hanging on the line receive a nice smell from the incense burning beneath them, so a person's two hundred and forty-eight limbs depend upon the ear, which gives them all life" (*Ha'azinu* 10:1). The ear has the ability to heal and treat the rest of the body, similar to the way that clothes on a clothesline soak up the smell of incense. This dependence on the ear was known to the Jewish people one thousand years before it was discovered by the scientific world.

This cohesion between the rabbis and the scientists

suggest that these two different disciplines may not be as unrelated as they appear. However, there are three *halachic* issues that must be considered to determine the status of Chinese medicine - the prohibitions of idolatry, sorcery, and imitating the ways of idolaters.

The first *halachic* issue, idolatry, perhaps pervades the fundamental concept of Chinese medicine and acupuncture, the existence of Qi. Various Jewish sages have validated the existence of a universal energy, which permeates all of creation, a substance similar to Qi. For example, the Ramban mentioned the existence of an “ethereal essence devoid of corporeality” capable of “bringing the potential to the actual” (*Bereishis* 1:1). The Greeks called it the *hyle* while the Biblical language referred to it as *tohu*, the primary matter created by G-d. This concept is also found in a number of rabbinic works, in addition to Kabbalistic thought. When asked about the existence of Qi, the Kabbalist Rabbi Yisroel Eliyahu Weintraub answered, “there exists such a force that sustains all of creation. Some of the early writers referred to it as *sechel hapoel* [the active intellect] or *galgal basechel* [the sphere of intellect] (Rambam in *Moreh Nevuchim* and others), others called it by different names ... It is one of the forces found in this material world, but because of its subtleness, it is referred to as something spiritual” [6]. Similarly, the Kabbalist Rabbi Chaim Vital mentioned that Kabbalah even discusses a universal energy which flows and pulsates through the human body (*Shaar Ruach HaKodesh, Drush* 1).

Furthermore, the manifestation of Qi as a polarized energy in the form of yin and yang relates to the Kabbalistic understanding of the essence of God’s force in the world. According to Chinese philosophy, yin is associated with the moon and darkness, passivity, and femininity, while yang is associated with the sun and light, activity, creativity, and masculinity [5]. This philosophy is similar to the words of the Zohar: “Rabbi Yossi said, “There is nothing in the world that is not in male and female form”” (*Bereishis* 157b). Even in the scientific world, many known types of energy, such as electricity and magnetism, exist in these polarized forms [6]. Regardless of their polarized manifestation, a Jew must recognize that all energy, all matter, was created by God during Biblical creation (*Mishneh Torah LaRambam, Hilchot Yesodei HaTorah* 1:1).

Although the concept of Qi exists in Jewish sources, some rabbis have declared it idolatrous and have forbidden any association with it. Rabbi Menachem Kleinman compiled a list of alternative therapies

which he prohibited on the basis of their relation to Qi [7]. Rabbi Yitzchok Stein, the Foltichander *Rav* and an *Av Beis Din*, expressed concern regarding Qi, believing that Chinese philosophy viewed Qi as a god-force with independent will. These practices, therefore, contradict the tenets of the Jewish faith (*Kuntres Al Tifnu*, pg. 24). Rabbi Chaim Yisroel HaLevi Belsky, who served as the *Rosh HaYeshivah* at *Yeshivas Torah V’Daas* and as a senior *Kashrut* advisor to the OU, considered acupuncture to be problematic due to its controversial explanations of forces and energies [8].

However, there are those who believe these idolatrous claims to be fundamentally mistaken. In his book *Alternative Medicine in Halacha*, Rabbi Rephoel Szmerla, a *dayan* from Lakewood, NJ, explained that the fact that certain people worship Qi as a deity does not automatically render it idolatrous. He quoted the Shulchan Aruch which stated, “it is permissible to benefit from anything not made by man nor altered by man, even though it has been worshipped. Therefore, it is permissible to benefit from mountains and hills ... that have been worshipped by pagans” (*Yoreh Deah* 145:1). According to the Shulchan Aruch, natural elements are not forbidden despite having once been worshipped as a deity. Similarly, Rabbi Szmerla quotes Rabbi Chaim Falagi who stated that “anything not altered by man remains permitted even if it has been worshipped, as stated in *Avodah Zarah* 45a” (*Responsa Chaim B’yad* pg. 34). Rabbi Falagi supported his statement with the fact that the Sages were able to benefit from and employ demons even though the demons had been worshipped; therefore, a Jew can benefit from the sun and moon even though pagans worship them. Since Qi is neither made by man nor altered by man, it is permissible to gain benefit from it.

Furthermore, Rabbi Szmerla explains that Qi is not necessarily a Chinese god-force, and, therefore, is not idolatrous. In Chinese philosophy, Qi is viewed, not as a power with a will of its own or as God himself, but as a force originating from God. In addition, Qi is not treated as a divine being which one attempts to appease. It is not worshipped in any manner, there is no temple to which it is dedicated, and people do not pray, offer sacrifices or perform rituals in its name. Therefore, it is similar to the forces of electricity and gravity. Rabbi Szmerla further proved his opinion by investigating the specific sources on which the Rabbis who perceive Qi as a Chinese god-force based their assumption, and by determining these sources’ claims to be baseless [6].

However, if a Chinese medicine practitioner perceives the energy he manipulates through acupuncture as a deity with an independent will, while this is uncommon, it is forbidden to receive treatment from him. The Jewish sages feared that the success of such a practitioner would lead people to believe in the power of invoked gods, as mentioned by Ramban, the Ritva, and the Rosh based on the Gemara (*Avodah Zarah* 27b). The Shulchan Aruch wrote that even if the practitioner is an idol worshipper, it is permissible to receive treatment from him as long as the patient is unaware of the practitioner's spiritual beliefs (*Yoreh Deah* 155:1). Certainly, it is preferable to be healed by a G-d-fearing individual if possible [6].

As mentioned above, some of the greatest Jewish medieval sages have validated a substance that seems similar to Qi. One may wonder why the notion of Qi seemingly originates in Far Eastern writings rampant with sorcery and idolatry. Both the Ramban and the Ran agree that all nations recognized spiritual concepts such as the soul, the aura, and the afterlife, but the Greeks and the Western world chose to disregard this knowledge and instead focus on the tangible, physical world (*D'rashot Torah Hashem Temima* 147, *D'rashot haRan*, *Drush* 1). Therefore, Western literature and culture minimally discuss the existence of such forces while Eastern culture has not only preserved this wisdom but has also incorporated elements of metaphysical and religious beliefs, which have formed a convoluted blend of both truth and idolatry [6]. However, this combination of beliefs and reality does not render the entirety of their wisdom invalid. *Chazal* state that non-Jews do possess accurate, logical reason: "If someone tells you there is wisdom among the Gentile nations, believe him" (*Eichah Rabbah* 2:13).

The second *halachic* issue concerning acupuncture is the prohibition of sorcery (*kishuf*). The Mishnah defined a sorcerer as one "who actually performs a miraculous feat...not one who merely creates such an illusion" (*Sanhedrin* 67a). The rabbis in the Gemara expound on this Mishnah and write that sorcerers convene the natural order of the world. Ramban further explains the Mishnah's definition of sorcery as an act which "opposes the constant forces [of the natural order]" (*Devarim* 18:9). The Meiri clarifies that "whatever is achieved through natural means does not constitute *kishuf*" (*Sanhedrin* 68a). The Rivash also explains, "the Midrash [states that] sorcery is done through the intermediary of demons ... In Tractate *Pesachim* [*Pesachim* 112], it is said that *kishuf* is done

with strands of hair, specific potions and herbs...used for incense offerings in the process of adjuring demons and uttering incantations" (*Responsa haRivash*, section 92). Based on these definitions of early Jewish sages, sorcery is characterized by an act which contravenes the laws of nature by way of incantations, the burning of incense, and the invocation of demons and angels.

Rabbi Rephoel Szmerla wrote, based on the aforementioned commentaries that "an act that seems to violate the laws of nature but is not achieved through such rituals [those mentioned by Rivash] does not constitute *kishuf*" [6]. Since acupuncture contains none of these practices, it seems to be a form of natural therapy and not sorcery.

The third *halachic* issue concerning acupuncture is the prohibition of imitating the ways of idolaters (*darchei ha'Emori*). The Torah forbids this imitation in order to distance Jews from irrational practices which might be associated with idolatry or sorcery, as explained by the Rambam (*Moreh Nevuchim* 3:37). As the *Maharam Shik* wrote, "as long as a practice is based on some kind of reason or logic, it is not included in the prohibition of *darchei ha'Emori*" (*Taryag Mitzvos*, Mitzvah 263). Rabbi Yosef Shalom Elyashiv, one of the recent *poskei haDor*, ruled that all modalities of alternative medicine are permissible only if it is possible to prove that the practitioner uses natural means of healing. It is not enough for the practitioner to believe the practice to be natural, while it still has a sense of magic or *darchei ha'Emori* [9]. Therefore, Rabbi Rephoel Szmerla notes that acupuncture, which is rational and supported by empirical results, does not fall into this category [6].

The Chinese medical practice of acupuncture does not necessarily present a *halachic* concern to the prohibitions of idolatry, sorcery, or imitating idolaters. As the Kabbalist Rabbi Yisroel Eliyahu Weintraub said, "Acupuncture is nothing more than a therapeutic treatment practice whose goal is to restore optimal body function by treating the energies of the *nefesh* [soul] rather than by treating the physical body ... It is no different than all other means of healing that we are permitted to use" [6]. However, one should always consult a competent *halachic* authority before considering any questionable form of alternative medicine, especially since certain forms of alternative medicine may raise issues which have not been covered in this paper.

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Infertility Treatments under Halachic Scrutiny

By Jacqueline Fried

We unfortunately live in a world in which infertility is an issue that affects many women and arises much too often. However, with continuous scientific development and research, there have been discoveries of various treatments that could reverse infertility. In some cases, the only possibility for women to become mothers is by ovum (egg) donation, ovary or uterine transplantation, or gestational surrogacy. These options are usually a last resort, and some of them have been done successfully only a handful of times in clinical trials. Ovum donation and ovary transplants are treatments for women who have a complete absence or reduced quantity of eggs, or a non-functioning ovary [1]. A uterus transplant is an option for absolute uterine-factor infertility (AUI), which is the absence or the complete dysfunction of the uterus [2]. Surrogacy is when a woman carries to term a fetus of another woman, usually to whom she has no genetic relation, and is an option given to women who have recurring miscarriages, failure of *in vitro* fertilization (IVF) treatment, or AUI [1].

These treatments and procedures, like almost all newly discovered medical developments, bring about ethical issues related to the risk posed to those involved. There are many health risks related to the treatments mentioned above, for example, risks related to transplantations include the length of the procedure for which the patients are under anesthesia and the danger of the body rejecting the transplanted organ which necessitates a prolonged period of immunosuppression [3]. In addition to the health risks, ethical issues and many *halachic* questions arise with these infertility treatments. Are these procedures permissible at all according to Jewish law? Assuming that a woman is obligated the *mitzvah* of procreation, can one be lenient in the laws of risking her life for *peru u'revu* purposes? For a baby born following these treatments, the identity of the *halachic* mother needs to be determined. Is there a difference between a genetic mother and a legal mother? In order to answer these questions a close look at infertility treatment and Jewish law is necessary.

With respect to the egg and uterus donor there are three possible issues in Jewish law: (1) *havala*, causing

bodily harm, (2) allowing oneself to undergo a life-risking surgery, which is different than *havala* because it is related to medical necessity, and (3) *sirus*, sterilization (this issue only applies to the donor of a uterus). In cases where a uterus is donated from a postmenopausal woman, the issue of *sirus* is circumvented, and if the transplant is taken from a cadaver, all three problems are irrelevant. The issues of *havala* and the risking one's life can be resolved by a Jew's obligation of "*lo ta'amod al dam re'echa*" (*Vayikra* 19:16), not standing idly by while a fellow Jew's life is in danger. This precedence only applies, however, if infertility is considered a case of *pikuach nefesh*, or a case where preservation of human life overrides *halacha*. While medically, infertility may not be seen as a danger to one's life, perhaps according to *halacha*, it can be compared to *pikuach nefesh* for emotional reasons, since the Torah and Jewish literature often compares someone who is childless to someone who is dead. If a donor's uterus is extracted for their own health, such as a necessary hysterectomy, and the organ would otherwise be discarded, then there is no issue of *havala*, risking life, or *sirus* because the procedure is done for the donor's own benefit. If the transplant is from a cadaver, issues of desecration or deriving benefit from a corpse arise. Rav Yechezkel Landau authorized such prohibitions to be waived for *pikuach nefesh* reasons and Rav Yaakov Ettlinger, who wasn't concerned with whether or not the case could be considered *pikuach nefesh*, established that procedures done commonly for the living, like organ donations, are not considered a desecration of the dead. All three potential *halachic* problems only apply to a donor who is healthy and still of child bearing age. Although it is a debate whether or not sterilization is applicable to women, most *halachic* authorities are opposed to the procedure. There is no formal discussion of leniency for the purposes of *peru u'revu*, and only the potential *pikuach nefesh* aspect of infertility would seem to permit the transplant. However, because infertility cannot be certainly defined as *pikuach nefesh*, donation of a reproductive organ from a healthy woman capable of having children seems to be impermissible according to Jewish law [4].

There are also potential *halachic* problems related to the recipient of these infertility treatments. While in cases of vital organ donations, such as kidneys, there is no prohibition of *havala* for the recipient because of *pikuach nefesh*, this is not the case with transplantation as a treatment for infertility. According to Rav Chaim Zev Wolf Weinreb, there would be no issue of *havala* for the recipient based on the assumption that there will only be the minimal amount of bodily harm, because the procedure is performed by experts. Additionally, he suggested that the prohibition could be circumvented for the purpose of *peru u'revu* and *shalom bayis*, or domestic harmony. Some *poskim* allow cosmetic plastic surgery to be performed for the sake of an individual's psychological health. The same logic can be applied to the case of infertility; by allowing it to be included under the umbrella of *pikuach nefesh* would subsequently waive the prohibition of *havala*. The *halachic* issue of risking one's life in this case goes beyond just the actual procedure and includes the prolonged period of treatment with immunosuppressive medications and the dangers that arise if a woman became pregnant after the transplantation. While there is no clear *halachic* decision on this exact matter, there is a possibility of leniency when it comes to uterine transplants, since they are only temporary, and the organ is removed once the maximum of two children are born or fertility is unfortunately not restored. Finally, the issue of *sirus* does not apply to the recipient because either the reproductive organ is either absent or is dysfunctional. According to Rav Moshe Feinstein, for women, there is no sterilization after pre-existing sterilization. While most of the discussion above applies to uterine transplants, the same logic for both the potential problems and solutions can be extended to the permissibility of some of the other infertility treatments discussed in this article [4].

In Jewish law, there is no differentiation between a legal familial relationship and a biological familial relationship. The biological relationship between parents and children give parents all of the legal responsibilities of parenthood in *halacha*. Two aspects that give a woman maternal status are the genetic aspect, which is ovulating an egg, and the physiological aspect, which is the actual pregnancy and birth. With the advent of various infertility treatments, these two functions are no longer mutually inclusive, a woman can be the genetic mother of a child without being the physiological

mother. If these two aspects of motherhood are subdivided, there are four possibilities of identifying the *halachic* mother: (1) the genetic mother, (2) the physiological mother, (3) both the genetic and the physiologic mother, and (4) neither the genetic nor the physiologic is the legal *halachic* mother. In the case of ovum donation or an ovarian transplant, the donor would be considered the genetic mother, while the recipient would be the physiological mother. In the case of gestational surrogacy, while the surrogate mother is the obvious physiological mother, there is also an obvious genetic mother. Finally, following a uterus transplant, the recipient who utilizes the fertilized egg of the donor would be considered the genetic mother, while the uterine donor could possibly be viewed as the physiological mother since it is her uterus that carried the fetus.

In his discussion of ovarian transplantation in 1908, Rav Binyamin Arye Weiss concluded that the *halachic* mother of a child born after such a procedure would be the organ recipient. He employed a passage from the Talmud stating that if a branch of an *orlah* tree, whose fruits are not allowed to be benefitted from, was grafted into a tree whose fruits were permissible, the branch would lose its original forbidden status since it becomes part of the permissible tree (*Sotah* 43b). Similarly, in the case of an ovarian transplant, the ovary becomes part of the recipient's body, and she is therefore the only *halachic* mother. According to Rav Eliezer Waldenberg, this passage in the Talmud was proof that in Jewish law the physiological mother is the legal mother in cases of ovary or ovum donation and of surrogacy. Rav Shlomo Zalman Auerbach disagreed with this logic because he did not believe that one can compare the *halachos* of plants to humans.

In contrast, some current *halachic* authorities changed the once widely accepted *psak* that the physiological mother is the legal mother. According to Rav Avigdor Neventzhal, "the egg donor is the only legal mother; and the surrogate is not more than [an] incubator." Proof that according to *halacha* maternity must include a genetic aspect was introduced by Rabbi Meir Bransdorfer from the Talmud (*Niddah* 31a) where it stated certain genetic factors that a mother passes on to a child, implying that in order to be considered a mother, one must supply her child with some genetically controlled traits [1]. In the case of a uterus transplant, the same logic introduced by Rav Weiss based on the case of the *orlah* tree can be applied to conclude that the organ recipient would be

the mother in Jewish law. Rav Yeshaya Silverstein further supported this position by bringing proof from another passage in the Talmud (*Bekhorot* 28b) which concluded that transplanted organs are considered part of the recipient's body in cases of questioning if animals that have had transplants were kosher. In the case of a uterus transplant, once it is accepted that a transplanted organ becomes an integral part of the recipient's body there is no distinction between the genetic mother and the physiological mother. Since the organ recipient is the one who undergoes all the aspects of maternity—ovulation, pregnancy, and birth—she is the only *halachic* mother of the child that is born [4].

Infertility has been an issue that affects women since biblical times, as we see in stories of our ancestors, specifically *Sarah, Rivka, and Rachel Imeinu*, our matriarchs. *HaShem* performed unbelievable miracles for them in reversing their infertility, thereby allowing them to bear children. As science continues to

develop, and new infertility treatments that once seemed impossible now are a reality, there is a new hope for women who suffer from infertility. Although every new development causes an array of potential *halachic* problems to arise, Judaism is a religion that welcomes questions, and has a built in system of how to resolve them. When one studies these developing infertility treatments, it becomes evident that *HaShem* is miraculously reversing infertility in our times.

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BRCA1/2 Mutations: Not Just Ashkenazi Mutations

By Yael
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With the help of modern technology, it is possible to discern cases of breast cancer caused by somatic mutations from cases of familial breast cancer caused by hereditary gene mutations. These genetically transmitted mutations are associated with an inherited predisposition to developing breast cancer; estimates show that carriers are up to 65% more likely to develop breast cancer than people who do not carry the mutation [1]. Of the known hereditary gene mutations, more than half are attributed to the *BRCA1* and *BRCA2* genes [2, 3]. *BRCA* gene mutations are found in 1 out of 40 Ashkenazi Jews, as compared to the rate of the general population which is about 1 in 400 [4, 5]. Due to the increased prevalence of these mutations in the Ashkenazi Jewish population, genetic tests often inquire whether or not patients descend from this population. However, recent studies have identified *BRCA1/2* mutations in Sephardic populations as well, so it is critical for all Jews to be screened for inherited *BRCA1/2* mutations.

About 2% of Ashkenazi Jews are carriers of *BRCA1/2* mutations, thus the Ashkenazi population is considered to be at a higher risk of developing breast cancer as compared to non-Ashkenazim, particularly Jews of Asian and African descent. More specifically, about 1% of the Ashkenazi population is considered to carry the *BRCA1* 185delAG mutation. This mutation is often mistakenly regarded as an “Ashkenazi mutation,” but research suggests that the *BRCA1* 185delAG mutation is present in the Iraqi-Jewish population at comparable rates: 0.47% in Iraqi-Jews and 0.9% in Ashkenazi Jews [6]. These populations differ in the actual development of breast cancer, but this may be a consequence of alternative influences, such as environmental or genetic factors [6]. To explain the presence of the *BRCA1* 185delAG mutation in both Ashkenazi and non-Ashkenazi (specifically Iraqi) Jewish populations, scientists deduced that the mutation emerged earlier than 70 AD, prior to the onset of the Jewish Diaspora. The Ashkenazi and non-Ashkenazi populations share a similar haplotype, so it is likely that they also share a common founder. Thus, scientists summarized that the mutation may have emerged when these groups coexisted, before Jews were physically separated as a

result of the destruction of the second temple [6, 7].

Furthermore, the *BRCA1* 185delAG mutation has been identified in the genomic structure of a non-Jewish, Latin American community in the San Luis Valley of Colorado. Although some members of the San Luis Valley community deny having any Jewish ancestry and lack any Jewish traditions, the common haplotype suggests that these people are in fact descendants of Jews. The presence of this particular mutation is consistent with the events pertaining to the history of the Sephardic population. In the 16th and 17th centuries, Jews living in Iberia, modern-day Spain and Portugal, faced severe discrimination. Many converted to Christianity in order to escape prosecution; these Jews became known as *Conversos*. When Spain and Portugal colonized the New World, many of these *Conversos* migrated there and even assimilated into the local population [8]. They immersed themselves in the communities of Central and South America, along with modern-day California, Arizona, New Mexico, Texas, and Colorado [3]. It is highly likely that in the process of assimilation, *Conversos* intermarried within the local population. The discovery of the *BRCA1* 185delAG mutation in the Latin American community in the San Luis Valley of Colorado provided evidence for the theory that intermarriage occurred between *Conversos* and the indigenous population and for the theory that the mutation emerged prior to the Jewish Diaspora [6, 9].

However, other more recent studies suggest that the mutation originated in the Ashkenazi population as a founder mutation and appeared in Hispanic and non-Ashkenazi communities as a result of independent migrations of Ashkenazi carriers. According to a haplotype analysis, the mutation originated 1200 years ago in the Ashkenazi population, 650 years ago in the Hispanic population, and 450 years ago in the Jewish-Iraqi population. It is inferred that the mutation originated in Ashkenazi Jews and spread to Hispanic and Sephardic populations via migration of carriers of the mutation. This contradicts previous theories that the mutation must have emerged before the Diaspora and does not have historical backing. One explanation regarding how the mutation was spread to the Iraqi-

Jewish population is that it was brought by Ashkenazi carriers involved in trade in the area [10].

Additionally, there are 5 known founder mutations in several Jewish communities. These are 185delAG, 5382insC, and 6174delT in Ashkenazi populations, 8765delAG in Yemenite populations, and p.Y978X in Iraqi, Iranian, and Afghan populations. Two potential founder mutations have been identified in Sephardic populations: p.A1708E in BRCA1 and IVS2 + IG > A in BRCA2. A common haplotype was detected in each of the two mutations, suggesting that they are founder mutations for the Sephardic population [11]. Although the exact rates of these mutations in the Sephardic population is unknown, this discovery provides further evidence that *BRCA* mutations are in fact found in Sephardic populations.

As technology progresses and researchers continue to uncover evidence linking inherited *BRCA* mutations

to the Jewish population, it becomes increasingly important for Jews to get tested for these mutations. This includes people from both the Ashkenazi and Sephardic communities, men and women alike. The benefit of knowing whether or not one is a carrier provides a unique opportunity to explore preventive measures in the hopes of deterring onset of disease.

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The human body is without a doubt extremely complex. In the context of college, studying for exams in courses such as anatomy and physiology can be overwhelming, with many tissues and organs that need to be memorized. However, when taking a step back, one can truly appreciate all of the wonders of the human body.

Many complicated chemicals and organ systems work together perfectly to miraculously maintain a healthy person. We must be grateful to *Hashem* for all of the miracles that continuously occur in our bodies. One tiny mutation in a gene could potentially be fatal. The *bracha* of *Asher Yatzar* was instituted by *Chazal* to be said after a person relieves himself to give the opportunity to thank *Hashem* for the amazing gift of a functioning body. The text of the blessing is recorded in the Talmud in *Brachos* (60b):

Blessed...Who formed man in wisdom, and created in him many orifices and cavities. It is revealed and known before the throne of Your glory that were one of them to be ruptured or blocked, it would be impossible to survive and stand before You. Blessed... Healer of all flesh, Who performs wondrous deeds [1].

The opening line “*baruch... asher yatzar es ha’adam bechachma*” praises G-d for creating the complex human body with His wisdom. Next, the blessing addresses the fact that humans have many orifices and cavities. The “orifices” refer to openings of the human body that are external, such as the mouth and ears, and they also denote microscopic external opening, such as sweat glands. The “cavities” mentioned in the blessing are within the internal organs that make up the different systems of our body and include organs such as the trachea, small intestine, heart, and spinal cord. As indicated by the blessing, if any of these orifices and/or cavities were to be ruptured or blocked, we would not be able to survive (*Shulchan Aruch, Orach Chaim 6:1*).

There are numerous examples in the human body where an organ should be open and, if not, a severe

disease or even death could result. One common example of this is coronary artery disease, in which, over time, plaque may build on the inner walls of the originally smooth arteries, causing them to narrow and, ultimately, to be completely blocked. The greater the restriction, the less blood is able to flow to the heart, which can cause the heart to be starved of oxygen. Also, the plaque could rupture, leading to a heart attack. Beginning from a young age, plaque can embed within the walls of the blood vessels. Plaque causes the inner wall of blood vessel to become sticky, so that inflammatory cells, lipoproteins, and calcium in the bloodstream may adhere to the plaque. As more cells join, the artery walls extend outward and the vessel becomes narrower. If plaque ruptures, a blood clot may form, starving the heart of oxygen and resulting in a heart attack. If a blood vessel leading to the brain is blocked, a stroke can occur [2].

There are other organs in the body that at certain times need to be open and other times to be closed. For example, the upper esophageal sphincter (UES) is located at the lower end of pharynx and guards the entrance into the esophagus. When food is ingested, it travels to the stomach by passing through the esophagus, with the UES relaxing to allow the food to pass through. Without the UES, or if it does not close completely, the esophageal contents are refluxed, causing a burning sensation [3]. Another example is constipation, in which it is difficult to defecate. When feces remain in the colon without being eliminated, much water is absorbed and thus the waste material can become dry, causing a very painful elimination [4]. This can occur because the sphincter muscles in the colon are not properly functioning or spasm frequently, thus causing it difficult to pass a bowel movement [5].

After realizing all of the potential problems that could occur within his body, one can truly come to understand the ending of this blessing in which he says that G-d is the “Healer of all flesh and performs wondrous deeds.” While the greatest act that a physician can perform is preventing disease and sickness, here, Hashem, the Ultimate Healer, is

recognized for allowing human bodies to function regularly in a healthy way [6]. The importance of this idea is echoed in the *Shemoneh Esrei* when one recites “Heal us Hashem - then we will be healed; save us - then we will be saved, for You are our [constant source] of praise.” It is amazing to note that while medicine and technology have certainly come a long way throughout history, many functions and structures of the complex human body remain unknown, and, thus, one must rely on Hashem to ensure everything works properly.

An important distinction can be made between humans, implied by the phrase “*asher Yatzar es haadam*”, who has created **man**, and other creatures, implied by “*rofeh kol basar*,” who heals **all flesh**. Both the *Mechaber*, who is the author of the *Shulchan Aruch*, and the *Rema*, pointed out a seeming incompatibility within humans. Each person has a *nesbama*, soul, which comes from the Throne of Glory and is so holy he cannot fully understand it, yet it is attached to a physical body that is very mundane. This contrast is resolved by *Hakadosh Baruch Hu* Himself, explaining why one says “*umafli la’asos*,” He acts wondrously, as He blends two seemingly conflicting concepts together, which makes the human body. This contrast comes up again in this *bracha*, because the words for orifices and cavities, “*nekavim nekavim*” and “*chalulim chalulim*” are repeated twice each, which implies that humans have parallel organ systems, *i.e.*, a physical one and a spiritual one [6]. We are so grateful to G-d for allowing us to exist with both physicality and spirituality, both of which are vital to human life. We learn from this blessing that if one of those organ systems were blocked, we would not be able to stand before G-d.

Reciting blessing of *Asher Yatzar* after the bathroom helps us realize that we should not take our health for granted. Dr. Kenneth Prager, a medical doctor and professor at Columbia Presbyterian Medical Center in New York, sheds light on how he came to appreciate this blessing. He related the story of a patient, Josh, who fractured his third and fourth vertebrae in a car accident, which resulted in him being a quadriplegic. After a long and difficult period of rehabilitation, Josh’s physical state began to improve significantly. One day, Josh miraculously no longer required a urinary catheter. Commenting on this feat, Prager said, “I thought of Abaye’s *Asher Yatzar* prayer. Pointing out that I could not imagine a more meaningful scenario for its recitation, I suggested it Josh, who was also a Yeshiva graduate, that he say the prayer. He agreed. As he recited the ancient *bracha*, tears welled in my eyes. Josh is my son” [7]. Such a powerful story teaches that through the blessing of *Asher Yatzar*, a deeper appreciation of our health and G-d’s constant presence can be achieved. By having the opportunity to say this blessing at different points throughout the day, I can stop to thank Hashem for the miracles He performs constantly, even the ones I do not know are occurring.

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BRCA1/2 Mutations: Not Just Ashkenazi Mutations

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Introduction

Over the last three millennia, dentistry, more than any other medical science, has experienced explosive growth. Dental care has existed since early civilization, as evidenced by the ancient Egyptians, Phoenicians, and the Central American Mayas. Upon the examination of our own tradition, we find mention of dentistry in Jewish writings as well. The Torah dictated the consequence of a “tooth for a tooth” as monetary compensation for a similar injury. One is required to pay a monetary value equivalent to the damage he inflicted (Exodus: 21:24). In later Jewish writings, the Talmud expounded further upon dental concepts. The focus of this article is to examine dental prosthodontics (the branch of dentistry concerned with the design, manufacture, and fitting of artificial replacements for teeth and other parts of the mouth) in ancient Jewish writings, and compare it to today’s advancements in dental science, as well as explore the ramifications it has in *halacha* (application of Jewish law).

Talmudic Text: Carrying Dental Appliances on Shabbat

The Talmud (Sabbath 64b - 65a) discusses the prohibition of carrying in a public domain on the Sabbath. It specifies various objects, including false teeth, that are forbidden to be carried or worn on the Sabbath.

A woman, for example, may go forth with a ribbon, or a hair net, or a wig into a courtyard, ...with a peppercorn... and with globule salt, and anything that is placed in her mouth, providing that she does not put it in her mouth in the first place on the Sabbath. If it falls out, she may not put it back. As for an artificial tooth, or a gold tooth, Rabbi permits it but Sages forbid it.

This excerpt sheds some light on the extent of dental science during the times of the Talmud. The mention of artificial teeth confirms that the prosthodontics branch of dentistry already existed. However, the extent and quality of false teeth during these times

must be explored. Many commentators, through their discussions of the issue of carrying, shed light on the artificial tooth and gold tooth and whether their presence constitutes carrying on the Sabbath. The gold tooth could lead to carrying because a woman may remove the gold tooth to show her peers its great value. Indeed, one did not blow the *shofar* (ritual horn) on *Rosh Hashanah* (Jewish New Year) when it occurred on the Sabbath, not because of the musical aspect of the blowing, but rather because the “blower” may come to carry the *shofar* on the Sabbath. Other commentators are of the opinion that there is no real issue of carrying, because a woman would not remove her gold tooth due to the embarrassment of walking without teeth. The Talmud further differentiates between a gold tooth and silver tooth. Unlike a gold tooth, there would be no issue of carrying a silver tooth on the Sabbath because a woman would not remove it, due both to its similarity to her other teeth, and to its lack of great value. Rabbi Channanel, a later Talmudic annotator, discusses that some “artificial teeth” were made of wood and other substances [1]. Additionally, Rabbi Ovadiah of Bartenura, a commentator on the Mishna, further explains the definition of an artificial tooth and a gold tooth. He translates the word “*tothevet*” differently than the classic translation of “artificial tooth.” Since it is acceptable in Aramaic to replace the letter *shin* (sh) with the letter *taf* (th), he explains *tothevet* as the Hebrew word *toshevet* - to sit. Meaning, the artificial tooth was “seated in the mouth in place of the lost tooth” [2]. He further describes the purpose of the gold tooth as a covering for a decayed natural tooth. This could be an early reference to a dental crown attached by bands and placed over the injured tooth. In concert with Rabbi Ovadiah of Bartenura, Maimonides writes in his comments on the Mishna that the “gold tooth is a gold cover in the shape of the tooth with a strange appearance to conceal a defect.” Maimonides also understands the gold tooth to be a crown to cover a damaged tooth. Lastly, ancient Hebrew sources describe how the aforementioned restorations were retained in place. “A denture which is a false tooth inserted in a woman’s mouth in a temporary fashion [was] kept in

place by pressure from the other teeth.” As the denture was held in place mainly by proximal tooth friction, it could only be held in place for a short time before falling out [3].

The various commentaries on the Mishna gave insight into dental sciences. It is clear that during Talmudic times, false teeth were only temporary and were comprised of different materials including gold, silver, wood, and ivory. In addition, dental crowns were also made of these materials.

Application to Ritual Immersion

Dental sciences play a vital role in properly carrying out the commandments in the Torah, in particular, the commandment of *tevila*. *Tevila* is the bodily immersion in a ritual bath, known as a *mikvah*, for the purpose of spiritual purification in the Jewish faith [4]. Women in particular immerse in the *mikvah* to achieve ritual purity after menstruation or childbirth in order to permit resumption of marital relations. Thus, *tevila* is an integral part of Jewish tradition, as is a basic component of the laws of family purity. Consequently, *halachot* relating to the *tevila* are thoroughly studied to ensure this mitzvah is performed properly.

A prerequisite before immersion in the *mikvah* is the removal of any barrier that would cause a separation between the water of the *mikvah* and the person. Any obstacle that creates a physical barrier is known as a *chatzitzah* [4]. According to Torah law, for a *chatzitzah* to invalidate the immersion process, it needs to include two components. First, the *chatzitzah* needs to cover the majority of the body and or hair. Second, a person needs to be *makpid* on the *chatzitzah*, meaning, she is conscious that the barrier is attached to her body. Therefore, she would be careful to remove the barrier under different circumstances. According to rabbinic law, even just one of the aforementioned conditions invalidates the immersion. Today, even if both criteria are not met, one should not do the *tevila* with a *chatzitzah* [5].

Due to the tremendous strides in the dental field, modern dental work poses many complications in properly carrying out *tevila*. These issues were not as extensive in Talmudic times because dental prosthodontics were limited, as seen above. While the Talmud made a clear reference to false teeth, these teeth were only temporary and could therefore easily

be removed before *tevila*. In contrast, modern dental appliances are extensive. It is common for people to undergo a tremendous range of dental work for both cosmetic and health purposes. Many orthodontic appliances are either temporarily or permanently placed in the mouth. This poses a great *halachic* dilemma, as the mouth must be free of any *chatzitzah*, even though it is not exposed to the *mikvah* water. [5]. To what extent does *chatzitzah* include dental appliances? Can a woman have a proper *tevila* with dental fillings, dentures, retainers, braces, *etc.* that are present in her mouth? Would these oral apparatuses constitute as a *chatzitzah* and invalidate the *tevila*? Many rabbinic authorities and dental professionals have worked together to determine the *chatzitzah* status for different oral appliances based on their function and permanence. As a general rule, every attempt should be made to remove any foreign material before immersion. However, if the barrier is inconvenient, difficult, or impossible to remove, then a rabbinic authority should be consulted as to whether the item constitutes as *chatzitzah* [6]. In most cases, a temporary *chatzitzah* should be removed while a permanent *chatzitzah* is permitted. Some of the main orthodontic appliances worn by people and their *halachic* ramification for *tevila* will be discussed below:

Dentures

A denture is a removable plate or frame holding one or more artificial tooth. Since dentures are usually removed for regular cleaning, one would be required to remove them for *tevila* as well, as they are not considered a permanent mouth fixture. In contrast, permanent false teeth (false teeth on a dental bridge) are not considered a *chatzitzah*, and therefore do not need to be removed. [6]

Dental Fillings

Dental fillings are a group of restorative materials used in dentistry. A filling is a way to restore a tooth damaged by decay to its normal function and shape. In this process, the decayed tooth material is removed, the affected area is cleaned, and the cleared cavity is filled with a filling material. Today, several permanent dental filling materials are available. Permanent dental fillings are considered extensions of the body and would not constitute as a *chatzitzah*. Additionally, a crown or cap, placed over the tooth to restore the tooth's shape, size, strength,

and appearance, is also not considered a *chatzitzah* due to its permanence. There are differing opinions on the *chatzitzah* status of temporary fillings. Factors such as the fitting of the filling along with the amount of time the filling will be in place factors into determining if the filling is considered a *chatzitzah* and would invalidate the *tevila*. These factors are determined on an individual basis and as always need to be discussed with one's 'local orthodox rabbi' [6].

Retainer

A retainer is a dental appliance used to hold teeth in their correct position, and are especially common following orthodontic (straightening) treatment. A retainer needs to be removed before *tevila* because it is not permanent, and therefore would be considered a *chatzitzah* because it is foreign to the body [6].

Braces

The *chatzitzah* status of braces is highly debated. Braces are devices used in orthodontics that align and straighten teeth and help position them with regard to a person's bite, while also aiming to improve overall dental health. Many rabbis assert that braces are not a *chatzitzah* because of their health function and relative permanence. However, one should be careful to clean the braces thoroughly, remove temporary parts of the braces that would constitute as a *chatzitzah* (i.e., wax, rubber bands), and ensure that the brackets are firmly secured [6].

In summary, while the dental sciences existed during Talmudic times, the tremendous strides in the dental field lead to many *halachic* questions that did not exist prior to the explosive growth in dentistry. In particular, the development in dental appliances opened up many questions in regard to the Jewish rite of *tevila*. Dental alterations need to be considered by one's rabbinic authority along with one's dental professional to determine what is a *chatzitzah* in order to have a proper *tevila*. With the explosive development of the dental and medical fields in general, *halachic* considerations continually need to be addressed.

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In a noteworthy case published in *The British Medical Journal*, a 79-year-old man presented to his physician with severe discoloration of his lower legs [1]. After evaluating that lung, kidney, liver, and blood function were all within normal limits, the doctors were puzzled as to what caused the discoloration and swelling. A complete blood count test was ordered, and the patient did not respond to anticoagulants or antibiotics. Ultimately, after evaluating the blood count data, the physicians noted that the patient was deficient in vitamin C, and the discolorations of the skin were diagnostic of a very ancient disease called scurvy. Scurvy has many contemporary implications and is a source of study in modern medicine, but it also has been associated with ancient Talmudic pathologies. Exploring literature, both ancient and current, can shed light on the nature of this pathology as well as the Talmud's multi-faceted medical contributions.

On a basic scientific level, scurvy is caused by a deficiency in vitamin C (ascorbic acid). It often manifests itself in patients with signs of anemia, spontaneous bleeding, swelling, and exhaustion [2]. Vitamin C is essential for the body's production of collagen, which lends support to the tissues and blood vessels of the body. An additional function of vitamin C is that it assists in the absorption of iron. Without this essential role, red blood cells would be structurally deficient and spontaneous bleeding would occur. Low vitamin C intake is often associated with anemia for this very reason. Individuals at risk for scurvy are usually elderly people, or those who have high levels of alcohol intake, coupled by a low consumption of fruits and vegetables. Increasing one's intake of daily vitamin C can lead to a dramatic improvement in one's skin condition.

Oral health care providers can often detect the presence of scurvy by evaluating the condition of a patient's gums. Gums that bleed readily and peel from the bone and teeth, with areas of gingival overgrowth and inflammation, can immediately trigger a differential diagnosis including scurvy and blood tests must be performed. From a laboratory perspective, scurvy can be diagnosed by detecting less than 11 umol/1 liter of Vitamin C in a patient's blood count [2]. Generally, physicians recommend oral supplements to combat the low vitamin C levels. The

patient described above was given a prescription of 500 mg for seven days and a drastic improvement in his skin condition was noted.

As far as the history of the pathology, scurvy was first described in 1795 amongst British sailors on naval voyages. In fact, it is possible that the documentation of scurvy dates back to ancient Talmudic times, much earlier than the 18th century. On a Biblical level, it is clear that oral diseases had an influence on ancient Jewish populations and their surrounding neighbors. Yerachmiel Bratt, in his translation of *Ben Ish Chai's Megillat Esther* commentary, stated that the Jewish nemesis, *Haman*, was missing many of his teeth [3]. The king's command, in Chapter 6, that Haman maintain all previously articulated honors for Mordechai, was based upon the fact that Haman had a speech impediment caused by his multiple missing teeth. Thus, the king suspected Haman would speak differently when marching Mordechai through the streets and alter the words he previously committed to enunciate. This insight can also explain why Haman's voice was not recognized by his daughter, as noted in a famous *midrashic* interpretation [3].

The Talmud, in a number of different contexts, discusses cases of oral pathology. A gum disease described in the Talmud, known as *tza'fadinah*, is often associated with the disease known as scurvy. Dr. Rosner noted, that the evidence connecting this disease to what is currently identified as scurvy, was unclear [4]. Nevertheless, many Talmudic translations continue to interpret *tza'fadinah* as scurvy. The Talmud *Yerushalmi*, in *Avodah Zarah* (2:2), related the story of Rabbi Yochanan, who pursued active treatment of his gum disease from a Roman matron. The Talmud related that placing the stones of unripe olives upon the inside of the gums helped cure his symptoms. The Talmud also related that the particular disease Rav Yochanan suffered from resulted from eating certain wheat and fish products and it often presented itself as bleeding gums.

Rashi provided a definition for *tza'fadinah* as "a sickness of the teeth and gums which begins in the mouth and ends in the intestines and is dangerous to life" [4]. Utilizing this interpretation, many classic and contemporary translations of the Talmud considered this "gum-bleeding disease" to be scurvy. However, Julius Preuss, in his book, *Biblical and Talmudic Medicine*,

strongly opposed this interpretation and considered the disease mentioned to be a form of stomatitis, a derivative of a condition caused by herpes simplex virus-1 [5].

An additional Talmudic source, the *Mishna* in *Yoma*, stated that Rabbi Matthia permitted pouring medicine into the back of one's mouth on *Shabbat*. There is a debate amongst classical Talmudic commentators as to whether the medication was applied to heal the throat or the teeth. *Tur*, *Tosafot Yom Tov*, and *Rambam* all interpreted this passage to be referencing a form of tooth pain, which involved rotting of the gums. In direct opposition, *Rif* and *Rosh* interpreted this story in a literal fashion, assuming that the medication was intended for a disease of the throat. Once again, the precise connection between a Talmudic passage and scurvy is unclear and subject to debate. Dr. Rosner presented an additional Talmudic link to tooth pain, as it relates to the story of Rabbi Yehuda HaChassid, who suffered from a toothache for thirteen years [4]. The exact interpretation of this story is a matter of debate, and can never precisely be identified, given the wide range of oral pathologies known today. However, the only matter of certainty that can be gathered from these sources is that *tzafdinah* is a Talmudic pathology pertaining to the teeth and gums. Nevertheless, given the lack of clarity in the interpretation of *tzafdinah*, it becomes difficult to draw conclusions for contemporary *halachic* purposes. For example, violating the prohibition of taking medication on *Shabbat*, as Rav Yochanan did, for diseases of the mouth such as scurvy, cannot be easily derived from this discussion because the translation of the pathology was not clear.

In modern medicine, an additional condition that has roots in ancient Jewish text is halitosis. Generally, it is known that bacteria of the oral cavity contribute to the persistent foul odor of the mouth, which is diagnosed as halitosis. Hydrogen sulfide, indole, and cadaverine are just a few of the poor smelling molecules released from decomposed amino acids in the mouth. The tongue, which accumulates a high count of oral bacteria and is often neglected as far as oral hygiene is concerned, is an important source of bad breath. Similarly, fasting and sleeping lead to dryness of the mouth that contribute to halitosis. Salivary flow is essential to the efficient removal of bacteria and debris that accumulate in the mouth [6]. When examining cases of halitosis in the Talmud, one

issue that arises is that the etiology of halitosis can be multi-faceted. In fact, the causes both can be localized or systemic. Cases of bad breath mentioned in the Talmud also may result from periodontitis or diabetes. Thus, it is not clear that halitosis as the sole diagnosis would be precise in those circumstances. The lack of vitamin C in the diet of those individuals suffering from halitosis, or from an insufficient intake of water, also may have contributed to the frequent description of bad breath in the Talmud [6].

In a dramatic and somewhat surprising passage, the Talmud (*Ketuvot* 75a) noted that halitosis was grounds for a divorce between husband and wife. The Talmud suggested that *kobanim* suffering from bad breath should chew on peppers as an antidote. Otherwise, they would not be able to perform their services in Temple. *Rashi* noted that this antidote would not be acceptable for a married couple, because their frequent conversations would not allow for them to be constantly chewing on peppers. In contemporary dental care, improving one's oral hygiene via increased brushing and cleaning of the tongue can lead to an improvement in halitosis. Similarly, evaluating one's diet and intake of foul smelling substances can lead to a reduction in the severity of halitosis [7].

According to Shifman one of the interesting clinical insights that is present in the Talmud's discussion of halitosis is that both mastic gum and oil-water mouthwashes were used to combat halitosis [6]. In modern day dental practice, both of these options are utilized. Mastic gum is derived from a Mediterranean tree and was used to freshen breath. Water, salt, and oil were mixed in a solution designed for treating Rav Yochanan's gum condition described above. In the 1980's, anti-bacterial mouth-washes were developed to work in a similar fashion as the Talmudic remedies [6].

In a broad sense, the Talmud offers an interesting historical and *halachic* perspective into oral pathology. Gingivitis, scurvy, halitosis and other unknown conditions described by sages in Talmudic times remind scientists and talmudists alike that the fight against disease of the oral cavity is an ongoing process that requires further study in both modern and ancient texts.

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The Varying Degrees of Fever in the Talmudic Era

By Haley
Kandelshein

Fever is one of the earliest forms of illness that is still prevalent in the modern world. Fever has been known to date back to several of the earliest civilizations including the Mesopotamians, the Egyptians, and the Jews. Interestingly, the popular view among many early civilizations was that fever symbolized the presence of an evil spirit in an individual, and while this certainly was a popular view thousands of years ago, today fever is simply known to be our body's immune response to an infection. Fever, however, is not as straightforward as it appears. There are clear contradictions in the Talmud and other biblical sources regarding the Jewish approach to fever. While some Talmudic sources reference fever in a positive and healthy light, other sources refer to fever as a dangerous and deathly illness to be avoided.

One source regarding fever, which directly contradicts itself, is found in the Talmud,

Rava said about a fever: were it not for the fact that it is an agent of the Angel of Death, it would be as beneficial for a person, just as a prickly foliage is for a palm tree, if it is experienced once every thirty days.
(*Nedarim* 41a,b)

While *Rava* certainly acknowledged the threatening aspect of fever by denoting it as an agent of the Angel of Death, he continued to express that fever possesses certain benefits to the afflicted individual. It is difficult to comprehend that one could simultaneously encapsulate an eminent danger as a health benefit. Apparently, *Rava* expressed seemingly conflicting viewpoints.

To begin to understand *Rava's* intentions, it is important that we understand the illness that we are facing at hand. Fever is defined as an elevation of body temperature greater than 37.8°C (100.04°F). The elevation in temperature typically occurs in response to an infection present in the body, which is detected by the immune system. An infection causes the body's thermostat, located in the hypothalamus, to reset at a higher temperature [1]. This results in the vasoconstriction of blood vessels. Thus, the hypothalamus set point is raised, and blood flow is diminished to the periphery of the body, resulting in a decrease of heat loss. When the blood temperature surrounding the hypothalamus reaches the raised set point, vasoconstriction ceases. At the newly elevated body temperature, the immune system is able to effectively respond to the infection.

The primary reason for the elevation of body temperature

when an infection is detected is that an elevated temperature is optimal for the functioning of the immune system. When an individual experiences a fever, neutrophils, which are a type of white blood cells that fight infection, are released. The elevated body temperature allows the neutrophils to better fight the infection. Neutrophils travel to the site of infection, engulf, and ingest the invading microorganisms through a process known as phagocytosis. Additionally, the increased body temperature allows for natural killer (NK) cells to better fight infection [3]. NK cells are lymphocytes, or white blood cells, typically known for killing virally infected cells [4]. Therefore, it is ideal for the body to maintain its elevated temperature to best fight the infection.

Elevated body temperature, or fever, is the optimal environment for the body when an infection strikes. Because elevated temperatures are uncomfortable to the patient, pharmaceutical companies have developed a class of chemicals known as antipyretic drugs to reduce fever. These drugs work by stimulating heat loss through sweating and vasodilation, which is the widening of blood vessels, allowing for increased blood flow. This returns the hypothalamus to its previously set point. While controlling fever may seem ideal because it relieves the discomfort associated with fever, it may be drastic in the long run. By reducing fever through medication, the infection that caused the fever is not eradicated and can continue to propagate on a larger scale, in the individual themselves, as well as to other individuals. Additionally, antipyretic drugs, which reduce fever, also inhibit the development of an immune response. While a fever may be uncomfortable, the body needs to maintain the elevated temperature to eradicate the infection. Conclusively, antipyretic drugs may not be the optimal choice of treatment.

While antipyretic drugs, such as ibuprofen, acetaminophen and aspirin continue to be the convenient and preferred choice of treatment, during the Talmudic era, folk remedies were the medicine of choice. One such remedy found in the Talmud *Avodah Zara* 28b suggested, "Radishes are good for a patient with fever." It has been scientifically proven that radishes can lower body temperature and relieve inflammation associated with fever. Radishes contain antioxidants that bind to free radicals, and prevent oxidative damage to the immune system. Radishes have the ability to act as a disinfectant, thus killing the infection that caused the fever to arise. The natural healing properties of radishes have proven to be successful in treating many diseases [5].

However, often individuals experiencing a fever do not desire food and can go days without eating. This provides evidence for the scientific fact that a fever can nourish the body [6]. Since fever acts as a source of fuel for the body, the body does not desire food. Nevertheless, while the old adage may be “feed a cold, starve a fever”, modern research has proven this to be false. According to Scientific American, while one’s appetite may diminish, the body has a greater need for food when a fever strikes. The increase in body temperature causes an increase in metabolism. Fever thus causes more calories to be burned which makes food intake a necessity [7].

In *Nedarim* (41 a-b), Rava began his statement by referring to fever as an “agent of the Angel of Death.” This statement, which is clearly expressing the negative elements associated with fever, may be two-fold. Rava may have referred to fever as “an agent of the Angel of Death” because of its ability to kill an individual, purely from a physical standpoint. An additional source where fever is discussed in a deathly light is found in *Avodah Zara* (28a), where it is stated that burning fevers are considered life threatening. Scientifically, for a fever to become deadly, body temperature must elevate above 40°- 42.22 °C (104.0 °-107.99 °F) . This exceptionally high fever is referred to as hyperpyrexia. Fever in this range can result in convulsions, and ultimately lead to death. When treating this type of fever, one should attempt to cool down the patient with cold water, fans and wet sheets. One incident in which an individual suffered from hyperpyrexia was noted in the Talmud *Niddah* 36b, in which it was stated: “Rav Assi fell ill and they had to put him in hot [blankets] to relieve him from chills, and in cold [compresses] to relieve him from heat, [but] his soul departed to its eternal rest”. His attendants correctly attempted to reduce his extremely elevated body temperature in order to cure him, which today would be recognized as the correct form of treatment.

While the above incident illustrated one isolated event of an individual suffering from extremely high body temperature, one specific type of fever associated with exceptionally high body temperature is viral hemorrhagic fever [8]. This form of fever is considered life threatening and has no cure. It is possible that Rav Assi may have suffered from this form of fever. Some of the symptoms include elevated temperature, dizziness, internal bleeding, severe diarrhea, shock, kidney failure, coma and death. Since this fever is incurable and results in death, it can appropriately be referred to as “an agent of the Angel of Death”

However, when Rava referred to fever as “an agent of the Angel of Death”, he may not have been referring to a solely physical illness, perhaps the illness had a spiritual component. One hint at this is found in *Shir HaShirim Rabbah* (2:16), in which mention is made of a sage who had a fever and was cured by an incantation. Additionally, in the Talmud in *Shabbat* (67a), it states that a fever was treated with

an exorcism. These sources imply that fever may not only be a physical illness associated with elevated body temperature, but rather a spiritual manifestation. A physical remedy for the reduction of body temperature may not be possible if the illness is purely spiritual.

While Rava expressed conflicting approaches towards fever, the Talmud in *Yevamot* 71b simply considered elevated temperature to be a positive sign that is accompanied by strengthening powers [9, 6]. After Rava referred to fever as a deathly illness, he proceeded to give an analogy symbolizing the beneficial aspect of fever. He said that fever would be “as beneficial for a person as a prickly foliage is for a palm tree” (*Nedarim* 41a,b). As we have seen, a fever is advantageous in that it has the capability to fight infection by elevating body temperature, allowing the immune system to function and develop optimally. At the elevated temperature microbes are not able to reproduce and propagate. The body has the optimal physiologic conditions to heal and prevent the spread of infection. According to the Talmud in *Nedarim* 41a, if a fever is not life threatening, it is salutary to the body.

However, Rava also mentioned that a fever is only beneficial if it occurs “once every thirty days.” Rava stated that while fever does hold certain benefits, it should not occur frequently. He may have been alluding to a classification of a group of diseases known as “periodic fever syndromes” [10]. Periodic fever syndromes refer to a group of autoinflammatory diseases, which are all accompanied by similar symptoms. The primary symptom that is common among all of these diseases is a recurrent fever. This category of disease is often genetically inherited, and caused by the malfunction and an over activation of the immune system which causes systemic inflammation throughout the body. One of the diseases in this category is Familial Mediterranean Fever (FMF), a common disease among Sephardi Jews. FMF is characterized by recurrent attacks of fever accompanied by inflammation and pain. While the sporadic presence of a fever has the ability to activate our immune system and fight infection, excessive occurrences of it pose a danger to the human body and may result in a debilitating disease.

After analyzing Rava’s statement in *Nedarim*, it is apparent that fever was a prevalent disease during the Talmudic era. However, fever was not simply an illness with one diagnosis, one symptom, and one cure. It is possible that Rava’s statement may not be as contradictory as it appears; rather, that each element of his statement may be referring to a different type of fever, one more severe than the other. Fever during the Talmudic and biblical era was a prevalent disease and therefore was discussed quite frequently using different terms.

The Torah refers to fever as *chom*, inflammation as *kadachat*, and fiery heat as *charchur*. While some rabbis considered

these to be different stages of fever, others consider them to be forms of malaria known today as quotidian fever, tertian fever and quartan fever. Additionally, the Talmud mentioned illnesses associated with fever and chills. These illnesses are referred to as *aish* (fire), *shemesh* (sun), and *chamah* (heat). All of these terms are heat-related thus referencing the elevated temperature which is directly associated with fever. Furthermore, these three forms of fevers are directly associated with chills. Three types of fever associated with chills are external fever, internal fever and shivering producing fire. Chills, or shivering, often symbolize the beginning of an infection and the onset of fever. The reason that the human body shivers is as a response to the cold. Shivering causes the body to produce heat and warm up. One form of fever, mentioned in the Talmud in *Gittin* 67b that is associated with chills is termed *Talga*. Furthermore, forms of chill-associated fever are seen as being quite dangerous, and some rabbis have even termed them to be typhus. Typhus is a particular disease caused by a bacterial infection that are transmitted from the bite of an arthropod. Fever and chills are typical symptoms of typhus [11].

Additionally, fever may also be categorized based on the amount of days that it is present in an individual. According to the Talmud, fever can be categorized by length, whether it be one day, two days, three days, or chronic fever [12,15]. Chronic fever may correlate to the periodic fever syndromes. Lastly, fever may vary based on the season in which it occurs. According to the Talmud in *Yoma* 29a, a fever in the winter is a sign of a more serious illness than a fever in the summer. One possible explanation for this statement is that winter causes more individuals to stay indoors and in closer proximity to one another. Due to the cold weather, windows remain shut and prevent the flow of fresh air. This causes the indoors to be the ideal breeding ground for the spread of infection and diseases. Additionally, according to a study conducted at Yale University, the body's defense mechanisms against the common cold are not as efficient in cooler temperatures [13].

Lastly, an additional variable that is to be considered regarding an individual suffering from a fever is age. If a newborn baby experiences a fever above 38°C (100.4°F), the baby is considered to be in a critical condition [14]. Since newborns do not have the developed mechanisms which humans use to cool off or warm up, such as sweating or shivering, a fever can be detrimental. In the Talmud in *Yevamot* 70a it mentions that circumcision is postponed in a baby with a fever. The reason for that is because when a newborn baby experiences a fever, the baby is in a critical state and may not be able to heal properly from a circumcision. The circumcision may weaken the baby further, causing him to be in a life-threatening state.

Fever is likely to be one of the most talked-about illnesses in the Talmud. However, as previously seen, it is not as straightforward as one would think. It has an extremely wide range of severity, from a simple elevation in body temperature to a crippling and deathly illness, as seen in both the talmudic and scientific sources. There are many factors to consider when discussing a fever such as the age of the affected individual, the season in which the fever occurred, and the length of time that the fever lasted. Furthermore, a slight increase in body temperature has been scientifically proven to have certain beneficial properties, such as facilitating the activation of the immune system. However, a drastic elevation in temperature has the ability to raise one's temperature to an extremely fatal level. Fever appears to be one of most dangerous balancing acts in the world of infection.

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Within the last hundred years, there have been groundbreaking advances in neuroradiology, as well as in neuropathology. However, the Torah, written thousands of years ago, provides extensive insight into modern neurology. Jacob's battle with Esav's guardian angel, recounted in Bereishit (32:25-33), is much more than just an inspiring story of courage. Our inability to conduct a proper neurological examination of Jacob's injury opens up a variety of possibilities in the differential diagnosis of it, as reflected by the century-long debates among some of the most esteemed traditional Torah commentators [1]. In describing the struggle between Jacob and the angel, the text (Bereishit 32:26) reads, "Then he (i.e., the angel) perceived that he could not overcome him (i.e., Jacob), he touched the "רִכְ" of his thighbone, and the רִכּוֹ of Jacob's thighbone dislocated as he wrestled with him." Rashi translates the word "רִכְ" as "hollow," the convexity of the gluteus, as formed by hip musculature. "Touched," as used by the Bible, always implies an indecorous contact [2]. In this case it refers to the violent gripping of Jacob's hip by the angel so to rip its ligaments from it. Since ligaments help control the movement of the leg, Jacob's gross motor skills of his lower extremity (whether it was the right or left is not known) were impaired, rendering Jacob with a temporary limp. The Bereishit Rabbah states (32:25-33), that his miraculous full recovery was noted as a solar healing process, which occurred during the sunrise the following day [3].

The lack of detailed descriptions in Biblical and Talmudic writings regarding the nature of Jacob's limp made later scholarship on the topic riveting. The 14th century Jewish scholar Rabbi Bahya ben Asher believed that the angel targeted Jacob's sole moral wrongdoing, his marriage of two sisters, Leah and Rachel. [3]. As such, the angel injured Jacob near his genitalia as a punishment for this sexual offense. Trauma to Jacob's posterior resulted in damage to the sciatic nerve, which was "flattened" against his hip capsule. Jacob's limping gait is a textbook example of substantial neurological damage to the sciatic nerve causing neurapraxia, a disorder of the peripheral nervous system in which there is a temporary loss of motor and sensory function due to blockage of nerve conduction. Had the damage been any more severe, (for instance, if the wound had been deeper,) Jacob's disability would have been permanent, contradicting his full recovery, as hypothesized in Bereishit Rabbah (32:25) [4].

However, Jacob's radicular back pain, leg weakness, and temporary limping gait could have been symptomatic of a herniated lumbar disc resulting from spinal degeneration and damage, which would apply pressure to the inner core of intervertebral disc. Other neurological damage possibilities can be attributed to local trauma-induced meralgia paresthetica or lateral femoral cutaneous nerve injury, which cause pain, numbness and paresthesias of the anterolateral thigh [1]. In contrast to current medicinal theories, the Talmudic text (Hulin 89b) seems to assume direct severing of his sciatic nerve as opposed to radiculopathy and meralgia paresthetica [3]. Alternatively, the Rambam, a Jewish scholar and physician of the Middle Ages, proposes the angel's lack of physicality, which implies that Jacob did not really have a battle, rather, he experienced an intense musculoskeletal reaction to a prophetic vision [5]. In addition, he may also have suffered peripheral nerve damage [4]. The sciatic nerve is referred to as "gid ha-nasheh" (translated as "sinew of the thigh vein"). Based on the Talmud (Hulin 91a) the hip slipped away (nashah, from the root of nasheh) or was dislocated from its place, as explained by Rabbi Joshua ben Levi, a Talmudic scholar of the third century. A differential musculoskeletal diagnosis of the injury can also indicate a femoral fracture, soft tissue trauma, and articular problems. Assuming osteonecrosis occurred, which is the reduction of blood flow to bones in the joints, the aforementioned theories are unlikely. Such injuries would have left Jacob permanently immobilized or may have even threatened his life due to the high risk of infectious complications with no available treatment in Biblical times [3].

The priceless life lessons and morals of the Torah are meant to be internalized. Through the intense medical analyses of Jacob's infamous limp, we arrive at an enhanced understanding of our forefather's struggle. As a reminder of his defying bravery, consumption of the sciatic nerve is prohibited under Jewish dietary laws (Bereishit 32:33) [6]. Jewish tradition holds Jacob's survival and triumph over the angel as an example of Divine Providence, guiding him and his descendants through the adversities of the Jewish people's tragic yet majestic history.

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Gestational Surrogacy: Establishing Maternity in Jewish Law

By Aderet Liss

Technical advances in human reproduction have had significant impacts within Jewish law. While surrogacy in particular is one of the main solutions to infertility, many issues, both ethical and halachic, must be taken into consideration. Ethical concerns with surrogacy include commercialization of surrogacy contracts and commodification of children. As a result, laws have been established in certain states in an attempt to resolve both of these issues.

The primary halachic concern with gestational surrogacy is determining maternity. In a natural case of pregnancy, one woman does both acts of conception and childbirth and is therefore considered both the genetic mother and birth mother. When the two acts, however, are separated and done by two different women, how is maternity determined? Which act is considered more important? Within Jewish law, is a mother defined as the woman who carried and delivered the baby, or as the woman who contributed the genetic material? Rabbis have been struggling with these questions for decades, leading to a halachic debate with countless opinions. The answer to these questions has tremendous implications: it determines the Jewish status of the child.

The most widely accepted opinion in Jewish law is that the surrogate alone is considered the legal mother. The first biblical source that can be used to support this opinion is the account of the births of Yosef and Dina. Targum Yonatan had an interesting interpretation of this event. Leah had already given birth to six sons and the two maidservants had each given birth to two sons. Leah knew she was pregnant with another son and that Rachel was pregnant with a daughter. Yet, Leah did not want Rachel to have a lesser share in the founding of the twelve tribes than the maidservants. She, therefore, prayed for the fetuses to be switched. This intra-uterine transfer was carried out, and Leah gave birth to a daughter, Dina, while Rachel gave birth to a son, Yosef (Bereishit 30:21). This source seems to suggest that birth determines maternity while conception played no role. Leah conceived Yosef but gave birth to Dina – she is identified as Dina’s mother. Rachel conceived Dina but gave birth to Yosef – she is identified as Yosef’s mother.

While this is primarily a non-legalistic, anecdotal source, there are Talmudic precedents as well showing that the birth mother is considered the halachic mother. Yevamot 97b recounts the ruling that twin brothers, whose mother converted to Judaism during her pregnancy, are forbidden

to marry each other’s wives but do not have to perform chalitzah to each other’s widows. When a married man dies, leaving his widow childless, the brother of the deceased is obligated to marry the widow. In order to set the widow free from this obligation and allow her to marry outside her first husband’s family, the brother of the deceased must perform chalitzah. Through a deeper reading, this Talmudic account reinforces the idea that birth determines maternity. The chalitzah ritual only applies to brothers who have a common father, while the prohibition against brothers marrying each other’s wives only applies to brothers who have a common mother. Conversion to Judaism, however, severs all pre-existing familial ties. The law of chalitzah, therefore, is irrelevant in this case of twins because their relationship through their father was dissolved. Yet, they are still related through their mother because the prohibition of marrying each other’s wives still applies. Rashi commented that this prohibition applies because the brothers were born to a Jewish woman. Even though the mother was not Jewish at the time of conception, she was Jewish when her sons were born. It is evident from this case that birth determines maternity in Jewish law. This implies that the birth mother, i.e. the surrogate, would be considered the legal mother [1].

There is a second view that the genetic mother alone would be considered the halachic mother. A Talmudic proof for this can be found in Niddah 31a which stated that there are three partners involved in the creation of a human being: God, the father, and the mother. The father contributed to certain parts of the baby, such as the bones, nails, and brain. The mother contributed to other parts of the baby, such as the skin and hair. God contributed to the spirit, soul, sight, hearing, speech, ability to walk, understanding, and rational thought. This source essentially explained that the mother is the one who contributes genetic material which formed, in the words of the Talmud, the skin and hair of the baby. This suggests that the origin of the ovum, the female reproductive cell, is the sole determinant of maternal status [2]. It is her genetic contribution that essentially forms all of the child’s attributes. In a surrogacy case, therefore, the biological mother would be considered the halachic mother.

Contradicting this view that the genetic mother is the legal mother, new scientific data has emerged regarding what exactly occurs when a woman carries a child in her womb. The concept of mother-fetal cell exchange has been

introduced recently, demonstrating that there is a profound physical connection between the gestational mother and the child [3]. The new data show that stem cells from both the fetus and the gestational mother are exchanged via the placenta. During pregnancy, these stem cells are implanted in tissues of the other individual and can have significant implications. Maternal cells implanted into the fetus may benefit the fetus by suppressing its immune system from negatively responding to maternal antigens. The child contains not only its own cells derived from its genetic mother and father but also cells from its gestational mother. In addition, epigenetic studies show that environmental factors, such as the hormonal environment of the surrogate, her dietary habits, and her lifestyle, can influence different characteristics of the fetus. The gestational mother can essentially impact the personality and health of the fetus [4]. These recent findings indicate that the surrogate does not simply serve as an incubator. Rather, biological bonds are created between the fetus and gestational mother.

This new information supports the minority view that both the gestational and genetic mothers are considered legal mothers. This stringent opinion has been accepted by several major 20th century authorities such as Rabbi Bleich and Rabbi Auerbach. Since there are two legal mothers, the Jewish status of the surrogate is of importance. If the surrogate is not Jewish, the baby must be converted. There is also an alternate view that the concept of mafkir zaro

should be introduced into the equation. Mafkir zaro exists for a sperm donor – he waives his right to claim paternity to any offspring. This concept should apply to a surrogate as well. The source of the ovum, i.e. the genetic mother, is the sole halachic mother unless she is mafkir zara; if she waives her right to claim maternity, then the legal mother is the gestational mother [5].

Establishing maternity in the case of surrogacy is an incredibly complex issue within halacha. There is no clear-cut, black-and-white answer. While there are opinions that halacha should not change in response to scientific advancements, many modern rabbinic authorities understand that within Jewish law, science and Torah are completely intertwined. Future research will be focused on better understanding the exact connection between the mother and fetus during gestation, and whether that should truly have an impact on this halachic debate.

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Anesthesia: The Value of Compassion in Jewish Texts

By Yardena
Schwarcz

Anesthesia was first used for surgery by the American physician Crawford W. Long (1815-1878). Interestingly, Dr. Long kept his results of the successful surgery hidden. However, just four years later, an American dentist, Dr. William Morton, made his own discovery of anesthesia and its implications for medical procedures [1]. The concept of putting someone to sleep to alleviate pain during an operation is an idea that, surprisingly, stems from Jewish texts.

The earliest place in Bible that we see the allusion to anesthesia can be found in *Beresbit* 2:21 with the description of G-d creating woman from the rib of Adam, “And the LORD G-d caused a deep sleep to fall upon the man, and he slept; and He took one of his ribs, and closed up the place with flesh instead thereof.” The Hebrew word used to describe a deep sleep in this context is “*tardema*.” The Malbim interprets this as “a deep sleep in order not to feel the pain,” which is a remarkable statement for his time. In addition to the Malbim, Rabbi Samson Raphael Hirsch explains that *tardema* is “something like anesthesia” [2]. Although the concept of anesthesia is not mentioned explicitly in the Bible, Talmudic writings discuss the use of anesthesia and surgery in great lengths.

A case of cranial surgery is brought in the *Gemara* when the rabbis describes a disease called *ra'atan*, which can be cured through cranial surgery. The *Gemara* describes the various parameters and *halachot* involved with this case and goes into detail describing the method of this surgery. The first step is to create a mixture/potion, containing pennyroyal and wormwood with additional herbs, as anesthesia preparation. This mixture would soften the skull, thereby relieving pain. In terms of application of the mixture, the *Gemara* advises pouring 300 cups of this potion on to the patient's skull and *then* locating the soft spot on which to perform the procedure (*Ketubot* 77b). It can be implied from here that the use of this potion was not only for the soft spot on the skull, but for a different purpose as well. A commentary on this *Gemara* adds that this same potion would be used on the skull after surgery implying that its use was twofold. One use would be to soften the skull to assist with surgery and the second would be to reduce pain before and after the procedure. It can be implied from here that “the mixture was being used as a type of primitive (local) anesthesia” [3]. Interestingly, Roger Salerno, who was regent of one of the crusader states, encouraged the use of wormwood soaked in rose water and feathers to control blood clotting in 1170 CE, a

practice used for cranial surgery nearly 1,000 years prior. In modern terms, these specific instructions can be translated as preparing the anesthesia, sedating the patient, anesthetizing the site for surgery, and maintaining proper post-operative care [3].

There is yet another mention of anesthesia in the Talmud that can be found in *Baba Metzja* 83b. The rabbis bring a case of an abdominal surgery performed in order to remove fat, which can be understood in modern medical terms as an adipose tissue resection. There was an operation done on Rabbi Eleazar, the son of Rabbi Simeon, who “was given a sleeping draught, and taken to a marble chamber, and had his abdomen opened” [2]. Although the sleeping potion is not specified or discussed, there is an understanding that some form of anesthesia was used for the purpose of sleep and surgery. Furthermore, the astounding similarities between the Talmudic medical care and the modern knowledge of surgical protocol are quite noteworthy. As mentioned in this *Gemara*, as well as in the case of cranial surgery, finding a clean and sterile operating room such as a marble chamber for the surgery is strictly advised followed by proper pre-and post-operative care to reduce pain and possible infections [3].

In addition to the use of the surgical anesthetics mentioned in the Talmud, there is yet another circumstance in which we find the use of a potion to “numb the senses.” As the rabbis say in a ruling in *Sanhedrin* 43a “when one is led out to execution, he is given a goblet of wine containing a grain of frankincense in order to benumb his senses, for it is written ‘give strong drink unto him that is ready to perish and wine unto the bitter in soul.’ [proverbs 31:6].” There is a clear theme in the *Gemara* that Jewish law enacts ways to reduce possible pain in several varying cases. Whether it is surgery or a rare event of execution, our sages encourage the use of “potions” and alcohol to alleviate pain.

If Jews are so concerned with the reduction of pain and promotion of health, then why is the use of anesthetics not mentioned in a case of circumcision? Medical advancements in the field of anesthesia have brought forward several questions regarding its use for circumcision. Although it is clearly disproven today, before 1987 most medical authorities accepted the notion that neonates did not recall pain and that anesthesia was not important to administer to them [4]. Nonetheless, anesthesia is used today for all operation on neonates with the exception of ritual circumcision. Many anesthetic

injections and topical anesthetics have been developed to alleviate the pain of circumcision specifically for neonates. One possible way to reduce the pain of the procedure is by injecting 1 mL of lidocaine (1%) at the site [5]. The advantages of this procedure are its effectiveness in reducing pain over other local methods, however, the pain felt from the injection may be just as painful as the procedure itself. Another method to reduce the pain of circumcision is by “spreading a cream with various concentrations of lidocaine locally on the area of the foreskin about 1 hour before the circumcision.” Many practitioners found EMLA (eutectic mixture of local anesthetics) cream to be most effective when applied 1-1.5 hours before application [5].

Various sources are brought in to the discussion of allowing anesthetics to reduce pain during circumcision. There is a *midrash* in Bereshit Rabbah that quotes Rabbi Abba bar Kahana saying that “[Abraham] felt the pain of circumcision and suffered in order to increase his reward from G-d” [5]. Some rabbinic authorities bring this thought as an argument against the use of anesthetics for ritual circumcision. However, others argue that “Abraham acted out of supreme love of G-d. His behavior cannot mandate that we too perform G-d’s commandment with a similar level of devotion” [5]. Those objecting the use of anesthesia for circumcision often argue the importance of preserving not only the tradition of this custom, but also the way it was performed for millenniums. Rabbis S. Wosner, M. Halberstam, and M. Eliyahu believe “the Torah prohibits innovation” to be added to Jewish customs [5].

Other rabbinic authorities disagree with this viewpoint and claim that “there is no source in the Torah, in *halacha*, or in *kabbalah* requiring that circumcision be accompanied by

pain” [5]. In support of this statement, the Zohar clearly indicated that the pain of childbirth atones for the sin of Eve. Nonetheless, no one has ever objected to efforts to minimize that pain”[5]. The fulfillment of a *mitzvah* does not require the accompaniment of pain or suffering. While a direct commandment to feel pain during circumcision is not found, there are some that believe that some pain must be felt which comply with the above methods of anesthesia for circumcision, for these methods do not entirely eliminate the pain. Therefore, many authorities agree that innovations that do not conflict with *halacha*, as is the case with the use of local anesthetics for circumcision, are permitted.

The concept of anesthesia can be dated all the way to the time of creation and followed for millennia through Jewish texts and commentaries. Jewish *halacha* deeply values compassion in the field of healthcare and, in fact, seems to encourage the use of modern anesthetics. Reducing the pain of a patient in surgery, a baby who is getting circumcised, and even a criminal being led to their execution is meticulously instructed in many cases and signifies the incorporation of science in *halacha* by Jewish scholars.

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Our bodies are the physical instrument God gave us to perform *mitzvos*, and thus we must take care of them, as the verse states, “*Venishmartem meod lenafshoteichem, take great precaution with your lives*” (*Devarim 4:15*). It is understandable that something that poses a danger to health is *halachically* forbidden; for instance, smoking is prohibited. In fact, the *Rama* wrote, “One should avoid all forms of danger, because anything dangerous is treated more stringently than something forbidden by law. And one should be more concerned about possible danger than a possible prohibition” (*Yoreh Deah 116:5*). Possible dangers are treated with caution in *Halacha*. Potentially dangerous activities could range from typical daily activities such as driving, to occasional recreational activities such as skiing. They could also range from immediate dangers to more long term consequences.

At first, science did not fully recognize the health risks of smoking and Rav Moshe Feinstein ז”ל permitted it under the principle of *shomer petaim*; if the risk of an action is low, then the action is allowed. Rav Moshe allowed smoking because the associated health risk was thought, at that time, to be minor. However, once the health risk was acknowledged, regulatory attention shifted to banning or, at least, limiting smoking, *e.g.*, the smoking bans in closed workplaces [1] and it is generally accepted that Rav Moshe would no longer allow it. Not long ago, smoking was a social norm, but now it is associated with addiction, lung damage, and cancer. This demonstrates that if there is new medical evidence that something once thought to be safe is actually hazardous to health, it should, of course, be *halachically* forbidden. A current example is the over-consumption of foods and unhealthy eating habits.

Obesity, the second leading cause of death in the United States, accounted for 15.2% of deaths in 2000 [1]. Obesity leads to several conditions, such as hypertension, coronary artery disease, heart attack, stroke, elevated levels of serum cholesterol, type 2 diabetes, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, and endometrial, breast, prostate, and colon cancers. Many people who are overweight but not technically obese should still reduce their weight, as a precaution, because obesity is viewed as a spectrum disorder. Unfortunately, despite the scientific evidence showing the adverse health risks of being overweight, the percentage of the population defined as obese is rising. While much of the blame for obesity in the general American population is placed upon fast-food based diets, keeping kosher does not eliminate the problem. Orthodox Jews have their own particular unhealthy eating habits that are conducive to inducing obesity.

A typically orthodox Jewish *Shabbat* meal usually ends with the participants feeling unpleasantly full from the amount of food consumed. Yet, every week the same pattern persists. A study of a typical Orthodox Jewish diet found that people eat, on average, more than double the amount of calories on Shabbat than on a regular week day [2]. This issue should be taken more seriously, since the Torah warns against gluttonous behavior. *Bnei Yisroel* was punished with *slav*, an excess amount of quail meat, that caused death, because they greedily complained about the *monna*. This infamous incident in early Jewish history teaches us not to be excessively greedy with regard to food. Some opinions relate that the specific *al cheit* of eating recited on Yom Kippur refers to eating in a gluttonous way [3]. Gluttony is a sin, and we must treat the issue as such.

One of the most difficult obstacles to overcome in life is a habit, but fortunately the Rambam dedicated an entire chapter in *De’ot* (Chap. 4) to maintaining a healthy lifestyle. The Rambam noted that one should not only refrain from harming the body, but rather should actively strive to keep it strong (*Halacha* 1). The Rambam’s recommendations include to sleep eight hours a night (*Halacha* 4), to walk before meals, to eat or to drink only when hungry or thirsty, and to eat until satisfied, but not completely full (*Halacha* 2). The Rambam also recommended eating laxative foods at the beginning of the meal and only eating foods that are healthy and, even then, only in small portions (*Halacha* 6). These are a few of the many examples the Rambam offered on how to energize oneself. Some of these *halachot* may not apply today. For example, Rambam wrote to always mix wine with water, perhaps because at the time, the wine was extremely thick and sugary and the water was not purified. Today, there is no such need. Similarly, Rambam noted to only eat and drink when hungry or thirsty, but today a doctor will tell you to eat breakfast even if you are not hungry and to drink water throughout the day. Rambam also mentioned to avoid eating vegetables and fruits, especially fresh fruits (*Halacha* 11). Perhaps the local farmers in Rambam’s time used raw sewage to irrigate their crops, a modern problem noted with Arab farmers in current Israel [4]. If so, now that we are aware of the nutrients contained in fruits, Rambam would presumably revise this *halacha*. Regardless, Rambam provided twenty-three detailed *halachot* on every aspect of taking care of the body, observing that “a man who is wise overcomes his desires” (*Halacha* 10). Strengthening one’s physical self is a *halachic* necessity according to Rambam.

Eating right and exercising come as a struggle to many people, but so do many *mitzvos*. The Torah understands the influence of one’s environment in decision-making, as it

teaches the importance of surrounding oneself with good neighbors. The first step in overcoming a challenge is to identify the circumstances that enable it. Despite it being standard to eat excessively on *shabbat* and *yom tov*, one must realize that it is unhealthy to do so. Even when everyone else is munching sour sticks and potato chips, one should realize that consuming such food is antithetical to the Torah's ideal of *venishmartem meod lenafshoteichem*. One study showed that friends of obese people are 57% more likely to be obese [5]. Apparently, genetics is not exclusively at fault for obesity; we are also affected by our surroundings. Therefore, in order to negate the potentially harmful eating habits of one's community, a personal nutrition plan should be adopted as standard. One could talk to a nutritionist or use the internet to obtain information about an effective health plan. There are numerous approaches and the goal is for a healthy diet to be a priority.

Hashem gave every person a body; each individual should consider him/herself important enough to do *mitzvot*, "One has to remember that one is important, important enough to look wonderful and to reconnect with life" [6]. Therefore, being energetic and keeping in shape is for the

sake of doing *mitzvot*, "Our bodies do not belong to us. We have them as a precious charge from *Hashem* Himself. We have to look after them. We are not allowed to destroy or hurt them in any way or lead an unhealthy lifestyle" [6]. Eating healthy and exercising are necessary to maintain a healthy body; and maintaining a healthy body is a *halachic* requirement.

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Cloning: Can I Be My Own Grandpa?

By Sophie Shulman

Somatic cell nuclear transfer (SCNT), also known as reproductive cloning, is the process of inserting a nucleus from a somatic cell into an enucleated somatic cell. It takes between four and six days for the initial cell to grow and divide in a Petri dish and form the pre-embryo, which is then implanted into the uterus of a female to carry for the 9-month gestation period [1]. The first adult mammal that was successfully cloned was a sheep, named Dolly. In 1997, Ian Wilmut and his team took the nucleus from the mammary gland of a sheep and placed it into an enucleated differentiated cell of another sheep. The scientists were able to induce division through an electric shock. Even though both the cell of the nucleus donor and the cell of the nucleus recipient were fully matured, the recipient with the donated nucleus was able to return to its primary stage of totipotency, when a cell has the potential to develop into any type of cell in the body. The cloning of Dolly was a surprising discovery because previously, a cell's chosen function was thought to be irreversible, yet this differentiated mature cell was able to take on the characteristics of an embryonic totipotent cell [2].

Is the process of human cloning problematic? Some might suggest that cloning people creates an ethical dilemma as it is interfering with G-d's role as the creator. This question also comes up in the discussion of man's capability to heal. Rashi stated in Exodus (21:19) that we cannot say that G-d causes illness and man heals. Rather, G-d gives man the tools and the ability to cure. Using these Divine gifts to cure illness or bring about new scientific discovery would not be a challenge against G-d [2]. In Tractate Sanhedrin, Rabbi Shlomo HaMeiri stated that there is a difference between creation through the natural process and creation through magic. According to the Sefer Hachinuch, creation through the natural process is permissible if it brings about some type of healing [1]. Cloning would be viewed as a natural process, because it implants a "fertilized" pre-embryo into a woman, which mirrors the regular process of embryological development [3]. Therefore, the act of cloning would seem to be permissible according to the Sefer Hachinuch because it is a form of "healing" through a natural process. SCNT does not appear to involve anything that is forbidden according to the Torah. The Rambam stated that doctors can evaluate life or death decisions, and that the halacha can change based on scientific discovery [1]. If there is nothing inherently wrong with reproductive cloning according to halacha, then scientific discovery can influence the halachic process to make this permissible [2]. This article will further explore whether reproductive cloning brings more healing than harm.

Knowledge of SCNT both opens a new door in scientific discovery and raises some biomedical ethical questions.

Cloning can be performed on a smaller scale by renewing damaged cells, but also on a larger scale—by creating clones to later function as organ donors, or giving a childless couple the opportunity to have a child. There are always ethical questions that arise when interfering with nature. Reproductive cloning via SCNT can cause a loss of individuality and question the identity of the parent [2]. It can also cause major ethical issues if selecting traits for future children, or eugenics, becomes the focus [4]. It is still unknown what damage reproductive cloning can cause, as it is possible that creating a new human being from an "old", differentiated cell may cause birth defects [4].

Reproductive cloning may result in a loss of individuality in the clone. Two genetically identical human beings, one the nuclear donor and one the nuclear recipient, might feel a psychological burden, primarily on the recipient. Perhaps, there would be much psychological pressure on a clone to "fill the shoes" of the nuclear donor [4]. Dr. Joshua Lipschutz, director of the department of nephrology at the Medical University of South Carolina, claimed that no two people can be identical, because no two brains are identical. The brain, which establishes the individuality of the person, is shaped by the environment. Everyone's life experiences, opportunities, and developments are different. Identical twins, although genetically the same, have different minds and personalities because of their unique life experience [3]. The Talmud in Shabbat 156a discusses the idea of being born under different mazalot, zodiacs, and how it causes different predilections in human events and behaviors. People can overcome these predilections and direct them towards different life pathways [4]. Man is able to guide his own life using free will, which separates him from everyone else.

The motive for creating the clone can also become a halachic concern. The Torah states in Leviticus (18:5) that "You shall therefore keep my statutes and... man... shall live by them," which is the source for self-preservation. A person must help out someone else in need if they can do so without risking their own life. However, if helping out another person posits some threat to their life, the Torah does not want them to put another's life before their own. The halachos regarding organ donation takes these facts into consideration and if someone can donate without causing major harm to themselves, they are encouraged to do so [5]. Halacha would look down on the creation of a clone solely to be used as a heart donor. The Torah would view this clone as a real person with a unique soul, and thus, harvesting its heart would be considered an act of murder. However, a case where a family cloned a child to supply another pre-existing child who was in need of a bone marrow transplant, would be viewed differently. In the latter case, the cloned child was brought into their

family, and if the cloned child was able to save another's life without putting its own life at risk, it would be viewed as a mitzvah [4].

While reproductive cloning does not explicitly violate halacha, it may raise ethical questions. For example, determining the identity of the halachic parents, a question that arises within the topic of in vitro fertilization, becomes complicated when discussing cloning. Additionally, should the feelings and psychological burdens of the person who is cloned be taken into account? Reproductive cloning also may lower genetic diversity and ignite the eugenics movement. Science is always moving forward, but many see human reproductive cloning as a dangerous tool if used improperly, and as a result, there are people who are trying to hamper progress. While cloning does not seem to

include any halachic concerns, it is unclear where it may end up when left in the hands of people. There are many benefits that can come from SCNT, so with the consideration of our Rabbanim and medical authorities, perhaps we can reach new heights in scientific discovery.

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The grapple, a relatively newly established fruit developed in Washington, is the combination of an apple and a grape. The birth of a grapple occurred by simply infusing grape flavor into Fuji apples, rather than an apple tree and grape vine being combined and grown together [1]. Is the grapple then considered a hybrid fruit? A hybrid, scientifically, is the offspring from two different parental species, whether plants or animals [2]. In biology, the term hybrid has different meanings, including cross-pollinating plants, grafting in agriculture, and breeding of hybrid animals.

In the Torah and Talmud, there are vast discussions on hybridization, cross breeding, and grafting. The topic of hybridization has been acknowledged by many prominent Jewish commentators, and although each may have a different opinion for the rationale behind a halachic prohibition, Judaism does not support hybridization. The first mention of this topic begins in the Torah.

The topic of hybridization, *kilayim*, is first mentioned in Leviticus, and is later discussed in Deuteronomy. In Leviticus, the Torah reads, reads, “Do not let your cattle gather with a diverse kind. Do not sow your field with two kinds of seed. Neither shall there come upon a garment of two kinds of stuff mingled together (19:19).” In Deuteronomy, the Torah expands, “Do not sow your vineyard with two kinds of seed; lest the fullness of the which you have sown be forfeited together with the increase of the vineyard. Do not plow with an ox and an ass together. Do not wear a mingled stuff, wool and linen together (22:9-11).” These verses are somewhat unclear, and provide no explanation as to why mixing two animals or seeds is a prohibition. According to the Talmud (Yoma 67b), the laws of hybridization are categorized as commandments beyond man’s capacity to understand [3].

A major conversation of hybridization in the Talmud is the discussion of the *etrog ha-murkav*, the grafted *etrog* (citron). Grafting is an agricultural procedure that includes taking one tree branch and attaching it to a tree of another species. This method allows for new attributes, such as smells or tastes that are not naturally occurring, to strengthen a weak plant, or to prevent the plant from bacteria infestation and disease. Over the course of generations, people grafted branches of *etrog* trees onto lemon trees, and use the grafted *etrog* fruit as one of the four species on Succot. The Achronim were the first to comment on the suitability of this *etrog* for the commandment of the *arba minim*, four species. There are two reasons to consider when discussing the grafted *etrog*: the identity of the species and the prohibition of grafting. It was widely assumed that the grafting of *etrog* branches onto a lemon tree alters the physical characteristics of the fruit. However, scientifically, the host tree does not

genetically modify the grafted branch, but rather, only transfers minerals and water. Halachically, however, the grafted branch assumes the identity of the host tree species. The *etrog* either would be considered as the same species as a lemon or, according to some opinions, it would be designated as a hybrid of the two species, perhaps classified as an *etrog chaser*, i.e., an incomplete *etrog* that cannot be used for the mitzvah. Even if the lemon portion of the *etrog* was subtracted, the *etrog* would not achieve the minimum size required for the mitzvah. The addition of the lemon section would also violate the prohibition of *bal toseif*, adding onto a commandment by adding another species to the *arba minim* [4]. R’ Yechiel Michel Stern who is the main rabbi of Ezrat Torah, a Haredi community in northern Jerusalem is considered an expert on the halacha dealing with the four species. He consulted field experts who confirmed that even a pure kosher *etrog* still has traces of lemon due to cross pollination from bees carrying pollen from lemon flowers. How is this not *pasul*? R’ Shlomo Zalman Auerbach, the renowned orthodox rabbi and posek of Jerusalem, explained that pollen from a lemon flower cannot grow into a fruit by itself, rather it solely provides genetic material for an *etrog* flower to mature into a fruit. Therefore, the *etrog* is considered kosher even with a trace of lemon. He explained that grafting a branch of a lemon tree onto an *etrog* tree is an issue because they both can produce fruit independently, unlike the pollen from a lemon flower. Ideally, a pure *etrog* is preferred over an *etrog ha-murkav* (Masechet Succah 29-35).

The Hazon Ish conveyed his opinion about cross breeding when discussing taking resin from one plant and infusing it into another plant, as well as one plant shoot being grafted onto a different species of tree. He believed that cross breeding was only violated when a whole plant, rather than a germ cell, is grafted onto another plant of a different species, similar to the discussion of pollen from a lemon tree. He explained that a single shoot will grow into a plant when planted in the earth or grafted onto another plant, but a single cell from the shoot will not grow into a multicellular organism. Therefore, a shoot or resin of one species grafted onto a tree of another species will grow, and thereby violate the prohibition of cross breeding. He wrote further, regarding animals, that inseminating a germ cell of one animal into another animal of a different species was permitted because the germ cell was not considered a whole creature, like a shoot or resin of a plant is considered a whole creature that can independently grow into a single plant [5]. The Hazon Ish stressed the importance of evaluating whole and half creatures and deemphasized the act of cross breeding two species.

On a similar note, there has been discussion for grafting melon or watermelon onto pumpkins. Genetically, melon and watermelon do not differ greatly from the pumpkin, yet they still belong under different genera according to modern taxonomy. It has become common in many countries, including in Israel, to graft a shoot of a young melon or watermelon onto a pumpkin where the product grows normally. This procedure is advantageous because it produces seedlings resistant to soil-borne diseases as well as requiring less soil fumigation. The grafted plants also produce seedlings that are sweet and attractive. The question in Jewish law was whether all three species are indeed different. The Hebrew word for pumpkin is *dela'at* and was once considered to be in the species of *Lagenaria*, but was soon adopted into the *Cucurbita* species, the same species as melon and watermelon, over 100 years ago. This led to the dispute between the Sages about the taxonomic status of the pumpkin. There is also a range of the morphological variation of pumpkins, as well as the fleshy fruits of the *Cucurbitaceae* species, so sometimes pumpkins can be similar to the phenotype of melons and watermelons [6]. If this is the case, then the three species would be classified as one species, and thus, grafting between them would be permissible.

The topic of hybridization is not limited to plants. There has been discussion of horses and donkeys mating and pigs and sheep mating. There was a debate when the mule, the offspring of a horse and a donkey, was initially created. Ironically, the debate of a prohibition against the creation of a mule is not discussed, but rather the time when the first mule was produced is discussed. In *Pesachim* 54a, R' Nechemyah wrote that the mule was created the first *erev shabbos* of creation. Many commentators have varying views explaining R' Nechemyah's statement, one of which included the *Sefas Emes*'s opinion, which stated that Hashem decided to give man the ability to take existing creations and manipulate them through cross breeding, perhaps suggesting an allowance for such procedures [7].

Naturally occurring animal hybrids are mentioned in the Talmud (*Bava Kamma* 77b), in particular, the offspring between a male goat and a female sheep; both can interbreed as both species have a gestation period of 5 months. Also noted is that a sheep and ox cannot interbreed to produce a hybrid, as the gestation period of an ox is 9 months. Rashi in *Bava Kamma* 78a and in *Yoma* 49b, noted that a hybrid from a mating between a domesticated animal and a non-domesticated animal, for example, an offspring from a male goat and a female deer, is termed a *coy*. In the case of a non-kosher animal fertilizing a kosher animal, the Talmud (*Bechorot* 7a) discussed the status of the offspring. A potential example of this is a pig and sheep mating to create a *peep* or a *ship*. There are a few reports of this pig-sheep hybrid in Oaxaca, Mexico. The offspring are covered with thick wool like a sheep, but have feet, legs, and snout resembling a pig. According to Jewish law, R' Yehoshua ben Levi, a legendary *amora*, suggested that different species cannot successfully interbreed because the offspring is not categorized under the same species. In this case, the pig belongs to the genus *Sus* and species *scrofa* and the sheep belongs to the genus *Ovis* and the species *aries*. Furthermore, pigs have 38 chromosomes and sheep have 54 [8]. In conclusion, following opinion of R' Yehoshua ben Levi, the mating between a non-kosher animal and a kosher animal cannot successfully propagate.

As apparent from the wide topic of hybridization, there are many discussions in the Talmud evaluating the prohibition against grafting and cross breeding, and perhaps the ruling on the commandment is something with which to grapple.

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The domestic cat is a beloved household pet worldwide. While there is no reference to the domestic cat in Tanach, the modern Hebrew name for a cat, Chatul/a, is derived from Tanach. It appears once as a verb, chatal in Yechezkel 16:4, meaning “to enwrap or swaddle” and once as a noun, chatulah, a “swaddling band” in Iyov 38:9. These names perhaps elude to a cat’s tendency to wrap its body around itself when it relaxes or sleeps [1]. In the Talmud it is called Chatul, though at times it is called Shunrah, which is a specific term derived from Persian. The Persian name suggests that the domestic cats of Syria and Europe were derived from there [2]. In fact, researchers examined DNA belonging to nearly 1,000 wildcats and domestic cats from across the Old World and found that all domestic cats today are descended from *Felis silvestris lybica*, a wildcat that would have lived in Persia during the time cats began to become domesticated (around 1700 BCE) [3].

By Talmudic times there were many tame cats. This is shown by the statement that a cat never leaves a home it has once chosen, and therefore it need not be watched (Shabbos 51b) [2]. However, a cat bit off the hand of a child (Bava Kama 80b) which led to a Talmudic discussion about dangerous cats, from which the conclusion was that white cats and their offspring are dangerous and black cats are not. Rabbi Steinsaltz, a contemporary teacher and philosopher [4], wrote that the distinction between dangerous and harmless cats is not dependent on their fur color, but rather on their ancestry. During the Talmudic period cats were not fully domesticated; white, or paler cats, were more closely descended from their wild ancestor *Felis silvestris lybica*, a silver furred wild cat, and therefore were more dangerous [5].

There are numerous more mentions of cats in the Talmud. Perhaps the most famous of which is that one should learn modesty from the cat (Eruvin 100b) since it will not relieve itself in front of others and always covers its wastes (Rashi) [6]. The destructive qualities of the cat are generally recognized, as well. With its five claws (Chullin 52b) it eats mice (Baba Kamah 80a), weasels (Sanhedrin 105a), hens, young birds, lambs, and kids (Chullin 53a), and, occasionally, even large birds (Kesuvos 41b) [2]. Cats also kill and eat snakes (Pesachim 112b) and are, therefore, said to be immune to snake poison (Shabbos 128b; Avodah Zarah 30b). Duck entrails are a delicacy for cats (Beitzah 3a; Shabbos 142b) [6]. A cat gives birth after 52 days (Bechoros 8a; Beraishis Rabba 20:4), though modern medical knowledge notes 55 days [1].

The Talmud connects cats and forgetfulness. The reason why the cat forgets its master, whereas the dog will always remember him, is stated to be because cats eat mice, which are eminently the cause of forgetfulness (Horayos 13a) [2]. Eating food from which a cat has eaten makes one forget his studies (Horayos 13b) [6]. This idea has lasted into modern times; for in Russia at the beginning of the twentieth century Jewish boys were not even now allowed to stroke a cat lest they lose their powers of memory. The prohibition does not, however, extend to girls [2].

Cats notoriously play a part in folklore and superstition, and this is true in Judaism, as well. The Talmud recorded that to see demons one should burn the fetus of a black cat, which must be the eldest female offspring of a black cat that is also the eldest female offspring of a black cat, and sprinkle the ashes on one's eyes (Brachos 6a) [2]. The placenta of a black cat was once used in an exorcism (Brachos 6a) [6]. A woman's blood, offered to a cat, coupled with a potion, will deprive a man of his virility (Shabbos 75b). In the Middle Ages in some German provinces a cat was believed to be hidden in the bimah of shuls, pointing to the devil's presence there. This belief was held until quite recently. Jews were also accused of practicing magic and there are nursery rhymes which record that Jews could, and often did, turn themselves into cats [1]. In Russo-Jewish folklore, blood from the tail of a cat is regarded as a cure for skin rashes, while a cat put into a new cradle drives away evil spirits from the baby. Some Jewish superstitions are to place cats outside during a thunderstorm, a black cat in the house is propitious; a white one, unlucky, and when a house is built a black cat, among other domestic animals, is introduced into it for luck [2].

In regards to the halachic perspective on owning a cat as a pet, the general principle according to most authorities is that one may own a pet provided that the animal does not pose a danger to people or property [7]. Even more so, cats can kill mice (Baba Metzia 97a) and may, therefore, be bred and kept as pets because they keep the house clean (Baba Kamah 80a) [6]. In his book "Chayto Aretz", Rabbi Menachem Slay examined the propriety of owning pets purely for recreational purposes (i.e. the pet cat does not serve any practical purpose) and notes positive aspects of pet ownership such as acquiring an appreciation of the magnificence of God's creations. With appropriate care and attention to halachos that pertain to pet ownership, such as an animal's status on Shabbos, feeding animals before one eats, and the removal of reproductive organs [7], one can enjoy a pet cat with relative ease.

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“Houston, We Have a Problem:” Issues with Travel to (and Study of) Mars

By Liat Wasserman

Since 1969, when Neil Armstrong stepped foot on the moon, and continuing today, as NASA and SpaceX gear up for missions to Mars, *halachic* authorities have been looking into the complexities of keeping *mitzvos* in space. From determining how to keep *Shabbos* to examining the impacts on modesty while on-board the spacecraft [1], many questions have been raised. Nevertheless, we must take a step back and consider the very notion of Jews traveling in and studying space. Should we be spending so much time and effort in creating the possibility of a Jew in space?

As the verse famously states, “*v’nishmartem me’od l’nafshosechem*” (*Devarim* 4:15), we must guard our bodies very carefully; in other words, safety first. We are commanded directly from the Torah that safety should be our primary concern. We are even required to desecrate the *Shabbos* in order to save a life (*Shabbos* 132a). Given how highly safety is regarded, it therefore seems surprising that a Jew should be allowed to travel in space, especially to distant Mars. In addition to an increased chance of developing cataracts and decreased calcium metabolism [2], studies consistently show that astronauts return with long-term health risks due to the radiation to which they are exposed while away from Earth [3, 4].

A trip to Mars would result in much exposure to radiation. Astronauts would be in space for much longer, upwards of 900 days [5], and would be exposed to energy particles from deep space, with solar rays adding to galactic cosmic rays and Van Allen belt radiation. Traveling to Mars presents dangers to astronauts well in excess of those who are headed to the moon or to a space station [6]. The question thus remains as to whether one is permitted to risk his health, and possibly life, in order to travel to space, and Mars in particular.

Radiologist and Jewish medical ethics professor Dr. Daniel Eisenberg quoted the verse in *Tebillim* (166:6) stating, “*Shomer pesayim Hashem*,” translated as “*Hashem* watches over the simple ones.” The *Gemara* understands this verse to mean that *Hashem* guards people from harm when performing regular, everyday pursuits (*Avodah Zara* 30b). However, as Dr. Eisenberg wrote in his Aish.com article, “Taking a Risk,” such protection can only be applied to activities that pose minimal risk to safety and which are accepted by the general population. For example, a person is allowed to drive a car despite the inherent risk that comes along with handling such a machine, since it is unlikely that an accident will occur and society accepts the idea of driving as a normal, routine activity [7].

Such protection is also assumed for tasks that are necessary

for the individual to earn a living, even if there is increased risk and most people do not consider the activity to be a part of everyday life. This is derived from the *Gemara*, in which is stated, “For what did the worker climb a ladder or tree and risk himself? Was it not for his earnings?” (*Bava Metzvia* 112a). It is understood that for the sole sake of livelihood, this worker was permitted to put himself in the dangerous circumstance of hanging from a tree. Dr. Eisenberg compared the *Gemara*’s situation to an example of a painter hired to work on a bridge. There is a fair amount of danger as the person hangs off the side of the bridge, paint equipment in hand. But because he must do this in order to financially support himself and his family, the verse from *Tebillim* about *Hashem* guarding the simple can be applied in this situation [7].

Even with the permission to pursue a career despite seemingly great risks, one must remain within “reasonable parameters” [7], according to Dr. Eisenberg. If a risky event can be avoided, the person must do so. He related this to using cell phones. It is no longer a new discovery that cell phones emit radiation and can increase the likelihood of cancer. Use of a cell phone pressed against one’s ear is therefore discouraged and it is suggested that speakerphone be utilized [8]. Applying this to the third guideline, in which saving another’s life would be an occurrence in which risk-taking would be allowed (*Vayikra* 19:16), there is no requirement for someone to help a drowning victim if the would-be savior did not know how to swim and would thus only be increasing the danger for both parties involved [8].

Each event is subjective in terms of deciding whether risk would be appropriate, but Dr. Eisenberg presented a calculation. The risk in each case must be weighed against the benefits that would theoretically occur should the individual take the risk. In total, according to Dr. Eisenberg, the amount of risk that would be allowed by *halacha* is the amount that would not outweigh the benefits [8]. After all, we are commanded, “*v’chai ba’hem*” (*Vayikra* 18:5), that we must live by the Torah, not die because of it.

The discussion of risk-taking is furthered by the consideration of various types of risk. The *Shulchan Aruch* noted that one may not put coins in his mouth for fear that dried saliva may remain on the coin from an individual who suffered from boils (*Shulchan Aruch* 116:5). In his work *Mishneh Torah*, the *Rambam* recounted an instance when nine people drank from a cup that had been left uncovered and were unaffected. The tenth person to drink from the cup died because a snake had poisoned the liquid in the cup and the poison had descended to the bottom. The

problem was that all the men were forbidden to drink from the uncovered cup, since there was a possibility that the snake would poison it, as was not unusual in those times. For the tenth man, in particular, even though others had partaken in the drink, one could not be sure that there was no poison (*Mishneh Torah* 11:14).

The similarity between these two occurrences lies in the probability. Both the saliva-on-coin instance and the poison-in-cup instance have the risk already present. Dr. Eisenberg brought in another example, of unhealthy eating choices, to contrast the types of risks. If a risk has already been created, no matter how small, one may not partake in the activity. If, on the other hand, the risk is not yet present (*i.e.*, may only develop as time goes on) and is only considered because of past statistics, that activity, although is permissible, should be avoided [8]. The example of the cell phone would fall into the second category for two reasons. Radiation adds up over time, rather than there being one specific instance that carries significant risk, and there is no certainty that a major health problem will arise because of using a cell phone. Additionally, to refer back to previous arguments, cell phone use is accepted by the general population as a routine task, without much concern for the dangers associated. For all these reasons, cell phones, despite the risk of radiation, are allowed in Judaism [8].

Though its danger of radiation is exponentially larger, space travel can also be compared with the above categories to determine its permissibility according to Jewish law. Given the uncertainties of how safety technology might develop, the following analysis applies the *halachic* concerns to Mars travel while only focusing on the current state of our technologies. Additionally, due to the developing nature of the aerospace field, there are many opinions regarding the *halachic* and *hashkafic* ideas pertaining to the industry practices. Below are explanations for only the basic principles.

First is the question of whether a risk is accepted by society. At this point in time, the answer would be “almost.” Proper spacecraft operation requires many large, complex machines, and numerous failures can occur [9]. Furthermore, radiation is still a major focal point for researchers [3, 4]. But, as the idea of commercial space flight gains momentum, space travel is likely to become a fact of life. As Rabbi Yeruchem Eilfort summed up after the Columbia tragedy, in which the first Israeli astronaut Ilan Ramon was killed alongside his crew members, such disasters shock the world because safe space travel has become the expectation [9]. Thus, by the time astronauts will be ready to leave for Mars, it is possible that the dangers of space travel will become as concerning as were the dangers of driving when cars were first produced.

A story was related on Aish.com’s “Ask the Rabbi” of Rav Shimshon Rafael Hirsch, who insisted that he himself travel to Switzerland to the Swiss Alps despite the risk to his

health. His reasoning was that when he would reach the final judgment after his passing on to the Next World, he wanted to be able to answer in the affirmative when *Hashem* asked him whether he had seen the beautiful creation of the Swiss Alps [10]. Within the next few decades, perhaps Mars will become the new destination for those seeking to see *Hashem*’s wondrous creations. Even though Rav Hirsch risked his health, just as astronauts will do when heading to Mars, viewing the Alps was an accepted pursuit and was worth the risk.

Second, a risk might be permissible if it is necessary for livelihood [7]. At this time, according to Dr. Aureliano Rivolta in *Space Safety Magazine*, the general discussion is focusing on a one-way trip to Mars [11]. In such a case, an astronaut would not primarily be traveling for purposes of earning potential, since there will be no way or need for him to receive payment other than sustenance and supplies. When a spacecraft capable of returning to Earth is designed, the answer to this question of livelihood will likely change. Until then, according to this method of logic, the risk of Mars travel cannot be permitted on the basis of financial gain.

The *Noda B’Yebuda* famously wrote (*Tanina* 10) that a Jew could only hunt animals if doing so is necessary to earn money. One may cross a dangerous desert for the same reason. But, putting oneself in dangerous situations, such as these, is prohibited if for pleasure purposes [12]. This is similar to the ideas of hanging from a bridge and of travelling to space, given that danger is apparent at every moment. Thus, given the similarities between all four scenarios, there is room to say that travelling to the moon or space station, or to Mars should a return trip be planned, would be permissible for reasons of livelihood, despite the dangers. Any travel to space for pleasure purposes or vacation would seem to be prohibited.

Saving a life is the third reason someone may take a risk [7]. Unless we are entering into an era in which the film *WALL-E* is becoming the reality, with humans needing to find refuge away from the heavily polluted Earth [13], Mars travel will have no direct effect upon saving a life. According to NASA’s website, the current goals of the Mars missions are to examine the possibility of life on the Red Planet, to determine the feasibility of humans living there, and to provide explanations for Earth’s existence [14]. Thus, the astronauts will be risking their health and lives for the purpose of aerospace and exobiology research.

Using the verse that one may not commit suicide (*Bereishis* 9:5) and the verse that one may not get a tattoo (*Vayikra* 19:28), Dr. Eisenberg wrote that Jews may not willingly mutilate their bodies unnecessarily because our physical bodies belong to *Hashem* [15]. We must do our best to maintain whole bodies, both while alive and even after death. Dr. Fred Rosner, in his and Rabbi J. David Bleich’s co-authored book *Jewish Bioethics*, wrote that medical

research on healthy volunteer subjects, solely for the sake of a future possible need for the resulting information, is prohibited if the subjects would face “significant risk” due to the experiment [16]. This can be directly applied to the space mission. Damaging one’s body for the sake of achieving a better understanding of the Red Planet would be forbidden, even for a future need of information about the possibility of living in space, as in *WALL-E*. It must be noted, though, that this explanation reflects only current safety measures. Travel to a space station or the moon may eventually be safe enough to be allowed; at this time, though, there is not enough radiation protection for Mars travel to avoid causing excessive bodily damage to those on-board the spacecraft.

The last consideration for deep space travel is whether the effects on safety would be cumulative or immediate [8]. As with the cell phone example above, radiation from space does not affect an astronaut after a single radiation event. Rather, over time, carcinogenesis can develop and there is no certainty that everyone on a mission will face such long-term effects [6]. Thus, as with unhealthy eating habits, space travel may be discouraged yet not forbidden, according to this reasoning for risk-taking.

Although the specifics of keeping *halacha* and *mitzvos* in space are outside the scope of this paper, one topic of concern is the movement of an astronaut away from places of Torah. In *Tebillim* (119:72), *Dovid HaMelech* wrote, “*Tov li toras picha me’alphei zahav va’chesej*,” which means, “Your Torah is dearer to me than thousands of gold and silver pieces.” This phrase was echoed by Rabi Yosi ben Kisma (*Pirkei Avos* 6:9) when he refused an offer of an immense amount of money in exchange for coming to a village lacking Torah. Rabi Yosi wanted to remain in a city of Torah scholars [17]. A similar *mishna* stated that “one should exile himself to a place of Torah” (*Pirkei Avos* 4:14). *Rabbeinu Yonah* commented that this means one should live in a place with many Torah sages and actively “exile” himself along with the scholars in order to fully learn and gain from them (*Rabbeinu Yonah on Pirkei Avos* 4:14).

As of now, travelling to space unfortunately prevents a person from immersing himself in a city of Torah. The first Israeli astronaut, Ilan Ramon, brought a *sefer* Torah on-board the shuttle [18], but that is incomparable to a city full of Torah scholars, as described by *Rabbeinu Yonah*. Even more so, someone heading to Mars will be on the shuttle for years [5] and may even have to permanently remain on the Red Planet [11]. When descending to *Mitzrayim*, *Yaakov* sent his son *Yehuda* ahead of the family group so that the latter could set up *yeshivos* (*Rashi on Bereishis* 46:28). This way, by the time the seventy members of the family reached *Goshen*, they would arrive in a place of Torah.

At the same time, Rav Shlomo Zalman Auerbach (*Halichos Shlomo* 5:4) and Rav Moshe Sternbuch (*Teshuvos V’Hanbagos*,

vol. II, 63) stated that one should not travel to a place without a *minyán*, except for performing a *mitzvah*, for livelihood, or for health reasons. The *Shevet HaLevi* held that one should not be without a *minyán* unless absolutely necessary (*Shevet HaLevi*, vol. VI, 21:3). Perhaps an astronaut going to space can set up a place of Torah and nine other men can join him. At that point, he will have set up his own city of Torah and it will be permissible to travel there as long as all other requirements are met.

No matter the opinion as to whether travel to Mars would be permissible for a Jew, in current times another aspect of the aerospace field is receiving attention from *halachic* authorities. From the Americas to Israel and beyond, Jews of all kinds are spending their days studying the universe. There is little question of safety involved in these pursuits, as they are achieved from the comfort of our home planet, so the major question posed is regarding the devotion to discoveries that some religions worry will undermine their beliefs. The Lubavitcher Rebbe, Rav Menachem Schneerson, was once asked by exobiologist Professor Velvl Greene whether the latter should give up his search for life on Mars, after the professor received critique for his choice of profession [19].

As implausible as space shuttles may have seemed before the twentieth century and as laughable as life on other planets may have seemed just a few decades ago, all scientific discoveries were foreshadowed in the Torah. Already in *Sefer Bereishis*, the concept of travelling to space is evident. After the major flood that destroyed almost an entire generation, the next generation, termed the “*Dor Haflagah*,” wanted to ensure they would not be subject to another such destruction. They therefore banded together and decided to build a tower with its top reaching the heavens, “*v’roshe ba’shamayim*” (*Bereishis* 11:4).

Many commentaries regarded this tower as just that, a literal tower. Rav Yonasan Eibeshutz though, described the tower as a launching pad to escape from Earth’s weather system, and thereby from any future flood. The people building the tower planned on using gunpowder to launch their “ship” up to the moon, where they believed had suitable living conditions (*Tiferes Yehonasan, Bereishis* 8). It took years to create a space shuttle and find ways to launch it, yet *Dor Haflagah* were able to come up with such ideas long ago.

For Mars in particular, there is a mention of the planet and its discoveries in *Tanach*. During her poetic monologue after fighting off the powerful Sisera, Devorah the prophetess sang the praises of those who came to her aid and criticizes those who did not. It is during the latter part when she said, “*Oru Meroz... oru arur yoshveha ki lo ba’u l’ezras Hashem*” (*Shoftim* 5:23), which translated as, “Cursed is Meroz... cursed are its inhabitants because they did not come to help Hashem[’s people].” Many commentaries assumed Meroz to be the name of another nation or ruler,

but Rabbi Shlomo Yaffe brought a piece in the *Gemara* (*Mo'ed Katan* 16a) that understood Meroz to be a star [20]. Similarly, it does not seem likely that Meroz was another earthly nation or leader, according to the Lubavitcher Rebbe as quoted by Rabbi Yaffe, since there is no record of a ruler or earthbound location called “Meroz” [20]. Rather, many believed Meroz to have been a star or planet. Rav Pinchas Eliyahu Horowitz further detailed Meroz to have been an inhabited planet [21], which some understand to have been Mars, given the similarity in name. While there are others who disagreed and said that, as Rav Horowitz mentioned, Meroz is some other inhabited planet, the current studies examining the presence of life on the Red Planet, and further in outer space, may only now be realizing what the Torah and its followers knew long ago.

Given that these examples of innovations were included in the Torah, it is clear that there is nothing new that the Torah did not already take into account; as Rabbi Yosef Zaklos quoted [22] from *Kohel* (1:9), “There is nothing new under the sun.” Rabbi Aron Moss explained that as more scientific progress is made, more Torah is simply being uncovered [23]. The Lubavitcher Rebbe, who earned advanced science degrees, explained that in the phrase, “The Heavens belong to *Hashem*, and the earth He gave to the children of man” (*Tehillim* 115:16), the Earth includes anything physical. As such, planets and stars are considered part of Earth, while Heaven is purely the spiritual aspects of the universe. Hence, even the celestial structures termed “Heavenly bodies” are meant for us to discover and learn about them [24].

Rabbi Aryeh Kaplan added another angle to the argument that we should be searching for life and space discoveries. He wrote that if *Mashiach* comes early, which would be on the condition that all Jews return to Torah ways, the new era will be ushered in with incredible miracles. One such miracle would be “space flight and interstellar colonization.” We are expected to explore the universe as *Mashiach* comes. Similarly, the *Zohar*, as quoted by Rabbi Kaplan, believed that the description of the flood during *Noach's* time, in which the “floodgates opened” (*Bereishis* 7:11), referred to advancement in secular wisdom, otherwise known as science [25].

It is important to note that the term “secular wisdom” should not be considered as being solely for the gentiles. The *Rambam*, as quoted by Rabbi Shlomo Yaffe, stated that innovations and discoveries are meant to be utilized to better serve *Hashem*. Rabbi Yaffe argued that it is our responsibility as children of the Creator to find out all we can about *Hashem's* awe-inspiring creations, so that we may appreciate Him and what He has given us [20]. According to the verse, “*Ki er'eb shamecha ma'aseh etz'v'osecha*” (*Tehillim* 8:4); when we see the sky, space, and

Hashem's handiwork, we are fulfilling a *mitzvah* by marveling at the designs. In fact, we need to get started on exploration as soon as possible; there are 18,000 worlds in the universe that *Hashem* “roams over” (*Avodah Zara* 3b).

Based on the term “roams over,” many commentaries, including the 14th century Rabbi Chasdai Crescas, speculate that there is life on these planets [21, 26]. Rabbi Yosef Albo disagreed, however, saying that creatures on other planets are without free will so would not seem to have a purpose and therefore would not exist [26]. Nevertheless, the Lubavitcher Rebbe resolutely answered Professor Velvl Greene's concerns with, “Professor Greene, you should look for life on Mars. And if you don't find it there, you should look elsewhere. And if you don't find it there, you should look elsewhere. Because for you to sit here and say that G-d didn't create life elsewhere is to put limits on G-d, and no one can do that” [19]. Regardless of what we expect to find, it is a Jew's responsibility to learn as much as he can about *Hashem's* universe.

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Across all cultures, puberty marks an important milestone in human development. Specifically, the character of puberty as the prelude to reproductive capability signals the transition from childhood into adulthood. As such, its analysis has withstood the test of time and has inspired both religious and scientific discourse for centuries. The variability and determinants of pubertal age have been of particular interest to Chazal and scientists alike.

According to rabbinic thought, the anticipated ages of sexual maturity are 12 and 13 for girls and boys, respectively, as the ages of *bar* and *bat mitzva* signify adulthood in Judaic law. This assumption is apparent in the discussion in *Kiddushin* 16b regarding the ramifications of pubic growth in a boy below the age of 13 as an indication of sexual maturity. The rabbis of the *Gemara* unanimously accepted the pubic growth of a boy aged 13 or older as a sign of maturity. However, if the growth manifested above the age of 9 and remained until he was over 12, then the rabbis were divided on whether it was considered an indication of puberty (*Kiddushin* 16b). The discussion in the *Gemara* hints to the rabbi's nuanced understanding of the variability of pubertal age. They recognized that there is a standard age for the expectation of sexual maturation, as indicated by their unanimous acceptance of the growth as pubertal onset above the age of 13. However, their divergence of opinion on the child over the age of 9 demonstrates their understanding that pubertal onset is actually variable by person.

In fact, this subjective variability beckons further analysis throughout rabbinic literature. Chazal identified a number of factors that may be contributing influences on the age at which puberty first begins to occur. Some of these factors include whether a woman is from the town or the village. The *Gemara* claims that the upper signs of puberty manifest sooner in village-women, because they perform more physical labor (*Niddah* 48b). Wealth and impoverishment are identified as considerations as well in alternative pubertal development. The *Mishnah* suggests that for breast development, the right side develops sooner in wealthy women, because of the scarves that they wear, while the left side develops sooner in poorer women, because of the water jugs that they carry (*Leviticus Rabbah* 2:4). Additionally, the *Gemara* recognizes body weight as a pubertal determinant. When people approached Rav Hiyya seeking to initiate the onset of puberty, he advised them to either gain or lose weight depending on their physiques (*Niddah* 47b). Interestingly, many of the factors that the rabbis identified in the *Gemara* are reflected in modern scientific texts as well.

Rav Hiyya's assessment on body weight correlates with one of the more well-established determinants of sexual maturation. Researchers have found that weight, height,

and body mass index may influence pubertal age. An elevated level of subcutaneous fat, as well as a higher BMI in girls aged 5 through 9 is associated with an increased likelihood of earlier menarche, which is a girl's first menstruation [1]. Conversely, in a longitudinal prospective study of a population of U.S. boys, obesity was found to be associated with delayed puberty in males [2]. Thus, when Rav Hiyya advised those struggling with delayed puberty to either gain or lose weight, he was significantly ahead of his times. His advice came hundreds of years before modern science exposed that the relationship between body weight and age of sexual maturation was directly proportional for females and inversely proportional for males.

Furthermore, modern science has corroborated the rabbis' identification of locale and socioeconomic status as influencers of pubertal age in girls. Chazal recognized that potential differences in sexual maturation may exist in girls from cities as opposed to villages as well as in girls from wealthy as opposed to impoverished means (*Niddah* 48b, *Leviticus Rabbah* 2:4). Although the particular cause and effects cited in the *Gemara* and the *Mishnah* for these trends are not scientifically founded, the rabbis astutely made the associations between these environmental factors and pubertal onset. Research has shown that girls from families with relatively higher socioeconomic statuses tended to experience menarche at younger ages [1]. Some researchers have gone so far as to say that menarche is so sensitive to socioeconomic factors that menarcheal age may be useful in the estimation of the socioeconomic backgrounds of historical populations [3]. Additionally, many studies have found that girls from urban areas tended to experience earlier menarche when compared to girls from rural areas [4]. However, it is important to understand that factors like socioeconomic and locations act as umbrellas that contain many sub-factors, such as nutritional intake, access to healthcare, and overall general health, all of which play contributing roles as determinants of pubertal age.

Furthermore, the Sages and the scientists are both interested in the incidence of puberty at an unusually young age, and it is discussed in both rabbinic and scientific literature. Both contend with the plausibility of conception in early childhood. In *Sanhedrin* 69b, after much back and forth, the rabbis concluded that it was possible for an eight-year-old boy to father children. They cited the line of descent from Caleb to Bezalel as proof. The rabbis were able to calculate that Caleb must have been 26 years old when Bezalel, his great grandson, was born. Given that 3 generations descended from Caleb by the time he was 26, the *Gemara* reasons that each father must have been 8 years old when his child was born. The discussion there also mentioned that Bathsheba gave birth to a child at the

age of 6. In his analysis of the topic, Dr. Jeremy Brown concluded that the nature of this pregnancy was indeed scientifically possible. He cited a report from *La Presse Medicale* from 1939 documenting the story of a girl who successfully birthed a healthy child at the age of 5 [5]. Because conception is related to ovulation, it is possible for a girl to get pregnant before menarche, as girls may begin to ovulate before their first menstruation [6]. Although ovulation before menarche is not guaranteed, the ovulation may proceed menarche in conjunction with the normal menstrual cycle, which is generally not regulated in pre-adolescent girls. Conversely, according to both the *Gemara* and modern science, a boy must first experience the outward signs of puberty in order to father a child (*Sanhedrin* 69a). Thus, when the rabbis in *Sanhedrin* 69b referred to the plausibility of an eight-year old boy fathering children, they likely intended to assert that boys may experience puberty before the age of eight.

Indeed, the determinants of pubertal onset have been covered extensively within modern scientific literature. Yet, scientists are still unable to conclusively predict how the

variety of determining factors will interact to impact puberty. At this point, they have primarily identified determinants after analyzing trends across different populations, and then retroactively provided explanations for them. Interestingly, many of these trends have been identified centuries earlier in rabbinic literature. Although the rabbis may not have correctly identified the origins of the patterns that they observed, they managed to intuit some of the important environmental factors that influence pubertal onset.

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Environmental Pollution in the Ta'nach and in the Talmud

By Dr. Harvey
Babich

Rachel Carson's book, *Silent Spring*, published in 1962, brought the environmental hazards that stem from exposures to pesticides to the attention of the American public. Since then, much legislation was passed to control the deleterious impact of human activities upon the environment. President Richard Nixon proposed the establishment of the United States Environmental Protection Agency (U.S. EPA), which became operational on December 2, 1970. The U.S. EPA was charged with protecting the environment and human health from various chemical, physical, and biological hazards transmitted and deposited into the air, soil, and water. Before the establishment of the U.S. EPA, who was concerned with protecting the public from pollution? Apparently, the Rabbis of the Talmud were cognizant of pollution, and established laws to protect the public from environmental hazards; these laws are briefly mentioned in the Talmud. In the Talmudic era, the types of pollutant emissions were much simpler than those of today (synthetics, such as polychlorinated biphenyls (PCBs), polybrominated biphenyls (PBBs), BPA (bisphenol A), DDT, *etc.* were not manufactured), the sources of the toxic emissions were much less complex than of today (*e.g.*, family-run factories versus mega-industrial complexes), and the knowledge of the subtle health effects (*e.g.*, cancer) of pollution were unknown. Thus, legislation developed by the Rabbis was directed to prevent the nuisances of pollution to the public, rather than to protect the public from the adverse health effects of pollution [1].

Air pollution

Air quality has a profound effect on human health. Epidemiologic evidence has identified an association between outdoor air pollution and increased risk for several major chronic diseases, including respiratory and cardiovascular diseases, cancer, skin diseases, eye irritation, neuropsychiatric complications, cognitive impairment, and decreased longevity. The major air pollutants include particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead [2, 3]. The nature of a specific deleterious health effect is dependent upon the nature of the particular air pollutant. For example, there is a direct association between exposure to poor air quality due to fine particulate matter (0.1 to 2.5 micrometers in diameter), and an increasing rate of mortality and morbidity due to cardiovascular and respiratory diseases, including lung cancer [4]. Conversely, lowered concentrations of airborne fine particulate matter, as mandated by regulatory actions, are associated with an increase in life expectancy [5].

Ramban understood the potential deleterious effects of polluted air on human health, and suggested a causal relationship between ambient air pollution and longevity (Bereishis 5:4), specifically, that outdoor air pollution accounted for the progressive reduction in longevity noted in the early history of humans. Before the flood, the human lifespan was extremely long.

When the flood came upon the land, the atmosphere deteriorated for them, and their days of life gradually decreased. After the flood the approximate life span of the three generations that followed Shem was 400 years. After the Dispersion in the days of Peleg, the change of atmosphere had a further effect on shortening longevity to about 200 years. By the time we get to the patriarchs, although they lived longer (Avraham, 175 years; Yitzchok, 180 years; and Yaakov, 147 years), the life of ordinary people was 70-80 years.

Schoental [6], however, suggested that the decrease in longevity following the flood was related to the proliferation of microfungi, whose growth was favored due to the high humidity following a world-wide flood. These microbes excrete secondary metabolites, termed mycotoxins, which are poisonous chemicals usually associated with diseased or moldy crops, such as grains and seeds. Ingestion of some food-borne mycotoxins cause acute ailments that appear very quickly while the ingestion of other mycotoxins causes longer term chronic or cumulative effects on health, including the induction of cancers, immune deficiency, and decreased longevity.

A common air pollutant in ancient times was smoke, which is a collection of airborne impurities consisting of solid particulates, liquid droplets, and a variety of gases emitted when a material undergoes combustion or burning. The visible particles emitted from a fire are commonly termed "smoke"; the unaided eye can detect particle sizes greater than 7 micrometers. Soot (composed of carbon) is a component of the visible particulate matter in smoke. The invisible constituents of smoke are referred to as gases. Smoke typically contains hundreds to thousands of different chemicals. The chemical composition of smoke varies, depending upon the material undergoing burning and the conditions of combustion - *e.g.*, the availability of oxygen and the temperature of combustion [7].

Smoke-induced eye irritation may explain, in part, the dimming of the eyesight of Yitzchok. Chronic exposure to smoke can initiate various ocular pathologies, including the

formation of cataracts and the induction of macular degeneration. A cataract is the clouding or loss of transparency of the lens in the eye as a result of tissue breakdown and protein clumping. The causes of cataracts include aging, trauma, diabetes, and chronic exposure to smoke [8]. Macular degeneration, a medical condition typically occurring in older people, is characterized by blurred vision or by loss of vision, making it difficult to recognize faces [9]. Chronic exposure to smoke, more specifically to the oxidants in smoke, induce oxidative stress that damages the proteins of the lens of the eye and the macula of the retina [8, 10].

It came to pass when Yitzchok was old and his eyes were too dim to see, that he called Esav his elder son and he said to him, “My son,” and he said to him, “Here I am” (Bereishis 27:1).

This introduces the incident whereby Yitzchok bestowed the blessing upon Yaakov, instead of Esav. Biblical scholars have offered many opinions regarding the nature and cause of the dimming of the eyesight of Yitzchok. Rashi offered three possible explanations, one of which was that Yitzchok’s eyesight lessened due to chronic exposure to the smoke emanating from the burning of the sacramental incense offered by Esav’s wives to their idols. Smoke is an eye irritant (Mishlei 2:10). Incense burning inside the home, a common practice in Arabian Gulf countries, was identified as a significant source of indoor air pollutants. Analyses of the indoor airborne pollutants arising from the burning of incense included particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, formaldehyde, and carbonyls, including pentanal and glyoxal [11]. Possibly, Yitzchok already had the beginnings of cataracts and age-related macular degeneration, pathologies which were aggravated in the presence of the smoke emanating from the burning of incense by Esav’s wives as an offering to their idols [12].

In *Pirkei Avos* (5:7) mention was made of ten miracles performed in the *Beis HaMikdash*, one of which is that the smoke emanating from the sacrificial offerings on the Altar (*Mizba’ach*) rose in a vertical column, so as not to discomfort the eyes of the *kohanim*. The *Mizba’ach* stood in the Inner Courtyard (*Azarah*) of the *Beis HaMikdash*. As there was no roof above the *Mizba’ach*, potentially, smoke emanating from the *Mizba’ach* could have polluted neighborhoods surrounding the *Beis HaMikdash*. However, even on windy days, the smoke emanating from the burning wood pile on the *Mizba’ach* miraculously did not disperse downwards to discomfort the *kohanim* (Yoma 21b). In addition to smoke being an eye irritant, wood smoke creates particulate pollution that may evoke a spectrum of health effects, including asthma attacks, diminished lung function, upper respiratory illnesses, heart attacks, and stroke [13]. Thus, vertical movement of the

smoke alleviated a potential and serious health hazard to the *kohanim* and to the citizens in the neighborhoods surrounding the *Beis HaMikdash*.

When smoke comes into contact with the surface of any substance or structure, the chemicals contained within it are transferred to and absorbed into the substance or structure. Among the ten regulations enacted on entering *Eretz Israel* was one which, in order to preserve the amenities of *Yerushalayim*, proscribed the erection of kilns (furnaces used for processing limestone or to make pottery). Such furnaces emitted smoke and which potentially could blacken the walls of the surrounding buildings (Bava Kamma 82b).

Although the overt rationale for eliminating smoke from *Yerushalayim* was esthetic, there is an inherent covert health benefit, which is best understood by comparisons to cigarette smoke. For cigarette smoke, a distinction is made between first-hand smoke from second-hand smoke. First-hand smoke is the smoke that is inhaled by the individual smoking the cigarette, whereas second-hand smoke is the smoke that is passively or involuntarily inhaled by someone who is not smoking. Exposure to second-hand smoke increases the risk of various diseases, such as coronary heart disease, asthma, and cancer, in individuals not directly exposed to first-hand smoke. A relatively new concept is that of third-hand smoke, which is the residual contamination from cigarette smoke after a cigarette is extinguished. It consists of the pollutants from second-hand smoke that settle onto surfaces, such as clothing fibers [14], and can be re-emitted into the air and inhaled or ingested, even months later. Third-hand smoke contains carcinogens [15]. Thus, the disallowance of kilns in *Yerushalayim* eliminated the deposition of smoke on the surfaces of buildings, which would have been a source of third-hand smoke pollution and a potential health hazard.

Evidence that air quality affects the health of humans is relatively recent, as “medicine of early times lacked the necessary tools to provide the Jewish and non-Jewish scholars with data about health danger and thus we find hardly any reference to this point” in the Talmud [1]. Many cases of Talmudic air pollution centered on smoke and latrine odors. “A man may not open a bakery or a dyeing shop under another’s storehouse, nor open a cattle shed underneath a storehouse” (Bava Basra 2:3). A bakery and a dye shop in which dyes are boiled for soaking of fabrics generated sufficient smoke to cause a deleterious effect on grain or oil in his neighbor’s storehouse. Similarly, the manure in cattle shed emanated unpleasant odors to cause a harmful effect on grain or oil in his neighbor’s storehouse. Examples of Talmudic legislation include, [a] anyone who sets up a kiln must do it at least 50 cubits (*amot*) away from the city (Bava Basra 23a); [b] on

account of their obnoxious odors, animal carcasses, cemeteries, and tanneries should be located at a minimal distance of 50 cubits outside the city (Bava Basra 25a); and [c] a threshing floor should be 50 cubits in all four directions from houses, because the chaff produced by winnowing flax is injurious to humans and, upon its decomposition, acts as compost to generate excessive heat which adversely affects sown fields (Bava Basra 26a). Rambam (*Hilchos Shechenim*, 11:1) extended this law to any industrial activity that emits airborne dust or ash that could harm people or damage vegetation.

Mamane [16] contrasted the solving of air pollution problems in Talmudic times versus today.

When compared with today's problems, one could say that the main difference is in the scale, in the magnitude of the problems, as well as the solutions. The number of air pollution source categories in the Mishnah time was limited, although not the number of individual sources within a town. Factories were small and family operated. Thus distances of 50 cubits were considered a sufficient distance to minimize the impact of a family factory on a neighborhood. In severe cases, distance alone was not sufficient, but the 'industrial source' had to be located downwind of the town, along the prevailing wind.

In the midst of a discussion on healthful dietary habits the Talmud (Berachos 40a) mentioned *ketzach*, either fennel or a type of unspecified seed cultivated in Arabia. Rabban Shimon ben Gamliel said that "one who sleeps to the east of its (*i.e.*, *ketzach*'s) storage area has his blood on his own head." Apparently, *ketzach* generated a volatile chemical poison. Moist, heavy winds blowing off the Mediterranean Sea carried the volatilized poison to people sleeping to the east of the storage, thus explaining "one who sleeps to the east of its storage area has his blood on his own head." This is somewhat similar the red tide blooms off Florida's central gulf coast. *Karenia brevis*, the marine dinoflagellate causing Florida's red tide, produces chemical toxins that adversely affect the central nervous system of fish and other vertebrates, resulting in their death. Disruption of the dinoflagellates by wave action causes the airborne liberation of chemical toxins, which, when carried onshore by winds, may induce respiratory irritation in humans. At such times, beachgoers with respiratory conditions who are hypersensitive to red tide irritants, such as those with emphysema and asthma, are asked to leave the immediate area [17].

Discussions of various circumstances causing death of an intended victim are presented in Sanhedrin (77a). One such case involved a person who brought another individual into an airtight marble chamber, and subsequently lit an oil lamp. The burning fuel caused the air to "foul", resulting in the death of the trapped

individual. Apparently, as the chamber was airtight, the burning fuel consumed the oxygen, leading to death of the imprisoned individual.

Water Pollution

In the Talmud, there was less concern about water pollution, either because it was very rare, or because people were careful about their water supply. A person who dug a cistern or water hole for public use may wash his face, hands, and feet therein, unless there is mud or dung on his feet. If the cistern or water hole provided drinking water, he may not wash himself at all (Tosefta, Bava Metzia 11:14). Water left overnight without a cover should not be drunk, since harmful matter may have contaminated it (Avoda Zara 12b, 30a,b).

Industrial effluent, albeit on a smaller scale than today, was recognized. A pond used for steeping flax should be distant from a neighbor's vegetable garden, as the water runoff could damage the vegetables (Bava Basra 25a). The Talmud is referring to the process of flax retting. Flax, *Linum usitatissimum*, is a plant whose fiber is used to make textiles, such as linens. The plant grows as tall, slender stems. In the process of natural water retting, bundles of flax stalks are submerged and weighted down in ponds. The water penetrates into the central stalk portion, swelling the inner cells, and bursting the outermost layer of the stalk, thereby increasing absorption of water and allowing access by decay-causing bacteria. These bacteria dissolve the cellular tissues surrounding the fiber bundles, thereby facilitating the eventual separation of the fibers from the stem. The flax's soaking in a pond lasts for several days. Apparently, in the process of water retting, toxic chemicals from the flax plants were released, carried in runoff water, and caused harm to nearby vegetation [18]. To prevent damage to crops, these soaking ponds must be distanced from those areas in which a neighbor grew vegetables.

The most extreme example of water pollution was event in the first plague, in which *HaShem* turned the waters of the Nile River into actual blood or into a blood-like substance [19]. The reddened waters of the Nile River were suitable neither to irrigate the fields nor to drink; the Egyptian economy was crippled. The fish died (Shemos 7:20, 21; Tehillim 105:29) and their decomposition by aquatic bacteria of decay emitted a stench that permeated the atmosphere of Egypt. The appearance of dead fish floating upon the surface of an aquatic system or washed onto the shore is termed a fish-kill. Today, it is not uncommon, and the main causes of fish-kills are pollution (poisoning), suffocation (insufficient dissolved oxygen), and disease. In 1994 in St. Helena Bay, South Africa, a large bloom of algae formed in an estuary and extended into the open sea more than thirty kilometers out from the shore. The

bloom sank and decomposed, forming an aquatic area with almost no oxygen and lethal levels of hydrogen sulfide. Approximately fifteen hundred tons of dead fish and sixty tons of dead rock lobsters were washed ashore [20]. The fish-kill in the polluted Nile River was of a greater magnitude and resulted in extensive water and air pollution.

Soil pollution

An interesting incidence of soil pollution is noted in *Shoftim* (chapter 9). Gideon, a judge, married many women who produced 70 sons; he also sired a son, Abimelech, from a concubine. The seat of power of this family was in Shechem. After Gideon's death, Abimelech usurped the power from his half-brothers; he killed 69 of them, while one half-brother escaped. Abimelech's maternal relatives initially agreed to accept his leadership. A short time thereafter, Gaal the son of Ebed (probably, a non-Jew), entered Shechem with his army and mobilized the citizens to rebel against Abimelech. In the resulting battle, Abimelech was victorious; to punish the people, "he broke down the city and sowed it with salt" (*Shoftim* 9:45). This ritual of spreading salt on conquered cities was practiced in the Near East as a curse to anyone who dared to rebuild the city (Wikipedia). Plants normally live in soil environments that are hypoosmotic relative to the osmotic pressure of their cellular cytoplasm. In such hypoosmotic environments, water moves from the soil solution into the plants cells. By adding much salt to the soil, Abimelech changed the osmolarity of the soil solution to be hyperosmotic relative to the cytoplasm of the plant cells, thereby causing water to leave the plants. In such hyperosmotic environments the plants wilted and died.

Noise Pollution

Noise pollution refers to the generation of excessive noise that is deleterious to human activity or health. Consistent exposure to elevated levels of sound is associated with hearing impairment, cardiovascular disease, and hypertension. In the society of today, outdoor noise pollution is caused by machines and by transportation systems, such as trains, aircraft, and motor vehicles, whereas indoor noise pollution may be caused by loud music [22]. The noise pollution experienced at Jewish weddings by the extremely loud sounds is a potential health issue, manifested by pain perception, headache, ringing in the ears, and short-term hearing loss. An interesting solution was established in Israel, in which catering halls are required to install decibel meters to automatically monitor noise levels. When the noise level exceeds 85 decibels, electricity is automatically cut. Prior to this law, the average noise level at a Jewish wedding was greater than 100 decibels [23].

Although the health effects of continuous exposure to loud noise were not known in Talmudic times, loud noise was acknowledged, not so much as "pollution" but rather as an "annoyance." The Rambam (*Hilchos Shechenim*, 11:4) noted that each person is entitled to enjoy quietness, undisturbed by activities of his neighbors. For example, "If a courtyard resident set up a store in the courtyard, one of the residents can block him by claiming, "I cannot sleep due to the noise of your customers who go in and out of the courtyard." Noise of the customers' occasional arguments was disturbing to the sleep of the residents. In such cases, the storekeeper can be prevented from continuing his business. An exception, however, was made for a Torah school. Albeit children are noisy, a leniency was applied to allow the children to learn Torah (Bava Basra 2:3). Concern for those hypersensitive to noise was also acknowledged. Rav Yosef was easily bothered by noise. Blood-letters would practice under his palm trees. The spillage of blood attracted crows, which consumed the blood and flew to rest on the palm trees. Resting upon the branches the crows smeared blood on the dates and made much noise. Rav Yosef screamed, "Rid me of this crowing." Because of his hypersensitivity to noise, the blood-letters relocated their business (Bava Basra 22b, 23a). Milestones are another ancient source of noise pollution. Grindstones vibrate and emit loud noise and, therefore, must be distanced three *tefachim* from a neighbor's wall, as both could damage the integrity of the wall (Bava Basra 20b).

Excessive and continuous noise was characterized by the plague of *zfar'dea* (frogs). According to Rav Avigdor Miller, [19] two types of frogs were involved in the plague; one group of frogs croaked in the morning and continued throughout the daylight hours, and a second group of frogs croaked only a night.

The Egyptians could not sleep; and in the morning when the night croakers desisted and the Egyptian put his throbbing head on his pillow in hope to snatch some sleep, just then the day croakers began with their din. The constant raucous cries from all sides all day long sickened the people of the land. The chorus of frogs and toads can be deafening even in normal times. But at the command of HaShem the frogs caused a pandemonium in the land. As the ominous din from the river shattered the nerves of Egypt, they cursed the once revered Nile and wished it to become dry in order to cease supplying the multitudes of nauseating and cacophonous creatures that continued to swarm out of the contaminated waters.

Rav Miller's elaboration on the noise aspect of the inundation of frogs adds much to the understanding of the dynamics of the second plague.

Concluding statements

The scope of pollution in the time of the Mishnah and Talmud was much different than of today. For example, consider the magnitude of today's industrial complexes and the type of pollutants of today, *e.g.*, PCBs, PBBs, BPA, and DDT, versus mom-and-pop industries and wood smoke of 2,000 years ago. Apparently, water and soil pollution were not health issues, possibly as people of those generations were intimately connected to the land and understood the need to refrain from spoiling these environments. Air pollution seems to have been the main concern, albeit the health hazards from undesirable air were only understood on a simple level. For example, when R' Yehudah HaNasi became ill in *Beis Shaerim*, which was in a valley and had a hot climate, he was taken to *Tzippori*, which sat atop a mountain where the air was cool and crisp (Kesubos 104a). In Talmudic times, the focus on

pollution abatement was rather simple, as both the nature of the offending toxicants and subsequent the health hazards were minor, as compared to environmental issues in the 21st century.

Readers are directed to the articles by Attia and Attia [24], Carmell [25], Kottek and Seligman [26], Mamane [16], and Sichel [1] for additional information on pollution as viewed by *halakab*.

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