

# Derech HaTeva

A Journal of Torah and Science



**Volume 24**

**2019-2020**

A Publication of Yeshiva University, Stern College For Women

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Sincerely,

*Co-editors-in-chief*

Shani Kahan

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# Dedication

This year, the coronavirus pandemic has swiftly swept across the world. Hospitals have been overflowing with increasing numbers of patients in critical condition each day, all while lacking necessary life-saving equipment and PPE. Health-care professionals have worked countless hours to preserve the lives of patients and to allow the rest of society to safely quarantine at home.

The Jewish community was one of the first cohorts majorly affected by a spread of the virus in the tri-state area. Although the strict quarantine regulations placed globally have been constricting and difficult for all, community-focused Jewish life has been particularly hurt by these safety precautions. For a community that spends so much time gathered together to pray, study Torah, celebrate, and mourn, being isolated and apart has been immeasurably painful. Yet, we are proud to be a nation that never ceases to reach out to help one another, even under these circumstances.

We have chosen to dedicate this year's edition of *Derech Hateva* to the precious victims who have succumbed to COVID-19 and to the dedicated health-care workers who have tirelessly worked to save lives throughout. Our publication is a testament to the seamless ties between Torah and science and the meaning that one may find in our eternal Torah by understanding the underpinnings of the scientific world. Ultimately, however, we surrender our scientific achievements and pursuits to the supreme will of G-d, who is our ultimate healer.

We would like to extend our deepest condolences to all families suffering from the loss of family members from COVID-19 and to offer a prayer for a *Refuah Shleimah*, a speedy recovery, to those currently affected. We hope that the Torah study that went into writing this publication as well as its study by its future readers should merit bringing a swift end to this plague and an ultimate redemption to our people.

*Heal me, O LORD, and I shall be healed; save me, and I shall be saved; for Thou art my praise.*

רְפְּאֵנִי ה' וְאֲרָפָא,  
הוֹשִׁיעֵנִי וְאֲנִישְׁעָה:  
כִּי תִהְיֶה לְתִי, אֲתָה.

*Jeremiah 17:14*



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# The Third Trimester - Halachic Ramifications of the Viability of the 8th Month Old Fetus

By Noa  
Applebaum

Today, thanks to modern medicine, women around the world are lucky enough to experience the joy of childbirth without much concern for their baby's survival. Typically, a healthy and normal gestational term is considered to be around forty weeks, which is about nine complete months. Recent studies have shown that the optimal time for a baby to be born is actually between thirty eight and forty weeks. The further away one moves from this time period in either direction can increase the risks of the baby's health [1]. To ensure the health of the baby, the more time it spends in the womb until the end of the full-term, is considered better and safer.

Interestingly, according to Talmudic Rabbinic scholars, babies could stay in the womb for either seven or nine months, and be born perfectly healthy (Yevamos 42a). The "eighth month" baby, however, would die soon after being born (Yevamos 80b). In *halacha*, the "non-viable" status holds a great weight specifically when it comes to two cases, *Shabbat* and *Yibbum* [2]. For instance, the *Gemara* states that one may desecrate *Shabbat* to circumcise a baby born in the seventh month, however, one may not desecrate *shabbat* for a baby born in the eighth month as it was not viable (Shabbat 135a). The *Gemara* continues on even further and compares the baby born in the eighth month to a rock that maintains a *muktza* status and thus may not even be carried on *Shabbat*. Another time this issue of viability comes up is in the case of *Yibbum*, the biblical commandment for a man to marry his deceased childless brother's wife. The *Gemara* explains a situation where a woman gave birth to a baby in the eighth month, and soon after was widowed. The *Gemara* responds to this case by classifying the woman as childless, since the baby born in the eighth month is not considered viable, thus requiring *Yibbum* to be performed (Yevamos 80b). The *Gemara* in Yevamos 80b also adds that if this eighth month baby has visible signs of viability,

meaning fully developed hair and fingernails, the baby is considered viable and actually was meant to be born in the seventh month but for whatever reason was delayed in the womb. This statement indicates that in Talmudic times, a baby born in the seventh month was thought to be viable while one born in the eighth month was not [2]. This is rather perplexing as current research on gestational and fetal development seems to only indicate the opposite.

According to current research, a fetus continues to mature as the gestational cycle progresses. An ideal pregnancy is one that is said to reach full term, which is between 38 to 40 weeks. A baby born before term is considered a premature newborn, however, there are various classifications of premature babies. A baby born before 28 weeks, before the third trimester, is considered extremely premature, between 28 and 32 weeks is considered very premature, and between 32 to 34 weeks is considered moderately premature [3]. It has been shown that there are clear dangers involved when a baby is born early, and the risks only increase the earlier the baby is born. A recent study compared the various stages and survival rates of premature babies. It was concluded that 9.9% of all babies born between 27 and 31 weeks, *i.e.*, in the seventh month, were stillborns, and 5.4% of the babies born alive in this period died in the neonatal intensive care unit (NICU). From all the babies born between 32 and 34 weeks, *i.e.* in the eighth month, only 2.3% were stillborns and 0.7% died in the NICU [4]. Clearly, as the fetus remains inside the womb complications and risks of mortality decrease significantly.

In addition, formation of vital organ systems in the body develop as the fetus moves along weekly checkpoints, until the completion of the gestational term [1]. One of the major issues premature babies encounter is due to the lungs failing to completely develop. The lungs develop in five distinct stages,

including the embryonic, 4 to 7 weeks, the pseudoglandular, 5 to 17 weeks, the canalicular, 16 to 26 weeks, the saccular, 24 weeks to term, and the alveolarization stage, 36 weeks to 21 years [5]. One stage in particular, the saccular stage, is important to note as it takes place further along fetal development. The saccular stage is when branching morphogenesis occurs, which allows the lungs to develop their shape, while alveolarization has not yet started. The terminal airways grow in length and widen at the beginning of the saccular stage. This forms clusters of large airspaces and the area where future gas exchange will take place. When two airspaces meet, primary septa are formed, which contain a double-layered capillary network. The surface of the septa is mainly covered by type I epithelial cells, while type II epithelial cells cover the rest of the surface [5]. These type II cells produce surfactant which decreases surface tension and prevents alveolar collapse during exhalation [6]. Since premature babies are born before the lungs are fully developed, many times in the hospitals these babies will be given surfactant, other steroids, or oxygen mechanically ventilated. This can cause major damage to the cells due to oxygen toxicity [5]. When comparing the administration of surfactant to premature babies born at 27 to 31 weeks to those born at 32 to 34 weeks, 58.7% of babies born at the earlier stage were treated with surfactant, while only 12.7% of babies born at the later period were treated [4]. This indicates further development of the lungs as the fetus is maintained in the womb, thereby decreasing the need for supplementary surfactant, as well as the potential dangers that are associated with increased outside material. Additionally, pulmonary inflammation and steroid induced reprogramming of lung development is an issue premature babies have to deal with, leading to less efficient alveolarization progression [5]. This disease is known as bronchopulmonary dysplasia (BPD) [7]. Those with BPD have significant airflow restrictions, causing obvious problems. It has been noted that BPD in babies who were mechanically ventilated is prevalent at a younger gestational age and lower birth weight, thus supporting the idea that BPD development is influenced by the incomplete development of the

lungs [7]. In a study, 4.6% of premature babies born from 27 to 31 weeks were found to have severe BPD, while 0% of premature babies born from 32 to 34 weeks had severe BPD [4]. As almost all research has indicated, a baby is meant to stay inside the womb up until the end of term to ensure proper development. The earlier the delivery, the more likely issues and complications will arise.

At face value, all possible scientific evidence seems to contradict the *Gemara* regarding the viability of the seventh, but not of the eighth, month old fetus. A baby born during the seventh month of gestation should not be considered any more healthy and viable than a baby born during the eighth month, and in fact the opposite seems to be true. Instead of proclaiming that the Talmudic Rabbis to have been wrong, since they stated what they witnessed to be true, a reinterpretation of the text is necessary. The *Gemara* makes a statement that an eighth month born baby is considered “like a stone,” or as “dead flesh” (Yevamos 80a). This statement alone does not indicate that a baby born before eighth months is any more viable, rather it is simply saying any baby not born in the ninth and final month is considered non-viable because it has not yet fully matured. The Talmudic Rabbis even go on to say that maturation cannot be visible externally alone, and thus any baby born before nine months would be given the same non-viable status. Therefore, when the Rabbis talk about an “eighth month baby,” they were talking about any baby born before nine months that had not fully matured in the womb [8].

Now, the second issue that must be addressed appears earlier when the *Gemara* stated that a nine month pregnancy is one that lasts a full nine months, however a seven month pregnancy can end safely before the completion of the seventh month (Yevamos 42a). At first, one may want to draw the conclusion that there is some sort of mysterious intermediate time between the seventh and ninth month where the baby will not survive. Looking at the text and commentaries on a deeper level will actually show that this is not the proper conclusion.

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When the *Gemara* cited this statement it was meant to show that a baby can be born not only at the end of the seventh month but at the beginning of that month as well (Rashi, Yevamos 42a). Therefore, a baby born at any point after the start of the seventh month can be born healthy. This means that a baby born at any point in the third trimester could be considered viable. As modern science suggests, a baby born early during the third trimester has some chance of survival, with obvious necessary assistance [3]. When the Rabbis talk of a “seventh month baby,” they are referring to any baby born before the ninth month that has fully matured. This is indicated by the language of the text as the *Gemara* makes a clear distinction between an “eighth month baby” who is not viable and a “seventh month baby who was delayed in the womb” and is viable. The baby born after eight months is one that has not matured, while the one born in the seventh month has fully developed. Thus, based on this explicit distinction, it can be deduced that a “seventh month baby” refers to a fully formed baby, whether born in the seventh or eighth month [8].

Regardless of how these statements may be interpreted, modern day Rabbis are still tasked with responding to *halachic* issues that may come up as a result of the birth of a premature baby. Medicine has certainly evolved over the last hundreds of years and only continues to become more advanced. Today, premature babies born in the third trimester have a much greater likelihood of survival than they did many years ago. Since 1960, there has been a steady increase in the survival rates of premature infants born. It has been shown that babies born after 27 weeks have less than a 20% mortality rate [9]. With the help of advanced medical techniques during the pregnancy and after the birth, such as incubators, premature babies are given a stronger chance of survival and of being healthy [10]. For the most part, contemporary sources have taken these advances well into account. For instance, the Chazon Ish was approached with a question from one of his students regarding this issue of whether or not in modern times one can desecrate *Shabbat* for a premature baby.

He responded as follows,

“Nowadays, such infants must be given appropriate care even though this entails *hilul* Shabbos. This is not only true about an eight month fetus with undeveloped hair and nails, but even on behalf of a fetus of six months’ gestation whose hair and nails are underdeveloped. Even though in the time of Chazal such a baby could not survive, nowadays they often do!” [11].

Similarly, Rabbi Shlomo Zalman Auerbach maintains that medical knowledge has changed dramatically since the time of the Talmud and hospitals are well equipped with incubators and medication to save premature babies, including those born in the eighth month. Thus, it is a responsibility to ensure the safety of the child if they are able to be saved (Shmirat Shabbat Kehilchata). Rabbi Auerbach even added, “Don’t forget to be filled with gratitude to Hashem for the lifesaving wonders of modern medicine” [11]. New medical discoveries that possibly contradict the Talmud are not meant to be looked at as problematic, rather they should be celebrated as G-d’s doing.

An important value in Jewish tradition is to accept the Torah as true and timeless. At the same time, there are obvious questions that can come up as science and the world evolve. It is important to point out that our Talmudic scholars teachings were based on the known scientific knowledge at that time. As more research on gestation has surfaced, our modern day sages have worked to reconcile science and *halacha* while holding on to our core values.

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# *Ki Heim Chayenu: The Health Benefits of Jewish Religion and Law*

By Shani  
Axelrod

Every evening, in the *Maariv* prayer, Orthodox Jews worldwide proclaim- “*Ki Heim Chayeinu VeOrech Yameinu*” - for they are our life and the length of our days. The Torah and its laws are truly a spiritual lifeline, providing a connection to the Divine. Interestingly, a plethora of scientific studies indicate that a Torah observant lifestyle can also literally lengthen life and improve its quality.

Historically, Jewish law and practices have been shown to decrease mortality and provide health benefits. In the mid 1300s, the Black Death was brought to Europe, leading to the deaths of 25 million people over a period of 50 years. The plague spread rapidly but skipped over areas erratically. The Black Death today is known to be caused by *Yersinia pestis*, bacteria that lived in fleas feeding on rats. The plague spread primarily by inhalation and human contact, a problem in the Middle Ages characterized by undeveloped sewage systems and primitive sanitation habits. While they still died of the disease, Jews were affected at lower rates, a statistic which is attributed to the stringent sanitary practices in *Halacha*. Jews washed their hands multiple times a day, while the average gentile at the time could go half a lifetime without ever washing his or her hands. In general, sanitary conditions in Jewish areas were superior, as *halacha* prohibits prayer and Torah learning in places of foul odors. Furthermore, according to Jewish law, corpses are not allowed to remain unburied for prolonged periods of time—a practice which can lead to the spread of bubonic plague, typhus and other diseases. The lifesaving benefits of handwashing during the Bubonic Plague continue in modern day medicine [1]. Handwashing is one of the most critical factors in infectious control. In fact, handwashing is said to be the single most crucial intervention to prevent the spread of infection to patients from healthcare providers. *Halacha* requires Jews to wash hands for hygienic and spiritual reasons multiple times a day. Upon waking up, using the restroom, before and after a meal, after cutting nails, touching a corpse and before birchas kohanim, Jews partake in hand washing rituals [2]. Such behaviors offer protection from the spread and contraction of disease.

Many halachic requirements, including the Jewish

ritual of *tefillin*, have been found to be beneficial to heart health. A recent study has shown that the act of wrapping and wearing tefillin daily can potentially prevent heart attacks. Interestingly, this study backs up earlier Israeli findings indicating that observant men had less heart attacks on average than the overall population. In this particular study, the participants included religious and irreligious men, whose vitals were measured, in addition to their blood levels of circulating cytokines. Cytokines are molecules that adversely affect the heart and cause inflammation. The study found that daily tefillin-wrappers had lower cytokine levels than others, and also exhibited improved blood flow. Furthermore, tefillin seems to offer a sort of preconditioning by producing slight discomfort, which can provide protection from acute ischemic reperfusion injury. Such injury occurs amidst a heart attack when the heart lacks oxygen and experiences injury when re-oxygenated [3]. Remote ischemic preconditioning (RIPC) involves the brief vascular obstruction of organs and limbs, which has been found to protect against later cardiac events. Such preconditioning has been found to increase arterial diameter and blood flow while decreasing inflammation. This study found that even acute tefillin use increased blood flow volume and brachial artery diameter, and chronic use of tefillin results in reduced chemokine secretion and decreased leukocyte inflammation. In a previous study, Israeli men were found to have similar mortality rates regardless of religious affiliation, with the one exception being myocardial infarction, which occurred less amongst Orthodox populations. The wearing of tefillin may have been the factor that contributed to this observation [4].

In a study of 673 17-18 year-old adolescent Jewish residents of Jerusalem, plasma levels of triglyceride, cholesterol and low density lipoprotein were higher amongst secular individuals, and lower in the Orthodox participants. Previous studies of adults had suggested that coronary heart disease is related to religiosity, with Orthodox Jews smoking less and having lower levels of plasma cholesterol, triglyceride and low density lipoprotein cholesterol. These differences can be traced to the fact that the diet of

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secular subjects included more fat, saturated fatty acids and less carbohydrates. The results of the adolescent study is hypothesized to be due to the laws of *kashrus* giving constraints on food consumption [5]. The above findings are consistent with the lower incidence of myocardial infarction amongst religious groups. The Israeli Ischemic Heart Disease Study found that the 5 year incidence of acute myocardial infarction among secular men was 5.8%, while it was 2.9% among Orthodox men. Major CHD risk factors include smoking, and high levels of LDL and plasma cholesterol—all of which were shown to be lower amongst Orthodox groups [6]. In another Jerusalem study, secular participants had a significantly higher risk of myocardial infarction compared to the Orthodox subjects and psychosocial factors were thought to play a role in this observation. Jewish communities are characterized by social support and cohesiveness, and there is evidence that such community structure can reduce coronary heart disease. The practices of prayer and belief in a Supreme Being may be protective as well [7].

Several studies have proved a prolonged life expectancy amongst religious Jews. Bnei Brak, Israel's most religious city, has the greatest average life expectancy. In a Duke University study, individuals who attend religious services weekly were half as likely to have high levels of interleukin-6, associated with heart disease and cancer. In a Dartmouth Medical School study, 37 of 232 deeply religious patients recovering from surgery did not die within the first 6 months, while the rest did. Additionally, Orthodox Jews have lower rates of divorce and higher rates of marriage—which has been proven to have a positive effect on health [8].

Religious level also impacts diet and the health repercussions that result. In a study of Israelis, greater levels of religiosity were correlated with a healthier diet of less meat and dairy, and much more fish. Lower levels of smoking and stress amongst religious Jews contribute to longer life expectancy. In fact, it is predicted that an absence of religious involvement has an effect on mortality equivalent to 40 years of smoking a pack of cigarettes a day. Religious people also may have more of a motivation to maintain a healthy body in order to have a longer life of spiritual fulfillment and service of God. Furthermore, religious Jews were shown to have better mental health and lower hostility [9].

Interestingly, decreased rates of mortality are related to *Shabbos* observance. In a study of deceased Israeli Jewish men and women, ages 35 and above, the number of deaths showed a dip-peak pattern around *Shabbos*. In many previous studies, collective religious involvement was found to lower mortality. Through the performance of shared religious festivities, an individual obtains a sense of internal regeneration and focus that allows one to face daily life and cope with difficulties, positively affecting health and mortality. Such holidays, though, must be periodically repeated to replenish this internal strength. In this particular study, researchers examined the incidence of mortality before and after *Shabbos* as well as holidays. Results found a clear dip-peak pattern preceding the weekend with less deaths on *Shabbos*, and an increase at the beginning of the week. This pattern was found to occur in all forms of death, both internal and external. The *Shabbos* affect hypothesizes that regular *Shabbos* observance gives meaning to the passage of time, while its religious collective action lends coping mechanisms that can postpone mortality [10].

In a 16-year study of religious and secular kibbutzim, researchers compared the mortality of the two populations. Aside from religion, both kibbutzim share similar social and economic structure and function, and are close-knit, cooperative communities. Members of both types of kibbutzim were nearly identical in ethnicity, education level, occupation, and advanced technology. For all genders, ages and major causes of death, mortality rates were distinctly lower on the religious kibbutzim. Studies have found that consumption of fatty acids and total fat is lower in religious populations, attributed to *kashrus* standards. Amongst Orthodox Israelis, blood cholesterol concentrations and prevalence of smoking is lower than the general population, while smoking and plasma cholesterol were found to be higher and more frequent on secular kibbutzim. In general, members of religious kibbutzim had less stress. Religious kibbutzim offer a sense of belonging that bolsters emotional wellbeing and a relaxation response to frequent prayer. Moreover, belief in an Almighty God places autonomy in a divine source, while secular individuals view the source as within people. *Halachos* and guidelines on how to live life offer a regulated lifestyle that reduces ambivalence and stress. On secular kibbutzim, the divorce rate was 11-fold higher than the religious kibbutzim.

Amazingly, over a ten-year period, there were only 10 divorces in 17 religious kibbutzim (.7% of couples). There is also a sense of connection among cohesive religious communities, with religion offering a stronger kinship through communal rituals and social support [11].

Certain types of cancer are less prevalent among religious Jews. The incidence of malignant melanoma was compared between Orthodox and non-Orthodox neighborhoods in Jerusalem and outside Tel Aviv. Within Orthodox Jerusalem and Bnei Brak, the incidence of malignant melanoma was considerably lower than in the non-Orthodox neighborhoods of Jerusalem and Givatayim. Malignant melanomas are largely caused by sun exposure. Orthodox Jews of both genders follow laws of *tznius*, covering their heads and most of their body throughout the year. Males and females are also less exposed to the sun in adolescence and afterwards, hence decreasing the risk of such cancers [12].

Many studies have been done relating religious involvement to health, but few have attempted to measure the impact of religious beliefs. In a study conducted on a group of Jewish adolescents, strength of religious beliefs was associated with increased physical activity. In Orthodox belief, the body is seen

as a sacred object, a point of view which was found to be a predictor of healthy life choices among college students. Past research has determined that the belief in God having control over one's life and health may develop healthier behaviors. The Torah commands, "take utmost care and watch yourselves scrupulously," a *mitzva* to guard one's physical health. The Rambam understands this to include harmful behaviors like drug use, while maintaining healthy habits like a proper diet and physical activity [13].

While religion has long been known to increase one's emotional well-being, new findings of its health benefits are becoming more common. Judaism and its laws hold an infinite amount of wisdom and are shown to improve life in this world.

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# Maimonidean Perspective on Preserving Water Quality

By Deborah Coopersmith

Water has always played an essential role within Jewish life. Water is compared to be as vital as Torah, in the sense that they are both indispensable life sources [1]. There are many health benefits that are associated with drinking water. Water can turn an arid wasteland into a lush field. Before the Israelites entered Israel, they faced issues regarding their sources of water. During their 40 years of wandering through the desert, water was central to the collective experience of the Israelites, and elicited numerous complaints and lessons. In Masechet Taanit, three people are given credit for sustaining the Israelites while they were in the desert. Miriam is listed as one of the three and her crucial contribution to the Israelites was water. When she died, there was a major concern that the Israelites would die in the desert because with Miriam's death came the loss of the water she merited [2].

Water was used in the holiest Jewish ceremonies—it played an essential role in the *Beit Hamikdash* through purifying and cleansing both objects, animals and the priests. A priest must wash both his hands and feet before entering the *Beit Hamikdash* and before reading certain books as well [3]. Jeremiah called God, the "Source of Living Waters" because he too recognized that water was one of the most important ways God granted people life [4].

Until modern times and the inventions of drip irrigation and other water related innovations, Israel faced water insecurity and a farmer's produce depended on the rain or lack thereof. Rabbis argue that this is by design as it allows the Jewish people to realize that God is the provider for all their needs, not just water [5]. Countless Jewish texts reinforce this thought as they are replete with appreciation for and recognition of the importance of water. Dr. Jeremy Benstein discerned that Biblical Hebrew contains at least six different words to describe liquid precipitation (*geshem, matar, yoreh, malkosh, revivim, se'irim*) [6]. This illustrates that water was at the forefront of peoples' mind and a constant concern for them.

Human beings must have a sufficient supply of high-quality fresh water in order to survive. Today, humanity is faced with a threat to their water quality,

which is becoming a major environmental issue. Relentless plastic use is severely harming the water quality because plastic is entering water sources and takes ages to degrade. In 2017, researchers estimated that since the invention of plastic, humanity has produced 8.3 billion tons of it. Unfortunately, the amount of plastic produced is increasing every year. A 2018 study predicted, using data from aircraft and multi-vessel surveys, that the "Great Pacific Garbage Patch" contains around 79 thousand metric tons of ocean plastic. This number is 4 to 16 times higher than the ones previously suggested [7]. A beached whale was found in the Philippines last year with 88 pounds of plastic in its stomach; however, this whale is not the only animal suffering. More and more dead marine animals are being found with plastic in their stomachs [8]. UNESCO estimates that 100,000 marine mammals die each year because of plastic pollution, either because the plastic blocks the entrance to their stomach, thereby causing death by starvation, or by poking holes in their internal organs [9].

Moreover, it is not just large marine animals being affected. Through a combination of physical and chemical processes, most notably hydrolytic degradation, oxidation, photodegradation and mechanical disintegration, plastics fragment into micro- and nanoplastics. These nanoparticles could then be unknowingly ingested, inhaled or absorbed by fish, birds and humans. Ingestion is the main pathway that brings microplastics into the body; for example, microplastics can enter one's body simply through drinking contaminated water or eating seafood. Traces of microplastics have already been found in certain seafood species, like fish, shrimps, and bivalves. Microplastic particles have even been discovered in food not from water sources, such as honey, beer, salt, and sugar [10]. Through the use of FTIR spectroscopy, microplastics have been detected in tap, ground and bottled water. From 159 samples of tap water, 81% contained microplastic particles and out of 11 different bottled water brands, 93% contained microplastics [11],[12]. These shocking, new discoveries demonstrate the wide-spread reach of nanoplastics along with the food they are polluting.

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Nanoparticles are toxic to humans, and are likely carcinogenic as well. Many chemical additives are applied to plastic to improve the final product, however, these chemicals can and have leaked. When organisms are exposed to it, it can cause endocrine disruption or acute toxicity. Scientists have discovered that airborne nanoparticles caused dyspnea due to airway and interstitial inflammatory responses [13].

In Deuteronomy 4:9, the verse states, רַק הַשְׁמֹר לָךְ וְשָׁמַר נַפְשְׁךָ (But take utmost care and watch yourselves scrupulously [14]). Maimonides, medieval rabbi, physician and philosopher, wrote, “the sages have prohibited many things because they are dangerous to life. If anyone disregards them and says: “What claim do others have on me if I risk my own life?” or: “I do not mind this,” he should be lashed for disobedience.” Maimonides takes a firm approach on caring for one’s soul and believes one should do everything they can to avoid danger befalling themselves. One is even supposed to ensure their actions, or lack thereof, do not cause harm to anyone else. In an earlier section in the chapter, Maimonides wrote one must build a fence to prevent someone from accidentally falling into a well or pit on his own property, even if the person was not supposed to be there in the first place. It is considered to be a positive *mitzvah* to remove any threats of life. This includes not drinking from a river at night because one could swallow a leech by accident, going over a shaking bridge for fear of collapse or not putting coins in one’s mouth because a sick person might have spit on them [15]. The traditional Jewish belief is

that one’s body is a loan from God, therefore, one must do everything in his power to take good care of his or her body.

In regards to nanoplastics in the water and air, Maimonides would argue that one should do everything they can to avoid drinking from the contaminated water. However, because it is so prevalent and unavoidable at this point, people should actively use less plastic on a daily and yearly basis in order to slow the amount of plastic entering our waters and by extent, our bodies. While one cannot avoid nanoplastics entirely, they should put boundaries on the amount they consume by reducing the amount of plastic they use. Plastic fragmentation has become a monumental environmental problem and without widespread efforts to curtail the world’s plastic use, it is only going to become worse. The Jewish world, along with the world at large, should aim to use less plastic and find feasible alternatives. A large transformation could occur if every person made a few changes within their daily lifestyle. By saying no to single-use plastics, by using reusable containers and silverware and by avoiding products containing microbeads, the world can become a safer, healthier place for everyone to live in [16].

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# Increasing Paternal Age and its Effects on Fertility

By Elisheva Donath

“Fertility is a team sport,” said Dr. Eisenberg, a urologist and the head of male reproductive medicine and surgery at Stanford University School of Medicine. A seemingly obvious statement, yet one that could not ring truer. It is universally known that for an embryo to be created, an egg and sperm are required to enable the process. Many assume it is a woman’s lack of fertility that prevents her from becoming pregnant. This may be true; however, she is not the sole reason for a couple’s infertility. In reality, paternal age is also extremely important in the conception of a healthy child. It was estimated that forty percent of infertility cases are either fully or partially reliant on the male [1]. In addition to environmental factors and teratogens, elements which can disturb the development of an embryo or fetus, the age of the mother *and* the age of the father affect gamete health. The older the couple, the harder it is to conceive. Along with a mother’s advancing age comes health risks to her and her baby, such as gestational diabetes. This same risk is evident with men as well. A male’s sperm count and mobility decline with age, thus making it harder for spermatozoa to reach the egg and to fertilize it. Not only do male and female age contribute to the difficulty of a woman becoming pregnant, but a child born from aged eggs and sperm are at a higher health risk proportionate to the age of the parents at the time of conception.

Today, it is common for individuals to desire to finish their schooling before attempting to find a mate [2]. This means that by the time a couple is ready to have children, they are older and health risks for their children have become greater. It has been known for some time that the ability to become pregnant and conceive decreases with age. However, this concept has been found to matter for men as well. A study in the United States has shown that advanced paternal age has an effect on the baby in terms of prematurity, lower birth weight and other adverse effects [2]. Apparently, if fathers had their children at a younger age, many of these effects could be avoided. The health risks associated with paternal age were also found to affect children later on in life, at times correlating to psychological disorders such as bipolar

disorder and schizophrenia. Congenital and developmental disorders such as dwarfism and autism were also linked to advanced paternal age. Drs. Eisenberg and Khandwala mentioned that too often emphasis is placed on the age of the mother and the father’s role is, naively, ignored. This is because it is well known that women have a limited amount of eggs while men’s sperm continuously reproduce. But people forget to factor in the role of the environment and that with increasing age, mutations are likely to arise in sperm-forming cells.

Within the realm of environmental factors, one such risk to a fetus is the consumption of alcohol. It has become well publicized by bold warnings on alcohol bottles that a woman who consumes alcohol frequently has a higher risk of having a baby with fetal alcohol syndrome. What is not commonly discussed however is the effect of a father’s drinking habits on his child. According to an article published on CNN, many congenital heart defects are linked to the father drinking alcohol six months prior to a baby’s conception [3].

As more and more studies show the effect of paternal age on the ability to conceive healthy children, the factor in play appears to be total motile sperm count (TMSC). In a study performed by a fertility center in New Jersey, sperm cell count decreased by six percent in 120,000 male patients in a period of three years [4]. Researchers from Hebrew University and Mount Sinai’s School of Medicine discovered that sperm counts were reduced by fifty percent from the years 1973 to 2011 in 43,000 men. Universally, viable sperm is declining, both in men who are experiencing fertility problems and even in men who are not. The cause is unclear but appears to be associated with dietary and non-active lifestyles. Speculation has focused on the increase in the chemicals that the general population has been exposed to since World War II, not only in variety, but in ever increasing quantities.

In the book of *Bereishit*, the first *mitzvah* in the Torah directed at Jewish men is ‘*pru u’rvu*’, the commandment to have children, to ‘be fruitful and multiply’ [5]. With this imperative, one should be

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aware of factors that play a role in preventing fertility and how to improve a male's chances of producing offspring. There are also many laws in the Torah that govern marital relations. One such occurrence termed "religious infertility" refers to the inability to get pregnant due to the *niddah* period, where a woman is not permitted to have intimate contact with her husband [6]. During the time of a female's menstruation and for seven clean days thereafter, a woman is prohibited to her husband. This may lead to fertility issues in some women, especially for a woman who has a short menstrual cycle. Because of this unique situation, artificial insemination and *in vitro* fertilization - processes by which the egg is fertilized with the husband's sperm without intimate contact by the husband and the wife - were allowed according to most rabbinic authorities even during the *niddah* state. Interestingly, another practice that may contribute to fertility issues for males has to do with the high temperature of the water in the *mikveh* [7]. For those men who use the *mikveh* daily, the heat may have harmful effects on semen quality, and result in the spouse having difficulty conceiving.

Related to the commandment of producing offspring is the prohibition of masturbation. In *Niddah 13a*, wasting of seed is seen as transgressing the obligation of bearing children [1]. Known as *botza'at zera levattala* or *hash-hatat zera*, masturbation would fall under the category of "improper emission of genital seed". This commandment prohibits the limiting of a man's ability to conceive, as he is squandering viable sperm that could be used for the *mitzvah* of procreation.

Throughout early Jewish history, two of our forefathers, Avraham and Yitzchak were barren for many years before having children. Sarah, Avraham's wife, prays for a child and when she is almost ninety years old, an angel informs her that in the coming year she will have a son [8]. Sarah laughs; she has trouble believing the angel because her husband is too old. Even back then, there seemed to be an understanding that the age of the father could affect fertility.

In *Melachim Bet*, *Elisha Hanavi* is a guest of the *Isba Hashbunamit*. [9]. She and her husband have been childless for many years and Elisha, wanting to repay the couple for their kindness, blesses the *Isba Hashbunamit* with a child, which she will give birth to in the coming year. She refuses, thinking it is impossible at her *and* her husband's old age. Regardless, the

prophecy of Elisha comes true and the couple is blessed with a son. The child grows up, only to die suddenly. The only clue from the text as to the cause of death is the reference to a headache suffered by the child. This story is quite puzzling. Might the elevated age of the couple at the time of conception have affected this child?

Curiously, by the time males reach the age of thirty-four, sperm counts start to fall [10]. In general, the number of sperm per semen sample, the motility and the vitality of sperm decline in a man's early forties. Sperm function as well as sperm counts gradually decrease in the decade between a man's thirties and forties. Of course, there are other factors that affect a male's reproductive capacity besides his actual age, such as nutrition and lifestyle, sexual function and activity, and oxidative stress and inflammatory and immune disease. Research shows that there are three neurocognitive diseases that are highly correlated with advanced paternal age: schizophrenia, bipolar disorder and autism [10]. In studies done on each of these disorders, the maternal age and other risk factors were held constant in order to test the impact of paternal age. It was found that fathers in the twenty-thirty age range always had a much lower risk associated with bearing children with one of these particular disorders, as opposed to fathers over fifty years of age.

To confuse matters somewhat, teenage males also have a higher risk of fathering children with these disorders. For younger men, the risks associated with fathering children are likely due to immature sperm, alcohol and drug abuse and/or a stressful environment.

Many other congenital abnormalities, autosomal dominant disorders, miscarriages and pre-eclampsia have been linked to advanced paternal age. As a male gets older, the risk of fetal death, pre-term birth and low birth weight also increases slightly. In many of these cases, the mother's age also mattered. However, the difference in paternal age seemed to have a much more pronounced effect than did maternal age. In one research study conducted on paternal age and the transmission of mutations to offspring, it was estimated that a man in his mid-thirties would transmit double the amount of mutations to his children in comparison with a twenty-year-old father. However, a man seventy years of age would pass on eight times that amount of mutations [11].

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Astonishingly, when age was taken into account from both parents, offspring mainly inherited mutations from the paternal side.

With more infertility issues arising due to late marriage and perhaps, the introduction of newer teratogens in our environment, there are constant innovations in technology to resolve these problems. With these innovations, questions arise as to whether such situations should ethically be allowed due to the indirect health effect upon the unborn child.

MicroSorting has become one such new method that is used to separate and distinguish between the X and Y chromosomes, thereby preventing X-linked genetic diseases [12]. Through FISH (fluorescence *in situ* hybridization), analysis of the X and Y chromosomes can be identified through the emission of certain colors. MicroSorting is also being used for gender selection and family balancing. Once this FISH analysis has been introduced and parents can decide what gender child they want, the questions have to be posed as to whether technology is enabling the human race to play G-d. Where is the limit? As humans, do we have the right to impose our own views of how our children should look and behave? [13]. Despite the ethical questions that arise, MicroSorting is believed to be a tool that can prevent risks to babies being born to older couples or for those who have had difficulty in conceiving.

There is much evidence today that illustrates the

association of advanced paternal age and damage to sperm DNA resulting in abnormalities and breakage [10]. In turn, this affects a couple's ability to conceive and may result in potential health risks to future children. For these reasons, it is not only important to know, but obligatory to teach others and to provide the necessary means such as genetic counseling and prenatal testing for genetic disorders so that people understand the risks of producing offspring later in life.

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A new phenomenon has reached our generation before the facts and dangers have even surfaced. More and more studies are being done on the effects of vaping, even though for some, it's already too late. Stories of people dying from lung diseases related to vaping are flooding newspapers, and commercials spreading the dangers of vaping are becoming increasingly prominent. From a *halachic* perspective, can vaping possibly be permitted, and if so, what are the transgressions that might apply?

Vapes, also known as e-cigarettes, contain many ingredients that are harmful to the body. Nicotine, which is also the addictive ingredient in regular cigarettes, is present in vapes and has negative effects such as the possibility of causing an increase in blood pressure, heart rate, and a narrowing of arteries, as well as increasing the risk of a heart attack. In vapes, solvents are used to dissolve either nicotine or sometimes marijuana-derived compounds, such as tetrahydrocannabinol (THC) or cannabidiol (CBD). THC is the chemical in marijuana responsible for its intoxicating effect, and has been implicated in many of the recent illnesses reported nationwide. E-cigarettes produce an aerosol by heating the e-liquid inside with metal coils. These coils can be composed of a variety of substances including an alloy of iron, chromium, and aluminum, termed kanthal, or a combination of nickel and chromium. The visible aerosol, or cloud, produced by vapers is generated by glycerin, a product made from vegetable oil. The sweeteners in e-cigarettes include sucralose and ethyl maltol [1].

Many of these ingredients are approved by the FDA; however, that designation only refers to when those compounds are consumed in food. Perhaps the most dangerous part of e-cigarettes is the unknown. It is unclear whether some other toxic chemicals or pesticides have found their way into the e-liquid, or whether heating e-liquids leads to the formation of compounds not yet documented [1].

The unknown factor of the dangers of vaping potentially opens a *halachic* leniency. If the true dangers are unknown, then it falls under the category of "*shomer peta'im HaShem*" (*Tebillim* 116:6), which translates as, "God protects the simple person." This principle means that if there isn't concrete evidence of the danger of something, even if there are theories of

its ability to harm, it cannot be *halachically* prohibited. Rabbi Moshe Feinstein applied this concept to smoking cigarettes [2]. However, when more scientific evidence emerged about the dangers of smoking, many rabbis, such as the Tzitz Eliezer, Rabbi Eliezer Yehuda Waldenberg, a prolific *halakhic* decisor in Jerusalem, concluded that there was a widespread awareness of the risk of smoking, and so *shomer peta'im HaShem* no longer applied in the case of smoking [3].

The same conclusion of "*shomer peta'im HaShem*" with regard to smoking can also be applied to vaping. Although vaping has only recently become popular, many of its negative effects have already shown themselves in users. Vaping harms the body's immune system and generates many toxic chemicals, such as formaldehyde and acetaldehyde. Vapers show some of the same lung disease symptoms as people who smoke, such as smoker's cough [4]. In the summer of 2019, there were over 215 life threatening illnesses reported related to vaping [5]. Hundreds of patients, usually previously healthy adults, were showing up to the emergency room with serious respiratory damage [6]. Studies are showing that even vaping a couple of times can be harmful to the lungs [4]. While the cancerous effects of smoking can appear many years after the person started smoking, recent cases have proven that the fatal cost of vaping can surface soon after the person starts vaping. With this new information, it is impossible for vapers to be protected under "*shomer petai'im HaShem.*"

In addition, vaping could be *halachically* prohibited on the grounds of "*ve'nishmartem ma'od et nefshotechem,*" (Deuteronomy 4:15), which means "you should exceedingly guard your health." The Rama stated that even a *safek sakana*, the possibility of danger, fell under that prohibition (*Shulchan Aruch, Yoreh De'ah* 116:5). Therefore, even if vaping only causes an increased risk in various respiratory diseases, that risk falls under a *safek sakana*, which one is obligated to prevent.

Conversely, perhaps there is a situation where vaping could be *halachically* permitted. An example might be someone who uses vaping for the purpose that it was originally developed: as a healthier alternative to smoking cigarettes. A particular benefit of vaping is that there is a 99% reduction of formaldehyde and

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carbon monoxide in secondhand vapor compared to that generated from combustible cigarettes [7]. This reduction in noxious vapors almost completely eliminates the problem of secondhand smoke. A study in the New England Journal of Medicine noted that e-cigarettes were nearly twice as likely to enable a person to quit smoking than nicotine replacement therapy [8]. However, there is a *halachic* precedent of not permitting a lesser prohibition in order to prevent a major prohibition [3]. Thus, even though vaping is better for a smoker than smoking combustible cigarettes, it cannot be *halachically* allowed on these grounds. The other question that comes into play is whether someone who vapes is under the status of *oneis*, someone acting without free will (*Avodah Zara* 54a), because they become addicted to nicotine. When asked if the principle of “*oneis rachmana patrei*” (an *oneis* is exempt from punishment) would *halachically* allow someone to continue smoking without consequences, the Chofetz Chaim stated that the person was not an *oneis* when he began smoking and therefore was responsible for his sin (*Likutei Ma’amarim* 13). However, if a smoker used vaping to help quit smoking, then when the person started smoking he was not considered an *oneis*, but when he switched to vaping, he was already reliant on nicotine, placing him under the *oneis* status. Therefore, there is room to say that it is permissible within *halacha* for someone to begin vaping solely to quit smoking.

While vaping may have been innovated for smokers, a significant percentage of its users are actually teenagers who have never smoked before. According to the Centers for Disease Control and Prevention and the Food and Drug Administration (FDA), one in four high schoolers and one in ten middle schoolers vape [9]. Teenagers are drawn to the various flavors contained in e-cigarettes, and studies found that these flavors can actually increase the toxicity of the e-cigarette. A study testing the effects of flavors in electronic nicotine delivery systems found that, most notably, menthol, coffee, and strawberry-flavored aerosols significantly reduced cell viability and metabolic activity compared to air controls [10]. Young children have an extra risk involved; nicotine has a negative impact on their still-developing brains [1]. As a precaution, the FDA recently banned e-cigarettes flavored with anything except menthol in order to reduce their appeal to young children [5]. Teenagers are also more likely to experiment with the use of e-cigarettes, which can be even more dangerous. To get the biggest “hit” of

nicotine from each puff, teenagers may remove the outside cover from the e-cigarette and use an eyedropper to drip the liquid directly in. This action, called “dripping,” causes the e-cigarette to reach a higher temperature and creates a bigger vapor cloud along with a bigger “hit” to the throat. About one in four vapers try dripping [5]. The Biblical obligation of “*lo ta’amod al dam re’echa*” (Leviticus 19:16) requires parental figures and teachers to educate children and teenagers on the dangers of vaping. Furthermore, an underage vaper violates American law, and since the Jewish law of “*dinab de’malchei dinab*” (*Bava Batra* 54b) requires one to follow the laws of the land, that minor child is violating *halacha* as well.

New research and studies are continuously being performed to learn more about vaping’s detrimental health effects. As more risks and diseases are uncovered and more fatalities occur, it has become apparent that there are *halachic* ramifications to harming oneself through the use of e-cigarettes. Not only is a Jew required to educate those around him from the verse “*lo ta’amod al dam re’echa*” (Leviticus 19:16), but based on the verse “*lifnei iver lo titen michshol*” (Leviticus 19:14), which translates as “do not put a stumbling block in front of a blind person,” a Jew is obligated to be active in preventing the manufacturing of e-cigarettes before they get into the hands of those who fail to understand their threat. Is it not enough for us to understand the danger and refrain from vaping ourselves; rather, we have a higher responsibility to educate others.

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Infertility is a major motif in *Tanach* and is important to the Biblical narrative. Many women in *Tanach* have experienced issues with fertility, and their stories of struggle are meant to help us see G-d's involvement in our lives. Fertility is heavily emphasized to the point that it is even a commandment to have children, and the Talmud (*Taanit 2a*) states that G-d has the "Key of Reproduction." The advancement of modern medicine and medical technology can scientifically explain some of the different reasons of infertility during Biblical times, and can help us further connect to the blessing of reproduction.

Gender determination begins at fertilization when gametes combine to form a zygote. Fertilization of an X chromosome bearing egg by a Y chromosome bearing sperm yields an XY zygote, destined to develop into a male. Whereas, fertilization of an X chromosome bearing egg by an X chromosome bearing sperm yields a zygote with two X chromosomes, destined to develop into a female. Thus, females are designated XX, while males are XY. This definition seems simple. However, when there are abnormalities resulting in a deletion or in a duplication of a sex chromosome, gender determination becomes less clearly defined and further examination is needed to properly identify the sex of the individual. A person with a Y chromosome is always a male, regardless of the number of X chromosomes, and a person without a Y chromosome is designated as a female even if she has only one X chromosome. The chromosomal sex of a person is determined at fertilization, but the phenotypic sex of a person is influenced by many factors, such as embryonic interactions and the maternal environment. Due to these external factors an individual's phenotypic sex may differ from their chromosomal sex. External sex differentiation is not determined until the eighth to ninth week of development, and until then the embryo has both undifferentiated gonads and the forerunners of both the male and female reproductive tracts. If a Y chromosome is present then its *SRY* gene is activated, and the gonads develop into testes and the internal male tract forms. Without a Y chromosome, the undifferentiated gonads develop into ovaries and the internal female reproductive tract forms. Hormones are involved to form the external phenotypic sex differentiation. In males, testosterone

is converted to dihydrotestosterone (DHT), which induces the formation of the external male organs, and if DHT is not present, then the external female organs form [2]. When there are complications during embryonic development, the genotype affects the phenotype resulting in issues of maturation, such as secondary sex characteristics, external genitalia, and internal sex organs all which can cause difficulties with fertility.

Testicular Feminization Syndrome (now termed "Androgen Insensitivity Syndrome") is an X-linked recessive hereditary disorder, which may be transmitted from a mother to her sons. It affects the genes and gonads of males, resulting in genetic XY males with normal chromosomes, but who externally are phenotypically female. These individuals have what appears to be normal external female genitalia, but also have fully developed internalized male testes. Lacking ovaries and a uterus, they do not have menstrual bleeding and are infertile. Apparently, their body cells do not respond to testosterone. At puberty, the adrenal glands produce testosterone and estrogen; their body cells, however, do respond to estrogen, which stimulates breast development. Such people mature into extremely attractive females who are sexually orientated towards males. *Ketubot 10b* records an account that perhaps connotes this genetic disorder. A married man approached Rabbi Gamliel, and claimed that after intercourse his wife did not experience vaginal bleeding. The wife replied that she is from the Dorkati family, and explained how other women in her family neither experienced vaginal bleeding nor menstrual bleeding. Rabbi Gamliel then praised the man for being married into the Dorkati family. Commentaries elaborated on the Dorkati name, explaining that it meant "cut off from future generations" because these "women" could not bear children [4]. The women from the Dorkati family are thought to suffer from Testicular Feminization Syndrome, because in this disorder the females are infertile and do not exhibit menstrual bleeding, yet do exhibit secondary sex characteristics such as breast development.

Another example of infertility is seen with Sarah. The verse states "And Sarah was barren [*akarab*]; she had no child [*valad*]" (Genesis 11:30). The verse seems repetitive because it is obvious that a barren woman cannot bear a child. Commentaries suggest that the

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Hebrew word *valad* does not mean child, but interpret the phrase to mean that Sarah lacked something, causing her to be infertile. The literal definition of *akarab* means “not attached” so maybe there is a connection between the words *valad* and *akarab*. In a later verse it states, “Now Abraham and Sarah were old, coming on in years; Sarah had ceased to have the way of the women” (Genesis 18:11) indicating that Sarah no longer experienced menstrual bleeding, but had a functioning uterus in the past. The Talmud (*Yevamot* 64b) explained that Sarah was an *eilonit*, a woman lacking secondary sex characteristics. A modern medical interpretation would suggest that Sarah suffered from Polycystic Ovarian Syndrome (PCOS), a pathology in which the ovaries fail to release an egg due to an excess of male hormones, thus reducing fertility. The Ralbag commented that Sarah was overweight, which is one of the causes of PCOS. For this reason Sarah encouraged Avraham to marry Hagar and have her child. This caused Sarah to be depressed and to lose weight, thereby restoring her fertility. The connection between PCOS and the previous pasuk (Genesis 11:30) suggest that the word *valad* could mean that Sarah lacked a “dominant follicle,” and *akarab* could refer to the follicle not being attached to the uterine wall, causing infertility [8].

Previously, it was mentioned that Sarah was an *eilonit* and suffered from PCOS. The mention of an *eilonit* in *Mishna in Niddah 47b* gives rise to another cause of infertility.

Maimonides explained that an *eilonit* is a woman who lacks secondary sex characteristics and has difficulty during intercourse. The modern understanding is that this woman has Turner’s Syndrome. These women are lacking one X chromosome, so they are designated XO instead of XX. Signs of this syndrome are delayed or absent sexual development, a webbed neck, and infertility due to failure in the development of functional ovaries. Maimonides’ understanding of an *eilonit*’s difficulty during intercourse could parallel women with Turner’s Syndrome, because they are less sexually active and less likely to form relationships with a partner [10].

The fertility struggles that women in *Tanach* faced are there to teach us important lessons, and to help us empathize with their yearning to have children. The application of modern science to Biblical times enhances our comprehension of the infertility issues in certain women. The development of technology and fertility treatments are major advancements and indicate that the ability to have children is truly a blessing.

### Acknowledgements

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# “But Wait, There’s More!”: The Psychological Perks of Practicing Judaism

By Rivka Hirsch

The intersection of religion and health is a controversial topic that in recent years has been the subject of a growing number of scientific studies. The Torah famously states that the *mitzvos* are “לְטוֹב לָךְ”, good for you (Deuteronomy 10:13). This is generally taken to apply to the next world, in terms of the reward given for *mitzvos*. Nachmanides, however, writes that the *mitzvos* benefit and provide a *tikkun* for man in this world, beyond what he receives in *olam haba* (Deuteronomy 22:6). Although the *Ramban* does not provide further explanation as to what specific benefit man receives in this world for his performance of *mitzvos*, a growing body of research suggests that the practice of Judaism is “לְטוֹב לָךְ”, in this world, specifically in the realm of mental health and well-being.

Research done by David Rosmarin and colleagues looked at how religion predicts psychological distress and found that while religious denomination was not a strong predictor of distress, religious practice was. Categories like general religiousness, religious practice (such as prayer) and positive religious core beliefs (such as belief in a benevolent G-d) predicted lower levels of worry, anxiety, and depression among both Christian and Jewish individuals. The opposite was true for those with negative religious core beliefs, meaning the beliefs predicted higher levels of distress. In another study, Rosmarin looked at the variable of trust in G-d in a sample of 565 Jews using a self-report measure. The findings showed that higher levels of trust in G-d were associated with less anxiety and depression and greater personal happiness, and higher levels of mistrust in G-d revealed the opposite. This fits in nicely with the Jewish idea that *bitachon*, or trust in G-d, has a tremendous effect on man’s state of mind, allowing him to rest, knowing that G-d is taking care of his needs and thus he does not need to worry. As *Rabbeinu Bachya ibn Paquda* writes in his *Chovos HaLevavos* (*Sha’ar HaBitachon* introduction), one who trusts in G-d will enjoy “tranquility of soul, peace of mind, and diminished anxiety”, because he recognizes that G-d is in control and acts only for his good [1].

In a study comparing eleven religious kibbutzim to

eleven secular kibbutzim, researchers found that members of the religious kibbutzim had higher measures of sense of coherence and lower measures of hostility than their counterparts in secular kibbutzim. Sense of coherence is a psychological characteristic that considers one’s confidence in the predictability and worthiness of his or her life circumstances and in his or her ability to handle them. The researchers suggested that Orthodox Judaism’s beliefs and principles are the foundation for the sense of coherence of its devotees, and that is why religious kibbutz members reported higher levels than the secular kibbutz members. This adaptive psychological trait is protective, and that could explain the nearly double mortality rate in the secular kibbutzim between 1970 to 1985 compared to the religious kibbutzim. Judaism’s emphasis on moral and character refinement could also affect one’s level of hostility or aggressive behavior towards others, which might explain the lower levels among the religious kibbutz members [2].

Besides for the effects of individual religiosity on mental health, the social aspects of religious experience also lead to the increased sense of well-being among religious people. A study done on American Jews showed that higher measures of both self-reported activism in mainstream Jewish organizations and religiosity “were significantly positively associated with reported feelings of belonging, optimism, and self-acceptance.” Both of these aspects of Jewish identification involve associating with a group, showing that it could be the psycho-social benefit of belonging and finding commonality with other people that promotes positive mental health. Thus, since much of religious experience includes psychosocial aspects, that explains the correlation between religion and better mental health [3].

Emile Durkheim, the famous sociologist, saw religion as a social institution that introduces a collective consciousness among its participants, where individuals reaffirm themselves as belonging to a group [4]. This psychosocial element of Judaism is most apparent in synagogue attendance. *Shul*

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members attend *minyan* mainly for prayer services, but they also enjoy the camaraderie and social construct it affords them. Meeting twice a day every day constitutes social contact and allows *shul* attendees to form strong bonds of friendship and closeness that last beyond the *davening* service. *Minyan* is an example of a support system as defined by Gerald Caplan (1974), which guides and comforts its members, especially in times of crisis, such as mourning. Mourners participate in the *minyan* saying *kaddish* for eleven months after a parent has died, and this *kaddish* holds a prominent place in the prayer service. *Minyan* also includes elements of group dynamics, wherein individual behavior interacts with group processes. This is reflected in the multifaceted nature of the prayer service, incorporating personal prayer such as the Silent *Amidah* with the *Chazzan's* Repetition which requires group participation. *Shul* attendance satisfies the social need for connection, countering loneliness, and inspires a sense of belonging and self-esteem, as well as a feeling of being cared for and supported [5]. It is therefore no wonder that in a study done on American Jews in five cities with a high Jewish population, researchers found that greater synagogue attendance was associated with better mental and physical health [6].

Another study to investigate the social role of religion and its effects on health looked at two kibbutzim in Israel, one secular and one religious [4]. Kibbutzim were chosen because the foundation of the kibbutz is built on constant social support and community. The researchers were interested to see whether the religious kibbutz would show more of an increase in stress-deterrent responses than the secular kibbutz. This would point to religion's specific strength in promoting health, since both communities, being kibbutzim, had equally strong psychosocial ties. The results supported the hypothesis, showing that having a religious network did indeed counter the adverse effects of stress-inducing life events. While social religious activities counterbalanced the negative effects of recent traumatic life events, individual religious activities did not [4]. This suggests that it is the strength of the religious network that benefits mental health, rather than the individual religious practice. This study also revealed that it isn't just any social support community that promotes health, but that religious groups in particular have this special ability to encourage mental health and resilience.

In another study, research was done on how *shul*

attendance is a predictor of happiness and subjective well-being (SWB). The assumption in this study was that it is not just the psychosocial element of *shul* that promotes happiness, but also something inherent in the religious experience itself. All of the measures of religion studied (prayer frequency, synagogue attendance, subjective religiosity, certainty of G-d beliefs, and supernatural beliefs scale) were found to significantly correlate with happiness, such that greater religiousness correlated to greater happiness. The researcher suggested that *shul* enables all the other measures, arguing that "frequent synagogue attendance engenders more frequent prayer which, in turn, reinforces certainty of G-d beliefs and thus supernatural beliefs in general, [and] these all serv[e] to enhance one's subjective perception of religiosity" [7]. *Shul* attendance reinforces these principal beliefs which lead to higher SWB and happiness.

There are many limitations in this research. Among the foremost is that many measures of religiosity consist of a single item testing synagogue attendance, but in reality, that is often a poor assessment of one's level of spirituality and connection. Another possible confounding variable is that as people age and endure ailing health, they are less able to come to synagogue, and thus, the research self-selects for healthier people when studying synagogue attendance because the only people going to synagogue are those who are physically capable because of their robust health. This then creates the illusion that people who attend *shul* are healthier, when really the effect is the other way around [7].

Beyond the methodological concerns in this area of research, there lies an even greater question. Obviously, the reason Jews are religious is not for the health benefits, so what value is there to even discuss this at all? There are many answers to this question, but one might be that the discussion cannot hurt. These "unexpected, benign side effect[s] of what... observant Jews conceive as purely religious occurrence[s]" are interesting, and can even add a greater sense of motivation to practice those religious rituals because we see one aspect of their tremendous value played out in our lives [5]. It also shows the depth and *chochma* behind the *mitzvos* G-d gave us, inspiring a greater sense of awe towards G-d's Torah. Of course, the mental health benefits gained from *mitzvos* are *not* the reason we keep *mitzvos*. The reason we keep *mitzvos* is because we obey the word of G-d.

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But it is a *kiddush Hashem* to see, in a few small ways, how the *mitzvos* are truly “לֵטוֹב לָךְ” in the realm of our psychological health.

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# Did Isaac Suffer from an Ocular Disease?

By Ayelet  
Klahr

It is fascinating to speculate that medical issues played a key role in biblical studies. In particular, it may be that ophthalmologic issues greatly affected the story of Isaac. It says about Isaac in Genesis, 27:1, "When Isaac was old and his eyes were too dim to see, he called his older son Esau and said to him, 'My son.' He answered, 'Here I am.'" Rashi, quoting the Midrash, presents different explanations as to why Isaac's eyes were dim. The first explanation is that his eyes were dimmed from the incense which Esau's wives offered to idolatry. There is much research and discussion of how smoke can increase the likelihood of one developing cataracts and macular degeneration, thus making it possible to suspect that Isaac was afflicted with cataracts or macular degeneration, both of which would dim his eyes. A study conducted at the Chinese University of Hong Kong revealed that there is a causal relationship between those who smoke and develop these eye diseases [1]. The New York State Department of Health has published that those who smoke are three times as likely to form cataracts and macular degeneration than those who don't smoke [2]. Dr. William Barry Lee, an ophthalmologist, explains that exposure to smoke reduces blood supply to the eye, enlarges the blind spot and reduces one's threshold of different lights [3]. Additionally, elevated levels of carboxyhemoglobin found in the blood of those exposed to secondhand smoke, depresses one's visual perception [4].

Another possibility that Rashi quotes from the Midrash is that Isaac's eyes were dimmed from the tears of the angels at the *Akeda*, when his father, Abraham, almost sacrificed him to God. The final explanation that Rashi quotes from the Midrash is that God caused him to lose his eyesight in order to ensure that the blessing would be given to Jacob instead of Esau. The Midrash does not say which condition he had, but it makes it clear that his eye condition was so severe that Isaac was unable to distinguish between his two sons. Thus, it is possible to assume that Isaac's eye condition prevented him from distinguishing between objects and people. Both cataracts and macular degeneration can impair one's vision to the point where they are no longer able to

distinguish between detail in objects and recognize people. The condition of cataracts occurs when the lens of the eye is clouded, causing images to be foggy because the light is either scattered or blocked, instead of being sharply focused on the retina to create a clear image. Additionally, cataracts change one's perception of color, which could be the reason why Isaac did not notice that Jacob's hair color was different from Esau's red hair [5]. Macular degeneration is a condition where one loses their central vision, and only their peripheral vision is preserved. One can form dry macular degeneration, in which retinal cells die, or wet macular degeneration, in which blood vessels leak into and beneath the retina [6]. Isaac, being unable to recognize who was directly in front of him, portrays the symptoms of one with macular degeneration who has lost his central vision.

The Ramban in Genesis 25:34 points out the juxtaposition of mentioning Isaac's dim eyes with Isaac's old age. The Ramban understands this connection to be the explanation of the reason for his poor eyesight, being that Isaac was elderly. Macular degeneration and cataracts are both a very common development as one ages. Another theory to explain Isaac's poor eyesight is diabetes. Dr. Reisenberger, a biblical scholar, writes, "Diabetes mellitus and its complications encompass a multiplicity of signs, symptoms and secondary conditions which include a constant need for water, increased appetite, lethargy and chronic fatigue, visual deficit and sexual dysfunction, including impotence" [7]. She notes that Isaac was always sure to stay near a water source and that is why his servants were always digging wells for him. Reisenberger also points out that Isaac had no big physical achievements that are recorded in the Tanach. She speculates that Isaac and Rebecca also had trouble conceiving due to diabetes, as trouble bearing children is a common symptom of the disease. Diabetes can affect eyesight, causing Diabetic Retinopathy, leading to blurry vision, glaucoma, cataracts, and even blindness. Having high blood sugar damages the blood vessels of the retina, the light-sensitive part of the eye, that sends signals to the brain through the optic nerve. Diabetes and high blood sugar will damage the blood vessels in the eye, causing blockages within them, leading them to bleed. The eye tries to grow new blood vessels to

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compensate for the blocked, damaged ones, but they do not function well and leak. Subsequent bleeding and scarring of the retina impair eye function and vision [8]. Thus, it is common for people with diabetes and fluctuating blood sugar levels to have defective vision. This could be part of the reason why Isaac had so much difficulty seeing and why it says that his eyes were too dim to see. It may be that Isaac suffered from one of several ophthalmologic conditions- cataracts, macular degeneration or diabetic retinopathy, which caused his poor vision that is mentioned in Genesis.

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# My Genes Made Me Do It: Behavioral Genetics and Free Will

By Aviva  
Landau

Secular American law and Jewish religious legal systems both hold that people are responsible only for actions done voluntarily with free will. In Jewish law, G-d does not hold accountable for sin those forced to break a law, or who did not know they were breaking a law, or broke the law unintentionally while trying to fulfill a positive commandment [1]. Such individuals did not willingly choose to sin; since they lacked free will, they are not liable for their actions. This concept gets complicated when considering behavioral genetics. If a person carries a gene that predisposes impulsivity or aggression, and ultimately sins, is that person still accountable for transgressive behavior? Should a person's genome be considered a coercive force that does not allow for free will and decision making?

Many decades of studies on twins, families and adoptees have shown that about half of the variation in behavioral traits is due to genetics. Scientists have tried to pinpoint genes responsible for everything from IQ, marital success, coping skills, addiction, and anxiety. These studies are very complex because a multitude of genes can impact one trait, and the environment greatly impacts how much these genes are expressed [2].

Scientists have tried to link specific genes with criminal activity. Studies indicate that a disproportionately high frequency of men with the XYY genome are convicted criminals. An extra Y chromosome is claimed to cause extreme height, increased aggressive tendencies, decreased intelligence, and abnormal features of the central nervous system, all of which are possible explanations for the increase in criminal convictions [3]. However, these hypotheses cannot be fully proven without larger sample sizes and without accurately calculating the frequency of XYY in the general population [4]. Additionally, it is important to control for socioeconomic environmental factors since they greatly impact results [5].

A mutant gene linked to aggressive behavior is a variant of the normal gene for monoamine oxidase-A (MOA-A), an enzyme breaks down neurotransmitters

including dopamine, norepinephrine and serotonin [2, 6]. People with this gene variant exhibit impulsive and sometimes threatening behavior, so it is nicknamed the "warrior gene" [7]. In a study conducted by the National Institute for Mental Health, participants were shown neutral and emotional faces while key brain regions were monitored. Researchers found that those with the "warrior gene" were hyperresponsive to the images, suggesting that they have trouble regulating their emotions and are therefore more likely to act on aggressive impulses [2]. In two European legal cases and one American court, defense attorneys attempted to admit the MOA-A gene as evidence for reduced capacity [7]. However, similar to the individuals with XYY, environmental socioeconomic and cultural factors play a crucial role in how the MOA-A gene is expressed and must be examined when studying behavioral genetics [8]. The gene only expresses itself as antisocial and violent behavior in people who have experienced trauma [2]. Additionally, although the gene regulates emotions and impulsivity, it doesn't necessarily lead to aggressive or antisocial behavior [7].

There are some Torah sources that seem to support the idea of a genetic susceptibility to certain types of behavior. Genesis 25:25 describes Esav as "red and hairy" at birth. Rashi takes this physical manifestation as a sign that Esav was predestined to be a murderer. Additionally, Genesis 36:24 recounts Anah breeding a dangerous cross-bred mule [1]. *Gemara Shabbat 156* blames Anah's proclivity for creating "evil" creatures on the fact that he was the product of an incestuous relationship [1].

While the previous sources speak of predestination and lack of free will, other Torah sources consider free will significant. *Gemara Nidda 16b* tells that an angel appointed to oversee the conception of new embryos takes a drop of semen and reveals the destiny of the person who develops from it, including characteristics like strength, intelligence and wealth, but not wickedness or righteousness. The Rambam reaffirms this idea in his *Mishnei Torah, Hilchot Teshuva*, chapter 5, "Free will is bestowed on every human being ... Let no notion ... pass through your mind

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that at the beginning of a person's existence the Almighty decrees that he is to be either righteous or wicked" [1]. According to these sources, G-d decides an individual's personal situation, but no more than that. G-d sets before each person "life and good, and dead and evil" (Deuteronomy 30:15); G-d may know the future, but each person has the power to choose a path [9].

This leads to another question: if people are genetically predisposed to act in a certain way, how do they also have free will? *Pirkei Avot* 3:19 says, "Everything is foreseen, yet the freedom of choice is given." The *Be'er Avos* comment on this *Mishna* and answers the question. "Even though a person has genetic or socially habituated inclinations, whether positive or negative, he is not a prisoner of these tendencies. G-d allows us the free choice to rise above our so-called 'natural' limitations." The *Be'er Avos* makes a clear distinction between predetermined character traits and predetermined actions. G-d, through genetics, may determine certain character traits of an individual, but that individual still has free will to make decisions [10].

This concept can be seen in *Tanach* as well. After Cain kills Abel in Genesis 4:9 and G-d asks him where Abel is, Cain responds with the famous question, "Am I my brother's keeper?" Rabbi Tendler explains what Cain means: "G-d, You are my brother's keeper. You are in charge. If you did not want me to be a murderer, you should not have given me the ability to murder. I am not to blame. My genes predestined by G-d are responsible for my actions." But G-d's position is explained in Genesis 4:7 "...sin is crouching at the door. It lusts for you, but you can master it." According to Rabbi Tendler, G-d tells Cain that He gave Cain a genetic predisposition to be quick tempered when his ego is not satisfied, but He also gave Cain the ability to master these negative impulses and lead a moral life [1].

In the ancient world, many believed that the position of the stars at birth decided one's personality. For example, those born under Mars were destined to spill blood. In *Gemara Shabbat 156* Rav Ashi explains that this does not necessarily mean murder; the person can become a surgeon, butcher, or *mobel* [11]. On the same *daf* Rava says, "I was born under the sign of Mars and I'm not a murderer." Abayeh responds, "Yes, but you do spill blood. [When you judge] in your court, you rule who is to be given whiplashes and who deserves death; so you are

indeed expressing your personality" [1]. In this case, the genetic impulse is being used for a morally ethical and correct action according to Jewish law.

Scientific evidence for behavioral genes clearly exists but it is difficult to identify which gene or combination of genes causes criminal behavior because genes can impact personalities but do not directly control actions. MOA-A may affect impulsivity and emotional activity, but does not automatically result in aggressive behavior [7]. A high proportion of individuals with XYY genomes may be in prison, and their genes may have given them a greater disposition towards ending up in this type of situation, but ultimately their decisions, and not their genes, got them in trouble. Genes cannot be considered a coercive force that does not allow for free will and true decision making. G-d endowed the gift of free will and the power to choose to do good or evil, regardless of underlying genetic makeup.

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The development of vaccinations has played a critical role in substantially eliminating the risk of contracting many deadly diseases. Poliomyelitis, smallpox, and rubella are some of the diseases which have almost been completely eradicated by science. Yet, despite having vaccinations, which keep children and adults healthy and free of these diseases, there are many people who still refuse to vaccinate themselves or their children. As a result, some diseases that had substantially disappeared are resurfacing, most recently, measles. The vaccination for measles was first administered to children in 1968. Since then, there was a decline in the incidence of measles until it was fully eradicated from the US in 2000 [1]. Controversies surrounding the side effects of the measles vaccine have contributed to an increase in unvaccinated people and an increase in the number of measles cases reported. In 2019 there were 1,249 cases reported in the US [2].

Measles is one of the most contagious viral diseases as it is spread by airborne transmission and can cause symptoms up to four days after first coming in contact with the virus [3]. Infants who contract the virus may only live a few months before dying. Although nineteen strains have been identified since 1990, the vaccine is only based on one strain of measles. Measles cannot be detected immediately when the virus is introduced into the body, rather it takes seven to fourteen days before symptoms begin to surface. Symptoms include the growth of Koplik spots, white lesions with a red ring surrounding it, in the throat, rashes, and high fevers.

A driving force in the anti-vaccination movement was a study published in 1998, in *The Lancet*, linking the measles-mumps-rubella (MMR) vaccination with cases of autism. This study generated confusion and concern for parents in the United States and in Britain, resulting in many parents questioning whether the vaccination was helping or harming their children. Although subsequent studies disproved the connection between the MMR vaccine and autism, many people were still skeptical, driving a decline in the number of children who received vaccinations around this time.

It was not until 2010 that *The Lancet* study was retracted, when it was confirmed that MMR vaccine and autism were not linked. Unfortunately, the damage still remains, as there are still numerous organizations promoting “anti-vaccination,” which has created another generation of parents who do not want to vaccinate their children. Overall, the

Orthodox Jewish community has supported vaccinating children, but there are groups within the population who oppose vaccinations. In this article, I discuss the *halachic* view on vaccinations [4].

What does *halacha* have to say regarding vaccinations? The sources generally coalesce around a couple key questions: a) Can you put yourself in danger? b) Can you put someone else in danger?

*The pasuk in Devarim (4:9)* states, “*Heshemar lecha ushmor nafshecha meod*,” which means that a person must take utmost care of and watch one’s self carefully. This *pasuk* refers to the *mitzvah* of protecting oneself from danger. Rabbi Ephraim Luntchitz explains that guarding yourself means taking care of your body [5]. Furthermore, in *Hilchot Deot (4:1)*, the Rambam teaches that *Hashem* wants us to keep a healthy body and one must avoid anything that harms the body by taking preventive steps to make yourself stronger. Lastly, the Talmud comments on the words from a *pasuk*, “*verapo yerapeh*” (*Shemot 21:19*), which instructs that “he shall provide for his cure.” The Talmud explains that one should go to doctors, as they are given permission to heal others on behalf of *Hashem*.

The *Shulchan Aruch* rules that *halacha* obligates us to remove anything dangerous from our midst. This is based on the *mitzvah* of *ma’akeh* - building a railing on a roof/elevated location so that no one falls off. According to the *Tzitz Eliezer*, this does not only apply to roofs but it also creates an obligation in any hazardous situation that could lead to death or severe injury. When looking at other cases, Rav Moshe Feinstein delves further and comments on the *issur*, or violation of drinking *mayim megulim*. This refers to water that has been left uncovered for an extended period of time, allowing for the possibility that a venomous snake could have drunk from it. R’ Feinstein comments that despite there being a very small chance of a venomous snake drinking from our water, it is enough of a concern that it falls under the category of *pikuach nefesh* (preservation of life). Furthermore, in the Talmud (*Bava Kama 16:2*) it clearly states that one may not own vicious dogs, which is another example of the importance of caring for one’s well-being. The *Rema* comments on the *Shulchan Aruch* explaining that he doesn’t believe it is necessary to have a rabbinical legislation written down regarding the prohibition of actions/non-actions that are dangerous by nature, rather something deemed dangerous should be treated more strictly than that of prohibitions. Further, the *Rema* commented that during the time of a plague it is

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necessary to flee as soon as the plague starts rather than wait and possibly contract the disease (Yoreh Deah 116:5)[4].

During the smallpox epidemic many Rabbis gave *psakim* on the requirement to move children from dangerous locations in which one may contract the disease. This is similar to the *Rema's* commentary that one should flee a city as soon as a plague hits. Failure to flee the city, or in this case remove your children from danger, can result in the labeling of *chayavim benashotam*, i.e., being responsible for their own fate. One then may say that the failure to vaccinate should also be viewed in cases similar to these epidemics. Rabbi Yisroel Lipschutz, a commentator on the *Mishna*, rules that despite risks of death and other complications, the good outcomes outweigh those of the bad and one should be vaccinated. Furthermore, Rabbi Shlomo Zalman Auerbach rules that one should be vaccinated. In fact he rules that if the only time one is able to receive a vaccination is on Shabbat, then the individual should be vaccinated on Shabbat [4]. This continues to show the critical importance and acceptance of vaccinations with approval from the *gedolim* in our time. Their *psakim* also shine a light on the importance of people protecting their children and making sure they are vaccinated, especially when an epidemic has arisen in their communities.

It is clear that in times of epidemic it is crucial to become vaccinated, but what about in times when there is not an epidemic? There is no concern that the yearly influenza rate will reach epidemic levels. Yet, physicians and public health officials encourage almost everyone to receive a flu shot (which appears to be in line with the *Rema's* opinion noted above). But since the incidence of these devastating childhood diseases, such as MMR, poliomyelitis, and smallpox, is so low, one might assume that the *Rema's* opinion would not be applicable and in turn, there would be no obligation to vaccinate. Rav Shlomo Zalman Auerbach and his student Rav Yehoshua Neuwirth both ruled that parents cannot

be compelled to give their children vaccinations but they can be strongly encouraged. Had the risk of infection from these diseases been higher, it is possible that these *poskim* would have then ruled that parents are required to vaccinate their children, rather than just encouraged. On the other hand, Rav Yosef Shalom Elyashiv stressed that since it is standard practice to vaccinate your children, parents are required to vaccinate their children. Furthermore, he says that a parent has the right to insist that other parents of children in the class vaccinate their children in order to not expose the class to the risk of the illness [4].

There are many *poskim* who do not endorse vaccinating children or require schools to insist that students be vaccinated. Rav Chaim Kamenetsky is one of the many *gedolim* who believes that it is the parents' right to decide if one should have their child vaccinated. He believes not all medical professionals know what is best, as there are many issues and dangers concerning the vaccine. Rav Kamenetsky believes those who are supporters of the vaccine cannot force or coerce one into giving their child a vaccine [6].

While there is still a discussion revolving around the *halacha* if one should get vaccinated, the majority of *poskim* follow the opinion that you should do what is best in protecting your children and err on the side of caution by vaccinating your children. It is noted that there is a minority of *poskim* who believe one should not get vaccinated. One should refer to their own *posek* when deciding what is best.

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# And There Was Sunlight: The Dangerous Deficiency of Vitamin D in Jewish Women

By Shoshanah  
Marcus

Over a billion people in the world are deficient in vitamin D. In addition to its important role in calcium regulation and subsequent bone formation, vitamin D plays a crucial role in a number of physiological systems. As a steroid with hormone-like activity, vitamin D regulates the activity of some genes and plays a crucial role in growth and development. Deficiency in this critical vitamin can have severe consequences and has been linked to serious pathological conditions, including: cancer, obesity, diabetes, depression, chronic fatigue syndrome, osteoporosis, and neuro-degenerative diseases such as Alzheimer's disease. Though some vitamin D is absorbed through dietary consumption, 50% to 90% of vitamin D is obtained through exposure of one's skin to sunlight [1]. Most cases of vitamin D deficiency seem to stem from people avoiding the sun due to the fear of skin cancer; however, for religious Jewish people there is a different component [2]. The religious Jew, especially the Orthodox Jewish woman, dresses in a modest way that covers the body more so than the average person, leading to an extreme lack of sun exposure, which ultimately results in dangerously low vitamin D levels.

Despite the Middle East having mostly clear skies and sunny weather throughout the year, the Orthodox Jewish religious residents in this area surprisingly have some of the lowest levels of vitamin D and highest rates of hypovitaminosis D, or insufficiency of vitamin D [1]. Religious Jewish women are among the most impacted by the lack of vitamin D because their traditional lifestyle fosters reduced exposure to sunlight. This deficiency is most pronounced in the ultra-Orthodox Jewish community. Not only do ultra-Orthodox Jewish women tend to dress in modest clothing and care for their children in an indoor environment, both of which limit their sun exposure, but they also lack proper education about the various health consequences of the lack of vitamin D.

Without an adequate understanding of their high risk nature for hypovitaminosis D, Jewish women may not be properly equipped to take preventative actions against potential health risks. The most common signs and symptoms of vitamin D deficiency include

generalized weakness, and reduced bone mineralization, or less dense bones, commonly known as osteoporosis. Osteoporosis is more common in women and studies have linked this condition to the cause of bone fractures in nearly 50% of women over the age of 50. Moreover, as women age and reach menopause, their levels of estrogen, a hormone which normally protects women from bone loss, decrease dramatically, contributing to bone breakdown and tremendously increasing their chance of developing osteoporosis [3]. In a study comparing patterns of osteoporosis health-related behaviors in premenopausal and postmenopausal ultra-Orthodox and secular Jewish women, both groups were found to have calcium deficiencies. The main difference between the two groups was that Orthodox Jewish women had less knowledge about osteoporosis and were less likely to receive a bone density examination compared to the secular Jewish women. Additionally, the Orthodox women typically only engaged in walking as their main source of physical activity while the secular women participated in a wider range of activity, which was most likely due to their different religious levels. These findings encourage an expanding of knowledge about the importance of vitamin D intake and osteoporosis for Jewish women [4]. With the proper education, Jewish women may be able to build up their bone strength with supplements or engage in the appropriate exercise to avoid the serious consequences of living with weak bones.

Although women are the most impacted group by vitamin D deficiencies, religious Jewish men are also impacted by this. Healthy, young men in high-level religious *yeshivot* were found to have severe vitamin D deficiencies and were considered a high risk group for metabolic bone disease. Dressing in modest attire, studying religious texts in an indoor setting, and waiting 3 or 6 hours between eating meat and dairy limited these men's calcium and vitamin D intake [5]. Aside from genetic factors, the combination of physical activity and dietary intake of calcium and vitamin D affects the peak bone mineral density (BMD) a person can obtain in their teenage years.

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The ultra-Orthodox Jewish lifestyle not only promotes indoor religious study over outdoor physical activity but also adheres to a modest dress code. Additionally, Rabbinical law requires one to wait up to six hours between eating meat and dairy, which limits the consumption of calcium-rich milk. In analyzing the BMD of 50 healthy, ultra-Orthodox Jews from Brooklyn, a study recommended that as a group at risk for poor bone health, ultra-Orthodox Jews should increase their calcium intake as well as increase in weight-bearing exercises, such as weight lifting and fast paced walking, to build up their bone strength [6].

Some have considered vitamin D deficiency to be “an ignored epidemic” and have urged health administrations to combat this growing issue [1]. Many concerns have been raised within the Jewish community to try to increase vitamin D intake among Jews, especially Jewish women. Studies have found that pregnant women who took vitamin D supplements during pregnancy were less likely to develop hypovitaminosis D [7]. Additionally, countries like Israel, where the levels of vitamin D in ultra-Orthodox people are dangerously low, have tried to fortify their milk but have faced some backlash. In response, some Israeli health officials

have recommended the Health Ministry to reevaluate their regulations [8].

Ultimately, the most crucial factor in deterring dangerously low levels of vitamin D is education. With the proper education and proactive measures, Jewish women will be able to combat hypovitaminosis D by beginning to take vitamin D supplements in their youth to avoid severe cases of osteoporosis in later age. In their developmental stages, young Jewish women have the ability to actively build up their bone strength and bone density in order to avoid the serious repercussions of vitamin D deficiencies without sacrificing their religious values.

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# Huntington Disease and Fragile X Syndrome Amid the Jewish Israeli Population

By Rachel  
Mauda

Many hereditary diseases stem from an expansion in specific genetic repeats. In this article, two genetic conditions, Huntington disease and fragile X syndrome, will be explored in relation to their prevalence in different Jewish Israeli sub-populations. Both conditions result due to an increase in repeats and have the potential to further expand and affect future generations. Hence, the ethical and *Halachic* ramifications of both will be discussed and the importance of genetic screening will be demonstrated.

Huntington disease is classified as a late-onset autosomal dominant disorder caused by extensive CAG repeats in the polymorphic Huntingtin (HTT) gene. In unaffected individuals, the length of the polyglutamine sequence gene ranges between 10-36 repeats. However, affected individuals are characterized with 39 or more repeats in the HTT gene, with a general correlation of earlier onset and severe disease progression with lengthier expansions [1]. The precise molecular mechanism by which the mutated gene causes the late onset neurological dysfunction is yet to be fully comprehended. However, the death of Woody Guthrie from the disease led to the joint efforts of his wife together with Dr. Milton Wexler and his daughters to identify the gene responsible for the Huntington disease [2].

Several studies [3, 4] proposed that, unlike the wild type, mutant huntingtin proteins enter the nucleus, lose their antiapoptotic functions and generate toxic products. It has been shown that polyglutamine peptides induce the formation of fibrillar aggregates which cause cell death when localized to the nucleus. These polyglutamine sequences trigger neuronal death, associated with the Huntington disease, by increasing reactive oxygen species and stimulating nitric oxide generation, cytochrome c translocation, activation of caspases and suppression of the ubiquitin-proteasome system. Though the exact mechanism by which the huntingtin protein aggregates are toxic is unclear, Perutz [5] suggested that glutamine repeats form small, beta sheets which are held firmly by hydrogen bonds and function as polar zippers by joining specific transcription factors bound to separate DNA segments. Their extension

may cause disease by triggering the agglomeration and precipitation of neurons.

Israel is a young state with a population that is currently mostly composed of descendants of European and Middle Eastern Jewish immigrants. The prevalence of the Huntington disease has not been widely studied in the Israeli population. Between the years 2006-2011, Melamed *et al.* [6] diagnosed ten Huntington disease probands, nine of whom were Caucasus Jews, also known as mountain Jews of Azerbaijani descent, and one was an Ashkenazi Jew. The haplotype analysis that was performed showed that eight of the affected individuals shared the same haplotype which was compatible with the A1 haplogroup. Their findings suggested that there was prevalence of the Huntington disease amongst the Caucasus Jews. They estimated the founder mutation to be 4.3-7.6 generations ago, correlating to approximately 80-150 years. Although the Caucasus Jews constitute 1.4% of the Israeli population, they encompass 27% of the Huntington patients in Israel.

A 2017 research study conducted in the Tel-Aviv Medical Center [7] evaluated 120 Huntington disease patients stemming from various ethnic origins. Their findings showed that amid the Mountain Jews and Karaites, two relatively small Israeli sub-populations, there was a high frequency of the Huntington disease. As mentioned, the mountain Jews originated from the eastern and western regions of Caucasus and are held to be of Persian descent. With the collapse of the Soviet Union, most of the Mountain Jews immigrated to Israel and other western countries. This study suggested that while Huntington disease is more prevalent amongst North American, European and Australian populations compared to Asian and African residents, there may be a cluster of the Huntington disease among selective Asian groups such as the Mountain Jews. The Karaites are a religious group that broke away from Judaism at around the 8<sup>th</sup> century A.D. and eventually settled in Israel. There are approximately 40,000 Karaites, 75% of which reside in Israel and constitute approximately 0.5% of the total population. The proposed reason for the high frequency of Huntington disease

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amongst these two populations is the typical inter-community marriage occurring within these two sectors.

Huntington disease, being a late onset disorder, projects an emotional, ethical and *halachic* concern to several individuals who are unsure whether they are carriers. Many single individuals who have familial background with the disease and are interested in marrying, face the *halachic* and ethical dilemma of whether they are obligated to undergo genetic testing for this disease and to inform the other party of their status. According to Rabbi Yehuda Shaki, the concerned individual must undergo genetic screening and inform the other party of their status in order to benefit both sides and avoid grief in future years [8].

Many women who have a familial background with Huntington disease and are interested in conceiving a child, often wish to ensure that their unborn would not carry this mutation via non-disclosure preimplantation genetic testing for this monogenic disorder. This procedure maintains secrecy and refrains from revealing the Huntington status to the patient. A similar procedure can be conducted when the man may be the affected individual. According to Rabbi Yehuda Shaki, *halachically* and ethically this procedure “beholds how good and how pleasant” technology can be in such circumstances to all parties involved [8].

Some cases often involve married men and women who are homozygous dominant for Huntington disease and are interested in conceiving a child. In cases of when the man is homozygous dominant for the disease, *halachically*, the couple may use a non-Jewish sperm donor and the child will not be considered a *mamzer*, however, the child would not be eligible for *kehuna*. In cases of when the woman is homozygous dominant for this disorder, a non-Jewish ovum donor may be used, and the child will have to be converted as he or she reaches adulthood [8].

Fragile X syndrome is one of the leading factors and a common form of inherited intellectual disability. It is an X-linked dominant genetic disorder triggering intellectual and behavior deformities. Most of the fragile X syndrome cases are a result of an expansion in the CGG repeats in the *FMR1* gene. Normal individuals have about 30 CGG repeats, whereas the pre-mutation is at 51-200 CGG repeats and the full mutation is above 200 CGG repeats. When the repeats are expanded to over 200, the abnormal

methylation and suppression of the *FMR1* gene product, the FMR RNA binding protein, occurs. The lack of the FMR protein brings about the syndrome. Premutation alleles may expand to full mutations during female meiosis. However, interspersed AGG interruptions decrease expansion risk and increase allele stability [9].

A study conducted at the Tel Aviv Medical Center [10] evaluated the frequency of the normal, intermediate and premutation alleles among Ashkenazi and non-Ashkenazi Jewish women. In addition, in order to assess the risk of developing fragile X syndrome, the number of AGG interruptions were evaluated among the two groups. It was found that 95.6% of all women had normal sized alleles (7-44 CGG repeats), with 3.2% having intermediate sized alleles (45-54), 1.2% with the premutation (55-200), and three women with the full mutation (>200 CGG repeats). Between the two ethnic groups, there was a difference in the distribution of the alleles. Ashkenazi women had a lower frequency of 33-49 repeats, whereas there was no significant difference between the intermediate repeats (45-54) among both groups. Ashkenazi women had a higher rate of 30 repeats and close to twofold the rate of premutation alleles (55-59). However, between Ashkenazi and non-Ashkenazi women there was no significant difference in the rate of alleles above 60 repeats. Though 55-59 repeats are classified as premutation, in such cases, the expansion to full mutation is less than 5%. Thus, the increase in the frequency of 55-59 repeats among Ashkenazi Jewish women may not be associated with the expansion of the repeats. Finally, it was found that Ashkenazi women had less than half of the cases in which two AGG interruptions or fewer in the *FMR1* gene were present. This suggested that a protective founder allele with two AGG interruptions increased the stability of the *FMR1* gene among Ashkenazi women.

Affected individuals and women who may have the premutation can undergo genetic screening to assess the severity of the situation and consult a genetic counselor to evaluate their risk of passing the fragile X syndrome to their children. A 2001 research study conducted at the Sapir Medical Center at Kfar Saba, Israel [11] showed the importance and effectiveness of genetic screening for this disease. Between 1992 and 2000, 14,334 Israeli women with no family history of intellectual disability were tested. Three

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women were found to have the fully mutated allele. 207 women were found to have greater than 50 repeats, 127 of which had greater than 54 repeats. Among the carriers of the premutation and full mutation, 177 prenatal diagnoses were performed. It was found that expansion occurred in thirty fetuses, five of which had an expansion to the full mutations. In addition, the findings showed that the cost of the test in this study was \$100 per person. Whereas the lifetime expense for taking care of an intellectually disabled child is greater than \$350,000. Therefore, they recommend a wide-scale screening for this mutation in order to identify female carriers.

As the years are proceeding, the Israeli population is becoming more homogenous. However, the genetics remain and evolve. Thus, it is important for all individuals and especially those at high risk to undergo genetic screening and test for all genetic conditions as well as for Huntington disease and Fragile X syndrome.

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# The Medical Significance of a Broken Heart in Tanach

By Tamara Morduchowitz

Cardiovascular disease is the number one cause of mortality in America. These diseases often involve a blockage of one or more blood vessels, which are responsible for supplying the heart with oxygen. As a result, there is a lack of oxygen reaching the heart, and that leads to death of cardiac muscle. This blockage is usually the result of an acute plaque rupture which occludes the artery. Such lesions can also cause cardiac arrhythmias which disrupt the normal heartbeat and can cause death (1). There are many subtle references to cardiac disease in the *Torah*. By going through different sources in the *Tanach*, one is able to connect these cases to possible cardiac disease.

One of the more famous *Midrashim* explained Sarah's death in *Parshat Chaya Sara*. It was written, "Sarah died in *Kiriath-arba*, which is *Hebron*" (Gen. 23:20). *Rashi*, Rabbi Shlomo Yitzchaki, who was one of the most well-known *Rishonim*, explained that Sarah died when the *Satan* told her that Avraham brought their son as a *Korban* to God. When Sarah heard the news, her "soul left her and she died." Dov Eliach, in the *Sefer Peninim Mishulchan Govohab*, quoted Rav Chaim Shmulevitz who questioned this story. Why did Avraham make it through the *Eikadab*, but Sarah who had just heard about it, quickly passed away? Rav Chaim Shmulevitz answered that God gradually informed Avraham about the *Eikadab* over a period of time, but Sarah received that news suddenly, which induced a heart attack. The *Peninim Mishulchan Govohab* explains that suddenly hearing shocking news can trigger death by a heart attack. Medically speaking, it is known that high stress has a significant impact on the body, especially the heart. Sudden stress or trauma can release stress hormones, such as cortisol and epinephrine. The release of these hormones trigger metabolic changes, which increase oxygen demand on the heart and raise blood pressure, both of which can induce myocardial infarction (1).

Interestingly, the Talmud *Sanhedrin* (107a) notes that when God tests humans, He gives them extra strength to be successful. God gave this strength to Avraham, but Sarah was not allotted extra strength. The *Mahari* explains that just before the messenger

had a chance to tell Sarah that Yitzhak, her sole son, was not killed, her soul departed due to sudden shock. Thus, Sarah, not Yitzhak, became the ultimate sacrifice.

Sarah was honored with an entire *Parsha* named after her death. Interestingly, the *Parsha* is called *Chayai Sarah*, "the life of Sarah." Rabbis teach that when *tzadikim* die, their *Neshamos* still live on by being remembered for their righteous deeds. Additionally, it is important to note that Sarah, someone so holy and connected to God, died just like anyone else, showing that even great people can die through natural means such as a heart attack.

The story of Nabal and Avigayil (Shmuel 1, 25) also gives insight on cardiac complexities. Nabal is described as a rich selfish man, married to a good righteous woman, Avigayil. The story describes that when King David and his soldiers fled from King Saul, they asked Nabal for food and water. Nabal harshly rejected King David's request and insulted David. King David got upset and considered attacking Nabal. Without her husband's knowledge, Avigayil prevented her husband from being killed by bringing food and water to King David and his army. She asked King David to accept her gifts and requested for no bloodshed to occur, and David agreed. When Avigayil told Nabal what she did, the *Pasuk* notes, "His heart died inside him and became like a stone" (Shmuel 1, 25:37).

The manner in which the *Tanach* describes that Nabal's heart died within him and turned to stone from the shocking news parallels what happened to Sarah, and is similarly consistent with the medical dangers of stress on the heart. Dr. Moshe Steier quotes the medical historian, J. O. Lebowitz, who described Nabal as an unhealthy eater and a heavy drinker with a bad temper. After his wife told him what she had done, anxiety from the loss of his money and property triggered a myocardial infarction and he subsequently died 10 days later, possibly from a second heart attack (2). A small amount of alcohol may be protective to the heart by decreasing the amount of blood clots, but chronic alcoholics, such as Nabal, have an increased risk of congestive heart

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failure and multiple vitamin deficiencies. Long term alcohol use is capable of damaging every organ in the body. The cardiovascular dangers of alcohol have been known for over a hundred years to be detrimental to health (3).

It has been taught that heart attacks are a modern disease related to the stress of everyday modern life and were not as prevalent in ancient times. However, there is little data to indicate that modern day stress is different than the stress encountered thousands of years ago, even with people's different lifestyles and diets. Reginald Magee sites research on the ancient Egyptian bodies preserved by embalming. Scientists found that the mummies exhibited various types of cardiovascular disease. They found calcifications in the aorta, femoral and carotid arteries and at the base of the brain. Microscopic examinations showed cases of cholesterol deposits, arteriosclerosis (scarring of the arteries), plaques and fibrous tissue in the blood vessels. These clinical lesions are common in patients with coronary heart disease. There were also writings on papyrus paper, which described small swelling of vessels consistent with an aneurysm. These lesions that were found in the ancient Egyptians seem very similar to cardiac disease found nowadays (4).

The causes of these cardiovascular diseases are unclear. As per this article, there is no evidence of common causes of heart disease such as tobacco, pollution, and certain diseases, such as syphilis, in ancient Egypt. Alcohol does not seem to be a major

factor in heart disease because in studies of Muslims who did not drink alcohol, heart disease was still evident (4). Therefore, Nabal's death may not be solely from alcohol use, but may also be a result of other factors such as meat consumption and stress (4). This indicates that stress may be a large factor in ancient and modern day heart disease.

While Sarah and Nabal both died from possible heart attacks, one was a noble person and one was not; this shows that heart disease does not differentiate between good people and bad people. Although the stress that caused Sarah's life to end is somewhat different than the shock factor received by Nabal, Nabal's age and unhealthy lifestyle made him more prone for death. The examination of the mummies also serves as tangible evidence that cardiac deaths and heart disease could have occurred thousands of years ago.

## Acknowledgments

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# Jewish vs Jew-ish: Possible Proof Through Mitochondrial Misconception

By Danielle Pasternak

Israel has always been known as a homeland and safe space for Jews all over the world. On May 14<sup>th</sup> 1948, the State of Israel was established; Jews everywhere were overjoyed, as they now knew that they had a country to call their own. Israel has a policy known as *Hok Hasbivut*, or the Law of Return, which allows anyone who is Jewish to claim Israeli citizenship. The Law of Return identifies someone who is Jewish as having at least one Jewish grandparent, or as someone who is married to someone who is Jewish. According to *halacha*, only someone born to a Jewish mother or someone who converted to Judaism through an Orthodox conversion is considered to be Jewish. The Chief Rabbinate of Israel recognizes someone as a Jew based on the Orthodox Jewish law, not according to the Law of Return [1]. This would mean that a person can be Jewish according to the State of Israel, but not *halachically* Jewish according to rabbinical law.

Since Israel is a Jewish state, there is no separation of church and state. Only an Orthodox Israeli Rabbi can marry a Jewish couple, and the laws of marriage are held according to Orthodox *halacha*. As mentioned, one anticipating marriage has to be *halachically* Jewish. Therefore, many immigrants who settled in Israel under the Law of Return cannot marry a *halachically*-recognized Jew in Israel, because they are not identified as Jews according to *halacha*, and/or lack proof that identifies them as Jewish [2].

With insufficient evidence to prove someone is Jewish, many hoped to turn towards DNA tests as a last resort. The majority of one's DNA is located in the nucleus of the cell, however, a small amount of extranuclear DNA is found in mitochondria in the cytoplasm. This DNA is known as mitochondrial DNA (mtDNA) [3]. Mitochondria, commonly referred to as “the powerhouse of the cell,” are responsible for converting energy obtained from food into energy that the body can use [4].

Mitochondrial DNA was thought to be transmitted only from mother to child. This is noteworthy because being *halachically* Jewish is also only transmitted from mother to child. Thus, the B'Mareh HaBazak says that for clarity on whether or not someone is Jewish, a mtDNA test can be done. If the

mtDNA test indicates transmission from a Jewish mother, it would seem to be proof of one's Jewish origin. The mtDNA is passed down identically from mother to offspring, unless a change occurred by random mutation [5]. However, *halacha* denies the validity of a mtDNA test to prove that someone is Jewish [6].

It has long been believed that mtDNA originated entirely from the mother, through the egg, even though sperm also contains mitochondria. A sperm cell is composed of three sections, the head, the midpiece, and the tail. The head contains the genetic information (*i.e.*, the haploid number of nuclear chromosome), the tail functions as a rotor for sperm movement, and the midpiece, containing mitochondria (with mtDNA), connects the head to the tail [7]. Many have thought that during fertilization only the head of the sperm penetrates the egg. This would indicate that mtDNA would only be inherited from the mother because the part of the sperm holding the mtDNA would never enter the egg and, therefore, would not contribute to the mitochondrial genetic material of the eventual offspring. However, recent studies have shown that the midpiece enters the egg as well, not just the head of the sperm [8]. Apparently, the father's mtDNA enters the egg, and the resulting embryo and fetus would have mtDNA from both parents. This new understanding of mtDNA transmission disqualifies mtDNA as a potential form of determining if someone is *halachically* Jewish because mtDNA is not only passed down through the mother.

With many new technological advances regarding mtDNA, new *halachic* challenges are introduced. Mitochondrial-based diseases result from malfunctioning mitochondria and the inability of cells to produce sufficient chemical energy for maintaining bodily functioning. Currently, there are no treatments for individuals suffering from many of these disorders. However, current studies on *in vitro* fertilization (IVF) technology have developed a procedure whereby these mtDNA diseases can be prevented from occurring. New procedures known as “mitochondrial replacement therapy” can allow parents to have healthy, unaffected children.

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Mitochondrial replacement therapy involves using an egg from a healthy donor. The nucleus is removed from the egg of the would-be mother with the mtDNA disease and is inserted into the enucleated egg from the donor. The hybrid egg (*i.e.*, consisting of healthy cytoplasm and mitochondria from the donor plus a healthy haploid nucleus from the would-be mother) is now fertilized with a sperm cell from the father. The zygote contains nuclear DNA from the mother, nuclear DNA from the father, and the mtDNA from the mitochondrial donor [10].

The fetus produced from mitochondrial replacement therapy would offer a way for mothers with mutated mtDNA not to transmit it to their offspring. 99.9 % of the fetus's DNA would come from its parents, while the remaining 0.1 % would come from the cytoplasmic donor. This child who is born from mitochondrial replacement therapy would therefore have 3 biological parents [11]. This raises multiple *halachic* questions. What is the *halachic* status of a baby if the female mtDNA donor is not Jewish? Would both mothers have to be Jewish for the baby to be Jewish? The first male child born to a *Bat-Kohen* or *Bat-Levi* does not require a *Pidyon Haben*, whereas the first

male child born to a *Bat-Yisroel* does require a *Pidyon Haben*. The question regarding this issue is what would the status of a first born baby whose mother and mitochondrial donor differ be in terms of priestly status [12]?

With technology developing constantly, many new procedures and treatments are always proceeding. Topics of DNA replication and donors involved in infertility, bring rise to many *halachic* questions about a baby's Jewish status. With many different opinions and, as of now, no set *halachic* guidelines, the question of whether or not one is Jewish or Jew-ish based on mtDNA still remains unanswered.

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# Determining Death; The Halachic and Medical World

By Shira Tziona  
Perton

A patient is brought into the ER, they had recently contracted a viral infection that attacks the muscles in the heart. Over time, the heart is weakened to the point that it is unable to pump blood through the body. The only possible cure is a heart transplant and, unfortunately, through the process of trying to acquire one, the patient needs to be put onto a ventilator and receive intubation. After a twenty-four-hour period of monitoring, the patient falls into a coma state and after 48 hours and a series of tests, he is pronounced brain dead. The family, who had already been spoken to about the idea of organ transplant, was confused, as their loved one still appeared to be alive, as their chest was moving up and down breathing. In truth, the debate of what establishes the death of an individual goes back to the times of the Talmud; the Talmud elaborates on whether death is defined by the ceasing of the heart's beating or the signal of the termination of the brain stem.

In the world of medicine, death is defined as “the cessation of circulation”. The assumption is that when circulations stop, the bodily functions that sustain life begin to shut down as they lose the flow of blood and oxygen needed to be sustained. However, although it used to be easier in the earlier years of medicine to term the cessation of circulation as the signs of someone dying, it is no longer that simple, as technological advances allow for a person to be sustained by machines in order to provide manual circulation. With this advent of technology, it is hard to determine whether the actual cause of death is the cessation of the heart or even the cessation of one's circulation as machines can all maintain those functions beyond the point of the actual ending of life. Thus, the defining factor that is used for determining death is through the concept of “irreversible loss” and this means that physicians determine death as the absence of tissues and/or function that are essential for life [1].

The Halachic world debates whether death is determined by the stopping of one's heart or of the brain stem. In the Talmud, we are presented with a case where a person who is not breathing is

considered dead. This view was adopted by the Talmud and the Shulchan Aruch. However, this opens up an opportunity to question what the Talmud actually means by a lack of breathing, as it could have two meanings: that it actually *causes* a person to die or that it is merely an identifying factor for being viewed as dead [2]. If we assume the latter to be true, then a person who is not breathing might not necessarily be dead. The ambiguity is important to address, as we often assume that if a person is not breathing, death has already happened. In an effort to clarify this, the Chatam Sofer explains that out of ten thousand cases, in ninety-nine thousand of them, the cessation of breathing was not the determining factor of their death [3]. Rav Moshe Feinstein goes on to explain that breathing cannot be a clear determining factor of death as there are times when one collapses and their heartbeat is so faint that it's; detection can go completely undetected. However, now a new question arises; what is it that makes an individual die? Seemingly, it is not the cessation of breathing, as that is only a post facto indication to an observer that the individual might be dead and not an actual inherent determinant [4].

When a patient is pronounced ‘brain dead’, this indicates an irreversible cessation of blood flow to the brain, as indicated by an assessment of the brain stem reflexes and an apnea test [5]. Accordingly, it is essential to determine the halachic status of the brain and heart and how they interact. In the Mishna, we are taught that if there is a situation where a person's life needs to be saved on Shabbat or Yom Tov, we are allowed to violate the prohibition of performing melacha on Shabbat in order to save a life. A Mishna in Yoma explains that if a structure collapses on a person on Shabbat, and it is not clear as to whether or not they are stuck beneath the debris, the bystanders should violate Shabbat by removing the rubble off in order to potentially save a life. How far does this go? The rabbis say that one should remove the rubble until the victim's nose appears and most rishonim agree with this point. Rashi explains that the reason why we would want to check up until the nose is because if a person does not exhale and we cannot see that sign of life in his breathing then he must be

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dead, and at that moment it would be prohibited to continue removing the rubble [6].

The question of whether death is defined by the ceasing of the brain stem or of the heart is illuminated upon by the Chatam Sofer who explained that for the majority of patients, if the heart stops beating, first, the blood it supplies to the brain will cease. Then, after a few minutes of failed resuscitation, the brain will slowly begin to lose function. When the brain stem dies, because it controls the respiratory system, the breathing will stop and the individual dies. There are very few cases where this process would be reversed, such that the brain would die first. When this does happen, the effect is the permanent cessation of the respiratory system flow, even though the heart may still be beating [6]. While we cannot suggest that the Talmud's view is simply incorrect, it may need to be supplemented with the iteration of *autonomous* breathing.

When a patient is being checked for possible brain death, the physicians check all the reflexes of the body in order to observe life in the brainstem. This is performed with a series of tests. Upon finishing these tests, the final determination is removing the patient from the ventilator, and if they attempt to breath, they are not considered to be brain dead, however, if they do not show any signs of attempted breathing, they are considered dead. For this determination, both Halacha and the medical world are on the same page. With the advent of the respirator, new questions have been raised regarding whether or not breathing can be an identifying factor of death. Through the testing of the hospital that the patient is in, the acknowledgment of the Mishna Yoma, as well as the different responses received from various rabbis, the ultimate decision that was concluded by the Israeli Chief Rabbinate was that once the irreversible death of the brainstem occurs, even if the heart is still beating, one is considered dead and the doctors are permitted to begin removing ones organs in order to save the lives of others [7].

When a person has reached such a vegetative state that they are deemed brain dead, the hardest party that is hit in the situation is the family and/or loved ones. The person does not appear to be different, almost appearing to be in a dream like state. Their bodies still feel warm, their chest is still moving up or down and if one stares long enough it is possible to convince ourselves that we see their eyelashes flutter. It is easy to create a multitude of questions; *they look exactly the*

*same! The doctors are giving up too quickly, they seem perfectly fine. Perhaps a miracle could occur.* A harsh reality of these forms of questions and hopes is that although there have been cases of patients waking up from both long-term and short-term comas, there is no incident to date of a patient waking up from brain death. Brain death is an occurrence that is irreversible and a lot more of a serious case than that of a cardiac arrest. When the heart stops functioning, we are able to get it to pump again, both inside and outside of the body, however, we cannot revive a brain stem.

The medical world and the halachic world will sometimes overlap and other times contrast in the positions they take on many different situations. One common ground that can be found is the autonomy of the patient and what is best for the outcome of the patient, both logically and ethically. The topic itself is difficult. Brain death is a very hard concept for many to wrap their heads around and the moments between being considered “alive” to “brain dead” are so minute, which makes these realities even more difficult to understand and deal with. The prevalence of this topic is such that it is important for all to understand and be familiar with. The concept of burying a person as soon as possible in Judaism is a factor in these sorts of questions, as, if the person is actually considered dead while we keep their body alive through machines, their soul is lingering in this world when there are much better opportunities for it in the next one. Organ donation is also a huge factor in this discussion, as one's overall functions and organ ability begins to shut down once he or she dies and there is an optimal time for success of an organ donation post-death. It is fair to say that this topic is not only medical or halachic, it is also personal.

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- Briefly, the physician should establish proximate cause and irreversibility of the coma and monitor the patient for an appropriate waiting time in order to exclude any possibility of recovery. The physician should then initiate the hospital policy of notifying the patients surrogate decision maker. Next, the physician conducts and documents the physical assessment of the brain stem reflexes, performs the apnea test, and ancillary testing. Brain death should then be certified and the decision of discontinuing cardio-respiratory support is then discussed.
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# Fingerprints: Uniqueness within the Community

By Esther Solooki

No two fingerprint patterns are identical. Even identical twins who share the same DNA possess different fingerprints. The ridge patterns present on an individual's fingers are inherited as a polygenic multifactorial trait. Not only is this trait controlled by multiple genes, but the prenatal environment to which a fetus is exposed influences his or her fingerprint patterns. Once the baby's fingerprints are formed, however, they are resistant to change by later influence, whether prenatal or postnatal [1]. Thus, dermatoglyphics, the study of epidermal ridges, is useful not only for the identification of individuals, but for genetic studies as well. Numerous studies have investigated the relative frequencies of fingerprint patterns, known as whorls, loops and arches, in distinct populations. The data suggest that "peoples indigenous to different parts of the world...differ genetically in their relative frequencies" of the three common fingerprint patterns. There is, however, no evidence to hint to an adaptive significance to different pattern frequencies. Each population, therefore, has acquired characteristic fingerprint genes by chance and passed them on to future generations, despite numerous migrations [2]. Specifically, Jews have been the subjects of many dermatoglyphic studies, which conclude with a common analysis: the frequency of fingerprint ridge patterns in the population studied is similar to the frequencies found in other Jewish populations.

Fingerprint patterns and their relative frequencies demonstrate that distinct, indigenous populations are genetically different from one another. At the same time, however, individual fingerprint patterns indicate that each person is unique.

## The Bond of the Nation

Two separate studies examined the ridge pattern frequencies in two distinct populations of Jews living in Israel – those of Middle Eastern descent and those of East European descent. Within each population, the researchers determined dermatoglyphic sexual dimorphism (distinct fingerprint pattern frequencies

found among the male and female sex) for each group. The researchers found, upon analysis of the ridge count frequencies in the Middle Eastern group, that "the dermatoglyphic characteristics are similar to those found...in other Jewish groups of different geographical extraction" [3]. In the next study performed, the same researchers concluded that the population of East European Jews who were studied presented similar "general characteristics of dermatoglyphics...to those found in other Jewish groups" [4]. Although these two groups of Jews lived in different parts of the world for many years, their fingerprint genetics showed similar frequencies in each fingerprint type. The similar frequencies hint to the common ancestral starting point of the Jewish people. At a certain point in history, the Jewish nation lived together in the land of Israel – indicating that each ethnic group preset within the Jewish community today originated from the same gene pool. While the Jewish community is made of ethnically different groups, its fingerprint genetics demonstrate its common ground.

Analogously, this unifying gene pool can take on a more symbolic meaning. While the nation of Israel travelled through the desert on their way to *Eretz Yisrael*, Moshe expressed to the Jewish people that they are "a treasured possession among all the peoples" in the eyes of God (*Shemot*, 19:5). On this verse, Sforno comments: even though all human beings are important to God since He is represented only through them, for each person is created in the image of God, the Jewish people are treasured among the rest of the world in the eyes of their Master. All individuals on this earth are created in the image of God. The Jewish people, however, hold a special place in God's heart. The Jewish nation has a bond to God, unlike any other nation. Like Sforno, Rashbam also discusses the unique connection between God and the Jewish people. Rashbam adds that although all the nations of the world are under the dominion of God, He has chosen only the Jewish people to be His own. God is in control of the whole world and all the people living in it. He has, however, specifically chosen

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the Jewish nation – and no other nation – to be His chosen people. This, in turn, is a characteristic which unites the entire Jewish community. No matter where we come from, what language we speak, or what traditions we keep, the Jewish nation is *one* because we were all chosen by God to be His people. Each and every one of us are able to relate to one another because we, as a people, are special in the eyes of God. The status we share as a nation exemplifies the connection we each share to our fellow Jews. We exist not merely as individual human beings, but as an individual within the larger context of *Am Yisrael*.

### The Uniqueness of the Individual

Perhaps more directly, the fact that each individual carries a specific fingerprint pattern relates to the individual's uniqueness. There are no two people with the same fingerprints - they are completely unique.

In *Parshat Naso*, the *Torah* lists the offerings which each of the twelve *nesi'im* brought in honor of the dedication of the *mishkan*. While each *nasi* brought the same offering, each of the *nesi'im* - and his respective offering - are listed individually. Our sages attempt to resolve this seemingly unnecessary repetitiveness and answer the question in multiple ways. *Chazal* in *Bamidbar Rabbah* explain that this repetitiveness is indicative of the uniqueness of each of the tribal leaders. The *midrash* states that the sacrifice of each tribe alluded to an aspect of their particular identity. While the leaders adhered to the divine guidelines, each inserted his own sense of individuality. Each gift was personalized by the individual who gave it (*Bamidbar Rabbah*, 13-14). Ramban interprets the repetition as a means of conveying the intention each *nasi* had for offering his personal sacrifice. While on a physical level, each sacrifice outwardly looked the same, each individual brought it with a unique idea in mind. Ramban emphasizes that the offering itself is a mani-

festation of an inner, spiritual connection to God (*Ramban*, 7:2-5). People connect to God in extremely different and personal ways. So too, the *nesi'im* brought their offerings with a specific personal touch which allowed for a deeper connection to God.

At first glance, the fingerprint patterns on our fingers are hard to see - they are not deeply etched into our fingertips. If we look a little closer, however, we are able to see the ridges present on our fingers and can then visualize how we differ from others. We are therefore able to visualize how each individual is unique in his or her own way.

People may tend to find differences among themselves and others, or between their community and another. Of course, it is important to understand that each individual has a special role and a particular quality to bring to the world. We must strive to understand ourselves and determine our specific mission in this world. At the same time, however, we must understand that we exist within the larger context of the Jewish people. There is a spiritual bond which unites us all in the eyes of God. So too, this bond should be a unifying force in our lives.

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# How twins can answer the question: Do we have free will?

By Ruth  
Tawil

We have all come in contact with, seen on TV, or read about identical twins. Oftentimes, they seem to act the same way, say the same things and one is almost able to predict what the other twin will do next; after all, they have the same genes. So, if twins' genes provide them with similar personality traits and lead them to make the same choices, does that mean that everyone's genes determine how they act and how they choose? Do our genes preprogram our choices? Free will is a key element in Judaism. The question is, does the tenet of free will in Judaism contradict genetic predetermination?

Identical twins contain the same exact DNA. Each protein and enzyme in their body and each physical feature are all produced from the same DNA template. For years, twins have been the center of research, especially to determine if diseases or traits are solely determined by the genetic code. For example, identical twins were used to identify those environmental factors that trigger diabetes, epilepsy, and autism in one identical twin but not in the other. The U.S. National Aeronautics and Space Administration (NASA) studied identical twins to determine whether space travel affected the genes of the identical twin who was the astronaut versus the identical twin who stayed on Earth. Identical twins have also been subjects in studies of personality traits and whether these traits were determined by the genes or by the environment [1].

It may be difficult to study nature vs. nurture in sets of identical twins because they typically grow up in the same environment, making their "nurture" aspect identical. The most effective way to study the influence of the environment on identical twins is to analyze twins who were separated at birth and raised in contrasting settings. In 1980, Robert Shaffan attended college in upstate New York and unexpectedly encountered his long lost identical twin, Edward Galland. Neither had an idea of the other's existence. Shaffan and Galland soon found that they were not just twins, but triplets! David Kellman, the missing triplet, found the two young men from the news, and the three triplets were united. The triplets were separated at birth and were unknowingly part of

a psychological study on nature vs. nurture. The lead researcher of the study, conducted at Yale University, was Dr. Peter Neubauer, who died in 2008 without publishing the results. By viewing these men in interviews and on TV, many interesting observations were noted. At the interview the three men showed up wearing the same pair of shoes. Was this genetically predetermined? However, the men led very different lives, even after discovering one another. At first, in interviews and at appearances, they seem so connected; they even jointly opened a restaurant in New York City. But it did not remain like this for long. Unfortunately, Edward committed suicide and Robert and David explained that they were very different people. Although they had some similarities, they believed that their distinct environments shaped their characters. Nurture can push nature in many different directions and we are not limited by our genetic constitution [2].

In *Strive for Truth*, Rabbi Dessler describes a man who is a heavy smoker. At night, he experiences severe chest pain, so bad that he promises not to smoke the next morning. However, upon awakening, the craving kicks in and in his mind the thought is, "I'll just have one." So, he smokes just one cigarette, which then turns into two, then three, then ten. How could this happen? He wanted so badly to get rid of his physical pain from smoking, even more than he wanted a cigarette. So why was he unable to resist? Rabbi Dessler explains that there must be something else besides his two drives, to smoke and to stop smoking. That something else is "him." He has the choice to follow his will of ridding this chest pain, but instead he follows his will of "I can have just one more." He very well knows that one cigarette will lead to another cigarette, but chooses it anyway. *Behira*, or free-will, is just the same. A person's *behira* is completely dependent on him. When one chooses good over bad and in turn overcomes his *yetzer harah*, the evil inclination, he has chosen the stronger will to do good over his will to do otherwise [3]. So too, our DNA may lead to act a certain way, but ultimately we have the choice to rise above our genetic predetermination.

In the *Torah*, we have two accounts of twins. The

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most famous are Esav and Yaakov, the sons of Rivka and Isaac, and the second set, Pharez and Zerah, the sons of Tamar and Judah. We know from the *pasuk* in Bereshit (25:22), “the children struggled within her,” that Rivka had physical difficulty during pregnancy. When they were born, Esav was described as red and hairy while Yaakov was holding onto the heel of his brother. When looking ahead in the *Torah*, the two brothers seem like polar opposites. Esav becomes a strong hunter while Yaakov becomes a learned and calm man. It seems almost obvious that these two men cannot be identical twins. However, the fact that Yaakov “took his brother by the heel in the womb” (Hosea 13:3) indicates that they shared the same amniotic sac and apparently were actually monozygotic identical twins. But, their physical appearances would indicate otherwise. A possible reconciliation of this discrepancy can be attributed to twin-to-twin transfusion syndrome, in which both fetuses shared a common placenta. If the placenta is shared unequally by the twins, one twin may have a share too small to provide necessary nutrients whereas the other twin may have an overabundance of nutrients – resulting in identical twins exhibiting differing appearances (phenotypes), albeit sharing a common genotype. The grabbing of the heel indicates that they were monozygotic and identical in DNA, yet their actions present them as very different characters. Clearly one's actions are not only based on their DNA. Like Yaakov and Esav, one has the inner power of rising above what was encoded in one's chromosomes [4].

Interestingly, Rav Samson Raphael Hirsch [5], in his commentary on Bereshit 25:24, states that, in fact, Yaakov and Esav were identical twins. Rav Hirsch writes, “After Rivkah heard of the complete contrast between the two sons that were to be born, everyone thought that the two would not look alike, which does happen even in the case of twins (*i.e.*, in fraternal

twins). The surprise was to find that the twins were indeed identical.” The only difference between the two twins was in their constitution. Esav was healthier and more physically developed than Yaakov but they were in fact identical twins. Rav Hirsch continues on to say, “The external resemblance, had they compared it with the revelation about the divergent paths, should have drawn the attention of the boys' educators. It was their duty to recognize that the root of the future dissimilarity lay deep below the surface, hidden in the depths of personality.” Their differing appearances reflected their future discrepancies and should have been a clue to their educators to nurture the boys accordingly. This account in *tanach* furthers the point that genetic constitution does not automatically determine a person's choices. Yaakov and Esav had the same genes, yet they led two very different lives. Their physical appearance foreshadows this and highlights the idea that a person is in control of their choices and has the power to choose their path in life.

The next time you see two twins acting the same way, instead of assuming that their identical DNA is what is causing this, think of the environment and the inner own control over one's actions. We all have the power to rise above our inherent inclination. We may have been given certain tendencies but ultimately we all have free will that allows us to choose to act and how to live.

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# From Oral Decay to Cardiac Dismay: The Seeming Correlation Between Poor Oral Hygiene and Cardiac Disease

By Tovah  
Blank

Oral hygiene and oral health have and will continue to occupy the mind space of physicians and dentists as diseases continuously reveal their origins within the oral cavity. Certain systemic diseases such as AIDS and diabetes initially manifest symptoms such as oral lesions or other oral problems. Additionally, according to the Academy of General Dentistry, over 90 percent of systemic diseases contain oral side-effects [1]. The necessity to maintain proper oral hygiene is by no means a relatively modern phenomenon, rather, it dates back to the *Tanach* and the Talmud. Moreover, throughout early Jewish texts, the sages and scholars make clear that there is a corollary between oral health and the overall health of the human body. Although there have only recently been discoveries showing that poor oral hygiene, dental caries, and gum diseases may lead to heart disease, there seems to be possible proof of this idea stemming from early Judaic religious literature.

There are several times throughout Jewish literature where the importance of teeth is mentioned. The Midrash Shmuel (*Avos* 4:1) comments on the Mishna's statement that a truly rich person is someone who is satisfied with his lot. However, he also notes that a truly rich person is someone who has all limbs, specifically someone who is completely healthy. He further substantiates this concept by stating that even the son of a king can be considered poor, if he is not healthy. He writes that *ashir*, or rich, is an acronym in Hebrew for "eyes, *teeth*, hands, and feet." The Maharal (*Niddah* 65a) also mentions teeth, where he writes that teeth are indicative of an aging body. He notes that a person's sustenance is diminished in the elder years because the teeth start to fall out, leading to the inability to eat properly. This reduced sustenance, in turn, causes the deterioration of the overall body. From this commentary of the Maharal, it can be seen that the mouth, and teeth in particular, can be viewed as a gateway to the general well-being and health of the entire body. Another example of this is cited in the Talmud (*Brachot* 44b). When discussing different food items, the Talmud

quotes a *Braita* explaining that eating meat of the spleen is beneficial for the teeth, but is bad for the intestines. On the other hand, eating leeks is harmful for the teeth but is thought to be beneficial for the intestines. The Talmud proposes different remedies for each malady, making it clear that it is necessary to maintain teeth in their proper condition.

In addition, the Talmud elaborates on the importance of proper oral hygiene, specifically in regards to bad breath, or halitosis. The Talmud (*Brachot* 44b) discusses that a person who consumes vegetables before the fourth hour of the day should not be spoken to because the odor emanating from the mouth is offensive to others. Rav Yehuda HaNasi was sensitive to the smell of garlic, and anyone who had eaten garlic was asked to leave his *Beis Medrash*. Rav Hiyya who initially stood up and left was approached the next day by Rav Yehuda HaNasi's son. When Rav Yehuda HaNasi's son asked Rav Hiyya about eating garlic and disturbing Rav Yehuda HaNasi, Rav Hiyya answered, "there should not be such behavior amongst the Jewish people" (*Sanhedrin* 11a). Meaning, that according to Rabbi Hiyya, it is improper to enter a place of learning with bad breath. Additionally, talmudists in *Ketuvos* (77a) discuss the parameters for which a *ketubah*, a Jewish marriage certificate, can be unquestionably annulled. The Talmud lists several activities or attributes that are considered major and minor issues for a reasonable divorce. Included in the list is one with a "polyp". When questioning what a "polyp" is, Rav Yehuda, in the name of Shmuel, quotes a *Braita* explaining that a "polyp" is foul odor of the mouth. If the husband discovers after marriage that his wife has a major disability or something that truly bothers him, such as bad breath in this case, he can legitimately annul the marriage without paying his monetary obligations normally incumbent upon him. Therefore, it is clear that *halacha* not only views bad breath as a major issue, but as something that is of serious concern and that should be avoided.

These sources show that Judaic literature discusses

the importance of oral care, but the specificities and reasons for its necessity are elaborated by the discoveries of doctors and scientists. Failure to brush and floss regularly can lead to the buildup of plaque, which is a sticky matrix of bacteria and their excreted metabolic waste. These bacteria can thrive within the plaque and cause inflammation, while other oral bacteria excrete acid, which erodes tooth enamel and causes cavities, possibly leading to complete tooth loss [2]. Although it is usually impossible for these bacteria to enter the bloodstream, routine oral treatments or procedures such as brushing teeth can open passageways for these harmful microbes to enter blood vessels. That is why it is imperative that one constantly maintains proper oral healthcare, so that initially these bacteria never grow. In addition, lack of saliva also proves to be a point of passageway for harmful microbes into the bloodstream, because saliva usually inhibits the flow of microbes and contains them within the oral cavity. This poses a particular problem for patients who take medications that reduce or alter saliva flow, because this leads to a greater risk for increased microbial entrance into the bloodstream [3]. Normally, however, an individual's health is not severely compromised by most of the bacteria that enters the bloodstream from the oral cavity. The problem, therefore, lies in those individuals with a compromised immune system, such as patients on immunosuppressants or undergoing chemotherapy. When bacteria enter the bloodstream of these patients, there is an enhanced risk of developing diseases throughout the body. Therein lies the beginnings of the theory that certain cardiac diseases are a result of poor oral health.

Untreated cavities and tooth loss have been found to lead to periodontal diseases, as oral bacteria can flourish and grow in small spaces. In a study performed, 46 percent of participants who were missing nine teeth or fewer presented with carotid artery plaque. Among the individuals who were missing ten or more teeth, 60 percent presented with carotid artery plaque [4]. This indicated that the greater the severity of the disease within the oral cavity, the greater the risk of the development of diseases throughout the body, specifically within the heart. This phenomenon of oral bacteria leading to cardiovascular disease is also supported by the presence of these bacteria in atherosclerotic blood vessels far from the mouth. Moreover, patients with diabetes (who often suffer from cardiovascular issues) benefit from periodontal treatment [5].

This idea of missing teeth leading to poor health is repeated several times throughout *halachic* works. In the Talmud (*Pesachim* 113a), Rav says to Hiyya, “do not get into the habit of drinking medication (out of fear of becoming addicted to the medication)...and *do not pull out a tooth*.” The Talmud is referring to the removal of an infected tooth, under the assumption that if the tooth would remain in the mouth it would heal itself. Rashi comments that Rav is referring to the necessity of an actual tooth remaining in the mouth, since pulling out teeth can lead to illnesses. The *Mor Kitziah* comments on the *Shulchan Aruch* (328) and notes that one should be careful about taking out a tooth. He writes that even during the week (as opposed to Shabbos where one might be more stringent regarding the removal of a tooth because of *refuah*), a tooth should not be removed because removal can cause damage.

Several studies attribute the greatest cause of cardiovascular diseases to gum diseases. According to the American Academy of Pediatrics, symptoms of gum disease include bad breath, puffy and protruded gums, gum bleeding accompanying brushing or flossing, pus formation around the teeth, and loose teeth [6]. Additionally, researchers have suggested that the bacteria found in patients with gingivitis were associated with peripheral arterial disease and atherosclerotic plaque in the arteries, possibly increasing the risk of a heart attack due to blockages. Strokes may also arise from the buildup of atherosclerotic plaque because the damage caused to the arteries and blood vessels throughout the body can lead to hypertension [7].

The Talmud references the severity of gum diseases in relation to the overall health of the body. In *Avodah Zara* (28a), Rav Adda bar Mattana comments on Rav's teachings that one may desecrate the Shabbos for treatment of a life threatening internal injury. The Talmud questions what is considered an internal injury, to which Rabbi Ami answers, is an injury “from the lips inward.” Rabbi Eliezer then raises a dilemma and asks what the *halacha* is regarding afflictions of the gums or teeth. In questioning whether such afflictions are considered external or internal injuries, the Talmud discusses the disease of *tzafidina*, which Rav Yochanon suffered from. This disease affects the gums and teeth, causing blood flow when items are placed between the teeth. The etiology of the disease was the consumption of very cold wheat foods and very hot barley foods, in addition to fried fish. Clearly, the Talmud is aware of the pain and

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sensitivity caused by eating foods of dramatically different temperatures and believed that food remaining on the teeth is a major cause of the *tzafдина* disease. The Talmud concludes that an affliction that affects the gums is similar to an internal injury and, therefore, a remedy for such a disease can be prepared on Shabbos. The Talmud continues, “Rav Nahman bar Yitzhak said: *tzafдина* is different, since it begins in the mouth, and ends in the intestines”.

According to Rav Nahman bar Yitzhak, the reason one is allowed to treat *tzafдина* on Shabbos is because it is considered an internal injury, as the disease spreads and eventually reaches the intestines. The *Shulchan Aruch* (*Orach Chaim* 328) codifies this idea by concluding that a person can violate the Shabbos to find a remedy for all internal sores, “from the teeth inwards, including the teeth.” The *Shulchan Aruch* continues and states that this case, in which one is allowed to violate the Shabbos, is specifically when one of the internal organs suffers damage from the wound. From here it is possible to draw proof that the Rabbeim were aware of the health issues that manifest throughout the body as a result of poor oral health. Therefore, one can deduce that perhaps such internal afflictions include those of the heart.

It is often the case that values and principles from Jewish literature and halacha emerge prominently in

secular studies thousands of years later. This phenomenon proves true once again as *halachic* literature suggests that poor oral health leads to diseases of the body. This idea remains a theory as a result of both inconclusive and scarce evidence that poor oral health leads to cardiovascular diseases. Nevertheless, there seems to be an unexplained correlation between the two, which is why it is strongly encouraged that people maintain their oral health by visiting the dentist regularly, thoroughly brushing teeth twice a day, flossing, and eating properly. By doing so, individuals will not only be protecting their mouths, but perhaps their hearts as well.

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# Genetic Diseases in the Jewish Persian Community: Can They Be Prevented?

By Leeroun (Lilly)  
Yaghoubian

Jews have a common gene pool dating to the Patriarchs and Matriarchs of the 12 tribes. Within the overall Jewish community there are genetic diseases that are more frequent to certain subgroups of Jews. Unlike other Sephardic and Ashkenazic Jewish communities, the Persian (Mizrachi) Jews have mainly remained isolated and stable for over 2,400 years. The Persian community remained an isolated population until the Islamic Revolution of 1979, when the Iranian Jewish community consisted of about 135,000 individuals. Most of the Persian Jews migrated to Israel after the revolution and now comprise about 3.5% of the Jewish community in Israel [5]. The remainder of those immigrated to America and settled in southern California and Long Island, New York [3]. Due to the high level of inbreeding within the Persian Jewish community, there are several rare genetic diseases that are found to be frequent in this specific community.

By studying the most common genetic diseases within populations, scientists are able to identify the genes responsible for such diseases. A study was done in 2010 that focused on 1,000 Persian Jews in Los Angeles, California who were screened for mutations responsible for four frequent autosomal recessive conditions. Those diseases included: pseudocholinesterase deficiency, congenital hypoaldosteronism, autoimmune polyendocrinopathy, and hereditary inclusion body myopathy. Pseudocholinesterase deficiency is more frequently called anesthesia sensitivity syndrome. Those who are affected, usually do not know they have the disorder until exposed to the specific anesthetic. The mutant gene cannot produce butyryl cholinesterase, resulting in the inability of the body to efficiently degrade certain anesthetics efficiently. Therefore, the anesthetic remains in the body for a longer amount of time and those affected may exhibit prolonged effects such as muscle weakness. The pathology congenital hypoaldosteronism, is caused by a deficiency of the activity of the enzyme, corticosterone methyl oxidase II. The disease is more commonly called, "salt losing syndrome." There is a wide range of clinical manifestations in those who are affected. More severe

forms of the disorder include critical dehydration and shock in the newborn period. A less severe form of the disease manifests in poor weight gain during childhood, short stature, weakness, dizziness, or salt craving into adulthood. It is clinically diagnosed in the first weeks of life because too much salt and a deficiency in potassium can be tested for in a urine sample. Early detection and treatment can allow for a normal life span and symptoms can even disappear by adulthood. However, more severe cases can lead to coma and death [3].

The Iranian Jewish community has a high frequency of specific hereditary diseases due to a combination of a founder effect and genetic drift. The evidence for the founder effect is seen in those affected with congenital hypoaldosteronism. Studies show that all of those affected are homozygous for two mutations of the gene CYP11B. In Mediterranean countries where Beta-thalassemia is prevalent, more than one mutation was found in the population. Studies show that in Jews from Iranian Kurdistan there are 5 different mutations that contribute to the high frequency of the disease. Since these mutations are different from the mutations found in other Kurdish Jewish communities, the high frequency of hereditary diseases can be attributed to the population's isolation. Moreover, another reason explaining the high frequency of some hereditary disorders may be due to the heterozygote advantage. The Jews in Iranian Kurdistan have a high frequency of G6PD deficiency which confers a selective advantage against malaria. Molecular studies done in this population show that only the G6PD mutation is found frequently and suggests that it's due to the founder effect [6].

Unlike the Sephardic and Mizrachi Jewish community, genetic screening has been widespread in the Ashkenazi community for decades and has educated and helped families everywhere. However, the Sephardic and Mizrachi communities were not as eager to participate in genetic testing for a few reasons. Dr. Ohad Birk, the head of the Genetics Institute at Soroka Medical Center in Israel, believes that the lack of genetic testing for Sephardic and

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Mizrachi Jews stems from the complicated genetic dynamics of their communities [6]. All Ashkenazim are affected by the same genetic diseases, however the Sephardic and Mizrachi Jews are more likely to acquire a certain disease based on their country of origin. Due to this, genetic testing became much more difficult and the different non-Ashkenazic communities each had their own specific genetic mutations. Thus, these non-Ashkenazic communities, and the Persian community in particular, developed unique sets of genetic disorders because they were isolated from the surrounding Jewish populations.

The norm in Sephardic, and specifically in Persian communities, is the acceptance of marriage between relatives, which contributes to the increase in maintaining genetic mutations within the community. According to a 2001 survey by the World Sephardi Federation, non-Ashkenazic Jews make up 26% of the Jews in the world and about 50% of the Jews in Israel [2]. Despite these statistics, genetic testing for non-Ashkenazic Jews is not as common. In 2009, the United States designed its first genetic disease screening program specific for non-Ashkenazic Jews. There is a noticeable gap between genetic testing available for Ashkenazic and non-Ashkenazic Jews. However, it is important to note that the lack of genetic testing for the non-Ashkenazic population is partially due to the attitude of the members within that community. There is fear within Sephardic and Mizrachi communities that a family with members who are carriers of a mutated gene may be stigmatized. The close-knit nature of such communities contributes to the need for privacy.

*Dor Yeshorim* is an organization that launched a program with the goal of genetic screening for non-Ashkenazic Jews. This program was started by Rabbi Yosef Ekstein who lost four children to Tay Sachs. He set out with a mission to educate the Jewish community and encourage prevention of genetic diseases. Before *Dor Yeshorim*, there was a huge stigma with genetic diseases and families were forced to remain quiet about these genetic diseases so not to be stigmatized and then their children would not be able to get married. Rabbi Ekstein wanted to prevent others from experiencing such horrible losses as he experienced. The method used in *Dor Yeshorim* is extremely novel because it provides anonymity. Jews are tested while they are young and only given the results once they are ready for marriage. If a man or woman is a carrier, that information is only shared if

he or she wants to marry a carrier as well. It is only vital information to share as marriage between carriers may yield a child affected by the mutated gene [1].

The system used by *Dor Yeshorim* follows the *halachic* ruling of Rabbi Moshe Feinstein, as he wrote, “It is advisable for one preparing to be married, to have himself tested. It is also proper to publicize the fact, via newspapers and other media that such a test is available...absolute secrecy must be maintained or prevent anyone from learning the result of such a test performed on another...” [1]. As of now, *Dor Yeshorim* has a panel that screens for 13 genetic diseases that are prevalent in non-Ashkenazic communities. The unveiling of *Dor Yeshorim's* addition has been embraced by major Rabbis and leaders of the Sephardic, Mizrachi and non-Sephardic communities. In May 2015, *Hacham* Yitzchak Yosef, the *Rishon L'Tzion* of *Eretz Yisrael* and *Av Bet Din* of the Chief *Rabbinate* of Israel's Supreme *Bet Din* encouraged all Sephardim to be tested for genetic diseases [1]. This change in attitude toward genetic testing in Sephardic communities has successfully helped many Jews around the world.

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# Talmud Chullin: Some science behind the text

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Every tractate in the Talmud has its own flavor, its own essence, and its own soul. The secular background needed to fully comprehend a tractate will depend on the overriding theme of that tractate. For example, one tractate may require a background in astronomy, a second may require a business mind, and yet a third tractate may require knowledge of mathematics. Without having the appropriate background, the *talmid* will just be reading words. This does not mean that the *talmid* should give up, but it just is a reality of the situation. Chullin is a tractate for which a solid background in zoology, veterinary science, and human physiology would be an asset. The intent of this article is to elucidate a few scientific topics or statements noted in Chullin, with the intent of making those aspects a bit more understandable or interesting.

## Fainting

In Chullin (3b) note was made that a proficient slaughterer of animals must not be squeamish upon seeing blood, as by fainting he may bungle the *shechitah*. A person is considered proficient when he slaughtered successfully two or three times and did not faint.

Physiologically, what is fainting? Fainting (or, syncope) is the sudden loss of consciousness resulting from a lack of blood flow to the brain. The anxiety or fear of seeing blood may cause an increase in heart rate and blood pressure, which is then followed by a sudden drop in blood pressure and pulse rate. The lesser flow of blood to the brain reduces the transmission of vagus nerve impulses to the musculature, resulting in a loss of muscle tone and causing the body to collapse under the pull of gravity. Once the person goes from an upright to a supine position, blood starts flowing to the brain and the person awakens. This phenomenon is termed “blood-injury phobia.” Symptoms prior to fainting include lightheadedness, nausea, sweating, inability to articulate words easily, weakness, and tunnel vision [1]. It is understandable that such pre-fainting symptoms will lead to bungling the *shechitah*.

Fainting upon the sight of blood is not a universal event, with only about 15% of Americans

experiencing a plunge in blood pressure causing one to faint upon seeing blood. Exactly “why” some people faint upon the sight of blood is not known, but it is believed to have a genetic component with an ancient mechanism driving it. Supposedly, there is an ancient “fainting gene” that confers a survival advantage. During battle, warriors who fainted and appeared dead were passed over. The sudden drop in blood pressure drop may have helped the wounded to avoid bleeding to death and facilitated blood clotting. Such survivors then transmitted the “fainting gene” to their descendents [2-4].

## Strange diets

In discussing *HaShem's* relationship with the non-Jewish world, mention was made of thirty commandments that the Noahites initially accepted upon themselves within the framework of the seven basic concepts of the Noahite Code. However, in actuality they only keep three of the thirty, one of which was that they did not weigh and sell meat of a human corpse in open markets. Apparently, they were “refined” cannibals who neither sold human flesh in the meat markets nor ate human flesh in public (Rashi, Chullin 92b).

Cannibalism had an impact on Jewish history. The story of Menasheh, a king of Israel who reigned for 55 years over Jerusalem, is mentioned in the third chapter in *Devrei HaYamin* II. He “did evil in *HaShem's* sight” and brought various abominations and idolatrous practices into the land of Israel. As a punishment, *HaShem* brought the Assyrian army against Menasheh, who subsequently was captured and led away in chains. The Talmud Yerushalmi, Sanhedrin (10:9) elaborates on the next events. Apparently captured by cannibals, once in enemy territory, Menasheh was placed into a large copper cauldron, with a fire lit beneath it. Realizing his precarious situation, Menasheh prayed to all the various gods he worshiped, but to no avail. Finally, remembering his Jewish heritage, he prayed to *HaShem* and was saved.

Another culinary delight is animal placenta. A Mishnah (Chullin 77a) discussed the case in which

one slaughtered an animal and found a placenta in its womb. If the person had a *nefesh hayafa*, *i.e.*, “a hearty soul,” and was not repulsed by it, he was permitted to consume it. Nonetheless, today most people do not consider an animal’s placenta as a food item (*i.e.*, it is not served even at a fancy *simcha*).

A current trend is for a birthing woman to request her placenta for later consumption (human placentophagy). The consumption of one’s placenta is thought to confer several (scientifically unproven) health benefits, including to enhance milk supply, to lower the incidence of postpartum depression, to increase energy, to ward off anemia, and to level off hormones [5].

Rabbi Aryeh Lebowitz [6] produced an audio *shiyur* of a woman who inquired the *halachos* of consuming her placenta. Discussed, amongst a variety of *halachic* responses, was whether consumption of one’s placenta was cannibalism, which it was not. Near the conclusion of the *shiyur* Rabbi Lebowitz noted that consumption of one’s placenta was reminiscent of the curse in *parshas Ki Savo* (Devarim 28:33), “You will eat the fruit of your womb - the flesh of yours sons and daughters, which *HaShem*, your G-d has given you - in the siege and distress that your enemy will distress you.”

Another unusual food item is the blood of kosher animals and fowl. Apparently, long ago, there was a strong desire to eat the blood from a slaughtered animal. Ramban (Devarim 12:22) explained that the desire to consume animal blood arose when the Hebrew tribes were slaves in Egypt. The people slaughtered animals to demons; the ritual included consuming the meat and blood of the sacrificed animal. The purpose of this ritual was to have the demons divulge future events. Thus, it was necessary for the Torah to state, “Only be strong not to eat the blood - for the blood is the soul - and you shall not eat the soul with the meat” (Devarim 12:23). Apparently, the Torah needed to stress “be strong,” as eating blood was ingrained in the populace (Rashi). Today, a Jew with an overwhelming desire to consume blood is directed to the liver, an animal organ saturated with blood. As Yalta, the wife of Rav Nachman, said, “Whatever the Merciful One forbade us, He permitted us something corresponding. He forbade blood. But permitted us liver” (Chullin 109b). The typical *kashering* preparation for liver is a bit more

complicated than for other types of animal meats, as it is designed to extract as much blood as possible and requires moderate salting followed by *kashering* by broiling.

The Torah prohibited consumption of animal blood in all its forms: whole blood (Chullin 35b), blood serum (Chullin 87b), *i.e.*, whole blood without the three basic cell types (red blood cells, white blood cells, and platelets), blood diluted with rainwater (Chullin, 87b), and solidified blood (Chullin 120a).

Before the Flood mankind was forbidden to eat the flesh of any animal. Only after the Flood was permission given to consume the flesh of animals, but with a limitation, “But do not eat flesh with its life force - its blood (Bereshis 9:4). Yet, in the non-Jewish world, animal blood is an ingredient in various culinary delights in European countries. Blood pudding/sausage, which almost always centers on pig’s blood, is part of the traditional Irish or Scottish breakfast. Other European countries have their own version of this sausage. Some, like the German *blutwurst* or the Spanish *morcilla* are stuffed with other cured meats, onions, or potato, as well as blood and grain. The blood of almost any kind of animal is used; livestock like sheep, goat, and cow are the most common, but duck and chicken can be used, too [7]. The Italian desert pudding, *sanguinaccio dolce*, uses blood of a freshly killed pig [8]. For those cultures who consume animal blood it is not such a far leap in thought to extend this to human blood, thereby possibly serving as the basis for the blood libel against the Jewish communities in Europe. Conversely, Jews, who are far removed from the consumption of animal blood in meats and fowl, the concept of consuming human blood is unthinkable. In fact, any meat that a Jew consumed has been soaked and salted within three days of the slaughter. This process, termed *kashering*, draws out the blood from the interior of the meat. The Jewish and non-Jewish concepts of consuming animal blood are at opposite ends of the culinary spectrum.

### **Head trauma and male infertility**

The following occurrence is mentioned in Chullin (45b): “Levi was sitting in the bathhouse and saw a certain man who smashed his head into the wall. Whereupon Levi exclaimed: The brain of this fellow has lost substance (*i.e.*, Rashi, the man experienced a brain concussion). Did he not mean to say that the

fellow would not survive? ' Abaye said, No, Levi meant to say that the fellow would not be able to father children.” Abaye concluded that such trauma to the brain would make the fellow sterile. Rashi commented that the reproductive ability of a man stems from the brain. Apparently, Rashi was referring to the hypothalamus-pituitary gland-gonad (HPG) axis, which will be explained shortly. The topic of traumatic brain injury (commonly termed, a brain concussion) as related to sports injuries, especially those of contact sports, and to injured soldiers is well documented to cause of male reproductive issues [9]. Located within the forebrain, the hypothalamus is a pearl-sized structure with many important physiological functions. Blood vessel connections between the hypothalamus and the pituitary gland, located at the base of the brain, allow for a pathway for hypothalamic hormones to travel to the pituitary gland. Of importance to fertility is the secretion of gonadotropin-releasing hormone (GnRH) from the hypothalamus to stimulate the anterior pituitary gland to release luteinizing hormone (LH) and follicle-stimulating hormone (FSH), which, in turn, stimulate Leydig and Sertoli cells, respectively, within the testes. Sertoli cells release androgen-binding protein which is necessary for spermatogenesis and Leydig cells release testosterone, which plays a key role in development of the male reproductive system and in stimulating male secondary sexual characteristics (Figure 1).

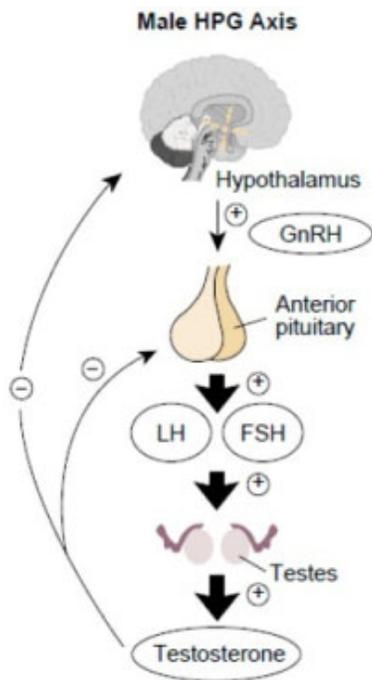


Figure 1. HPG axis

Disruption of the HPG axis may lead to impaired reproductive ability in the male [9]. Traumatic brain injury, as reported in cases of sports-related injuries, induces suppression of the HPG axis, as manifested in decreased libido, impotence (erectile dysfunction), hypopituitarism (a deficiency of pituitary hormones), hypogonadism (insufficient production of testosterone or impaired ability to produce sperm, or both), and infertility [9].

### Bone Marrow

Abaye and R' Yochanan (Chullin 125a) concurred that marrow inside a human bone regenerates flesh outside of the bone. Marrow is a sponge-like tissue found mainly inside large bones like the breastbone, pelvis, ribs, and spine. Within red bone marrow are hematopoietic stem cells which undergo asymmetrical cell division, producing another pluripotent stem cell and progenitor cells, which differentiate into red blood cells, white blood cells, and platelets. These cells, produced within bone marrow, eventually squeeze through pores in bone tissue and enter into the circulatory system (Figure 2).

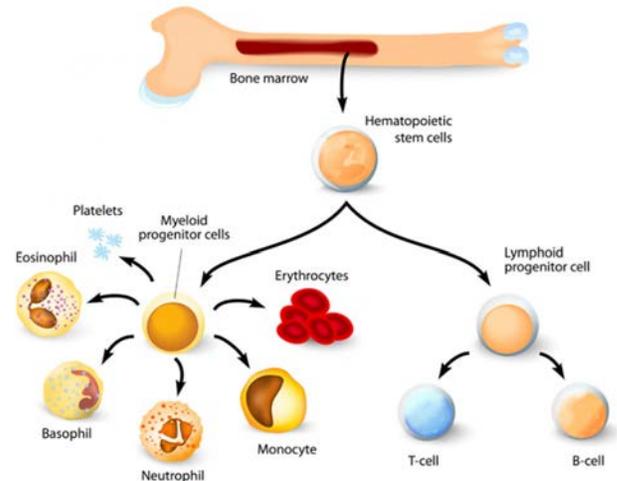


Figure 2. Differentiation of hematopoietic stem cells to different cell types found in blood.

In addition, relatively new findings from studies of bone marrow transplantations noted that hematopoietic stem cells apparently have a mind of their own and, in addition to differentiating into blood cells, were able to differentiate into buccal epithelial cells [10], hair follicles [11], and cells of fingernails [12]. This was described as “stem cell plasticity phenomenon” [13], *i.e.*, the ability of adult stem cells to cross lineage barrier and differentiate

into cells outside their own tissue. Abaye and R' Yochanan were perceptive in recognizing that marrow within bones was a living substance, which produced diverse cell types whose function was outside bones.

### Blood disorders

A *Baraisa* in Chullin (47b) noted that R' Nassan was in a city overseas when a woman approached him with her newborn baby to ask a question regarding circumcision. Apparently, her first and second newborn sons died upon being circumcised and she questioned about circumcising her third newborn son. As the newborn appeared red in color, he advised her to wait until the excessive surface blood was absorbed into the newborn. She followed his advice and the child survived circumcision. R' Nassan visited another city. A woman, whose two newborn sons died at circumcision, sought guidance about circumcising her third newborn, whose body color was *yarok*. R' Nassan diagnosed the problem that the blood system did not develop sufficiently. He advised her to delay the circumcision until the circulatory system fully developed. She waited and the circumcision was successful. Rashi defined *yarok* "like the color of grasses." Tosafos noted that *yarok* can refer to green, yellow, or a bluish hue of green. Attempts have been made to identify the specific blood disorders suffered by these babies.

Remembering that the Talmud is not a medical textbook, one needs to focus on the clues that were offered. First, as each newborn had two siblings who died at circumcision, it would appear, at first glance, that the blood disorder was genetic. Second, the skin color of the newborn was the key factor in the diagnosis. Third, the Talmud did not specifically note a problem with blood clotting. Rabbi Adin Even-Israel Steinsaltz [14], citing others, suggested that the reddish baby suffered from neonatorum purpura, a purplish or brownish red skin discoloration easily visible through the epidermis of the neonate. It is a hemorrhagic disease characterized by the escape of blood from the blood vessels; this disease may be accompanied by a low level of platelets, which are needed for blood clotting [15]. Dr. J. Brown [16], recently reviewed this topic, and cited J.L.

Katzenelsohn who postulated the disease as erythema (toxicum) neonatorum, which is a common rash in neonates appearing in up to half of newborns carried to term. The rash emerges between day 2-5

after birth. Some neonates are more sensitive than others and develop erythematous spots all over the body. The rash is thought to be due to an immune reaction, although clotting is sometimes suspected, but the connection remains unproven [17]. The most straight answer, given by Dr. Abraham Abraham (Nishmas Avraham, Yoreh Da'ah 263:3), is "I have no idea to what the rabbis are referring to" [cited in 16].

For the second case, the diagnosis is dependent upon the specific skin color of the neonate. If the infant was yellowish in color, then the diagnosis may be neonatal jaundice (Katzenelsohn cited in #16). The yellowing of the baby's skin is due to the breakdown of hemoglobin of fetal red blood cells, yielding the yellow pigment, bilirubin. Most cases of neonatal jaundice occur without complications [18]. A green tinge to the skin of the neonate may be due to hemolytic jaundice, characterized by periods of excessive hemolysis due to the unusual fragility of the red blood cells, which appear small and spheroidal [14]. A bluish skin (termed, cyanosis) usually is indicative of the lack of sufficient oxygen reaching the tissues. This condition may involve issues with blood vessels, the heart, or the lungs [16].

Lastly, it was suggested that *yarok* means pale, with the pathology being a lack of hemoglobin, possibly anemia [19]. A neonate with a deficiency in vitamin K appears pale. Vitamin K is responsible for the synthesis of prothrombin, a chemical important in blood clotting and produced in the liver. Babies are born with low levels of vitamin K and are at risk for vitamin K deficiency. However, on the 5th through the 7th day of a newborn's life as he/she is being breastfed, vitamin K is produced in increasing quantities by bacteria in the gut. Vitamin K, together with prothrombin produced by the gradually maturing liver, promotes blood coagulation. A vitamin K deficiency could lead to hemorrhaging [20]. Thus, there is a possibility that the neonate born with pale skin may represent a case of vitamin K deficiency. Furthermore, if this family had subsisted on a vitamin K-poor diet, this - not genetics - would explain the death at circumcision of the two prior brothers.

The *halachic* responses to these two cases in Chullin

were in sharp contrast to those recorded in Yevamos (64b). In Yevamos, a woman whose first two sons died upon circumcision was advised by Rabbi not to circumcise her third son. Rabbi Shimon ben Gamliel disagreed and suggested that she should indeed circumcise her third child, but if he died, she must not circumcise her fourth son. Other examples were presented in Yevamos with the genetic aspects of the bleeding disease clearly emphasized, with transmission through the female. Rabbi Yochanan said that there was once a case in Zippori in which four sisters had sons. The first sister circumcised her son and he died, the second sister circumcised her son and he died, the third sister circumcised her son and he died, and the fourth sister came to Rabbi Shimon ben Gamliel and he told her "you must not circumcise your son." These cases indicated that transmission of the blood disease was through the mother. Additional cases of newborns dying during circumcision were presented and the conclusion was that in all these cases the blood of the newborn was "thin," *i.e.*, it did not clot (Yevamos 64b).

The commonality between the circumcision incidents in Yevamos and those in Chullin was that the newborns had a blood disorder. The major difference was that in Yevamos the lack of blood clotting was emphasized, whereas in Chullin the color of the newborns was the deciding factor. Apparently, the cases in Yevamos and Chullin refer to different blood disorders, with the cases Yevamos being illustrative of the more serious pathologies. The bleeding diseases in Yevamos are thought to be representative of newborns either with hemophilia A (a deficiency in clotting factor VIII) or with hemophilia B (a deficiency in clotting factor IX), both X-linked genetic pathologies [21, 22]. In the era of the Talmud it was considered lethal and circumcision was avoided throughout life.

### **Wolf clawing**

There appears to be a discrepancy between Chullin (42a) and Arachin (15b) regarding the mode by which a wolf kills its prey. In Talmud Arachin (15b) it stated, "A lion claws its prey and eats it while still alive; a wolf tears its prey with its teeth, killing it and then eating it." In Chullin (52b), it stated that both a lion and wolf attack their prey by clawing, which injects a poisonous venom into the victim. Only a healthy kosher animal is suitable for consumption. The first Mishna of the third chapter in Chullin (42a) enumerated 18 physical fatal defects

that would render an animal *tereifah*. One such fatal defect is an animal that was clawed by a wolf or a lion. Rav Yehuha said, "One clawed by a wolf is rendered a *tereifah* in the case of small species (*i.e.*, goats and sheep) but not in the case of large (*e.g.*, bovine) species, but if clawed by a lion, it is rendered *tereifah* even in the case of large animals." Rashi explained that through clawing, the wolf or lion injected poison into the prey, which penetrated the flesh and burned a hole in prey's flesh. To be fatal (Chullin 53b), the clawing must be nearby a life-sustaining internal organ. Apparently, the amount of venom released by a wolf, as compared to a lion, was insufficient to be fatal to a large animal (*e.g.*, a bovine) but was sufficient to be lethal to a small animal (*i.e.*, a goat or a sheep).

This seemingly innocuous Talmudic statement triggered several potential difficulties [23, 24]: (a) Are wolves really that much smaller than lions, forcing the Talmud to note that a wolf attack on a small domesticated animal is fatal but not on a large domesticated animal? Observations of wolf packs in the wild clearly show that they attack large prey. (b) Clawing does not inject venom into the prey, as there are no poison glands near the claws, neither in a wolf nor in a lion? (c) Wolves attack their prey by using their teeth to tear the prey and do not attack by clawing, as does a lion. As stated in Arachin (15b), "A lion claws its prey and eats it while still alive; a wolf tears its prey with its teeth, killing it and then eating it." If so, why did the Talmud in Chullin need to mention a wolf mauls by clawing its prey? To tackle these difficulties, we need to clarify point-by-point: Apparently, our perception of the size of a wolf is based upon the species of wolf common in North America and Europe, *i.e.*, the gray or timber wolf. Adult gray wolves are 4 to 6.6 feet long and weigh from 40 to 175 pounds; females are much smaller than males [25]. Lions are larger than wolves. African male lions range from 330 to 575 pounds and are 8.5 to 11.5 feet long (including the tail); female lions are between 254 and 400 pounds and are 6.6 to 9.2 feet long including the tail [26]. North American/European wolves are smaller than African lions, yet such wolves are not small animals and they do prey upon large hoofed animals, such as deer, elk, bison, moose, and caribou [27]. If so, why did the Talmud note that a wolf mauling only of a small animal was fatal, rendering it a *tereifah*? As noted by Rabbi Slifkin [24], the species of wolf inhabiting the Middle East is

physically small, with an average weight of 50 pounds and length from 3.4 to 4.9 feet. Middle Eastern wolves avoid large prey, as a one kick from a large cow could disembowel the wolf. Difficulty one, answered.

The second difficulty is that today we know that clawing of a wolf or lion does not inject poison into the prey; there are no poison glands at the base of the claws of these animals. To solve this difficulty most cite R' Aryeh Carmel, in a footnote in *Michtav M'Eliyahu* (volume 4, letter 31, note 4), explaining that the claws of predators usually have flesh from prior prey lodged within their claws. Such flesh undergoes bacterial decomposition, producing metabolic end-products that are highly infective and toxic. Clawing would thereby inoculate infective bacteria into the flesh of the prey, and if the clawing was proximate to a life-sustaining internal organ, disease and death would ensue. The scientific community in the era of the Talmud was unaware of bacteria and of the concept of bacteria as the causative agents of infection and disease; the world would need to wait until the 19<sup>th</sup> century for the germ theory of disease to be formulated by Louis Pasteur and Robert Koch. Difficulty two, solved.

The third point to discuss is clawing as a mode of attack by wolves, especially, as the Talmud in *Arachin* (15b) noted that a wolf kills prey with its teeth. Indeed, wolves and lions have different modes of attacking prey. A lion is an ambush predator, using strong musculature of the front limbs and retractable claws to seize the prey, enabling it to make a lethal bite. Wolves lack retractable claws, hunt in packs, and rely on their jaws to subdue their prey. A pack of wolves may hunt the prey over long distances, tiring it out, and then mobbing the prey in coordinated bite-and-jump attacks. Biting the hamstrings and crippling the prey, the worn-out bleeding animal collapses to exhaustion [27]. Why did the Talmud in *Chullin* note that wolf clawing was potentially fatal, as a wolf attacks with its teeth? Apparently, a wolf has an extra toe, termed the dewclaw, on its hind legs (Figure 3). As opposed to the other digits, the dewclaw is sharp, not blunt, and can be rotated and used for gripping or ripping prey [28]. A wolf's dewclaws can be filled with bacterial-laden rotting flesh from a prior kill; such dewclaws may be the source of the wolf's lethal mauling as mentioned in *Chullin* (42a).



Figure 3. Dewclaw of a wolf

The clawing of a wolf, at the most, involves two dewclaws, whose purpose is not to maul the prey, but rather to hold and stabilize it. The amount of decaying flesh within a wolf's dewclaw probably is limited, perhaps, sufficient only to be fatal to a small, but not to a big, animal. Conversely, the main function of a lion's sharp, ultra-strong claws is to grab the prey and dig into its flesh. The claws are meant to grip and hold the prey, piercing through skin and muscle for a tight hold. A lion has five claws on the front and four in the back - the extra front claw (dewclaw) grasps prey from a different angle from the others claws, helping the lion hold on strongly. If these 8-10 claws are heavily contaminated with decaying flesh from a prior kill, it is understandable that such clawing would be fatal to large animals. Difficulty three, answered.

### Severed tail of a lizard

The Talmud (*Chullin* 21a) mentioned that geckos, a species of a lizard, were capable of severing their tail, with the excised tails jerking and lashing after removal from the body. This passage highlighted a unique survival mode, designed by *HaShem*, to allow a lizard to escape from a predator. This defense mechanism, termed "autotomy," is a process whereby, when threatened by a predator, the lizard can voluntarily shed its tail, which then serves as a decoy for predators. Tails are often brightly colored and their thrashing, lunging, and jerking movements on the ground draw attention of the predator to the moving tail and away from the lizard. This visual diversion allowed the lizard to escape. Nervous impulses responsible for movements of the shed tail begin at the very far end of the tail, in a portion of the spinal cord. This indicates that there is a control center located at the end of tail that is overridden by higher centers until the tail is severed, at which point its movement potential is actualized. The tail, in turn,

may rely on sensory feedback from the environment, mediating it to jump, pivot, or move in a specific direction [29].

Lizards that can sever their tails have “fracture planes,” between or in the middle of each vertebra, regularly spaced down the length of their tail. It is at these points that severing can occur. Skin, muscles, blood supply, nerves, and bone separate when the tail is severed and falls on the ground. Although beneficial for survival, the loss of a tail comes at a cost, as tails are important for jumping, climbing, and maintaining a sense of balance. However, over time, the lizard will regenerate another tail [29].

### Hybrids - mule/hinny

*Kil'ayim* refer to the prohibitions in *halacha* of a mixture, such as crossbreeding animals and working a team of different kinds of animals together., as noted in Vayikra (19:19), “You shall keep My statutes. You shall not let your cattle mate with a diverse kind ..” One such type of *kil'ayim* includes crossbreeding a horse with a donkey. Mating a male horse and a female donkey yields a mule and a male donkey and a female horse yields hinny. A horse (*Equus caballus*) and a donkey (*Equus asinus*) are different species, with a horse having 64 chromosomes in its somatic cells and a donkey having 62 chromosomes. If a horse and donkey mate, at fertilization the fusion of a horse gamete with its 32 chromosomes and a donkey gamete with its 31 chromosomes yields a zygote, to become either a mule or hinny (*Equus mulus*) with 63 chromosomes. The different structures and number of horse and donkey chromosomes prevent adequate pairing of chromosomes during prophase of meiosis I of gametogenesis; as a result most mules and hinnies are infertile [30].

The Talmud (Chullin 79a) noted differences between the phenotype of a mule and hinny based on lineage. Abaye observed that a mule with a deep voice, like a donkey which brays, was the progeny of a mating between a female donkey and a male horse. Whereas, a mule with a shrill voice, like a horse which neighs, was the offspring of a female horse and a male donkey. Rav Pappa added that a mule with large ears and a small tail was the offspring of a mating between a female donkey and a male horse, while a mule with small ears and a large tail was the offspring of a female horse and a male donkey. Such differences generated the *halachic* question of a mule with a deep

voice, large ears, and small tail and a mule with a shrill voice, small ears, and large tail are considered the same species or are different species. This has relevance of whether these two varieties of mule with differing lineages, can share a common yoke to pull a wagon (*i.e.*, is this *kilayim*?).

Although a Jew cannot purposefully breed a horse with a donkey to yield a mule/hinny, once created can be used and, in fact, were highly valued and most useful animals. They were stronger than a horse of similar size and they inherited the endurance and disposition of a donkey, tending to require less food than a horse of similar size. Mules/hinnies also tend to be more independent than most domesticated equines. The mule/hinny exhibits hybrid vigor, *i.e.*, the improved or increased function of a biological quality in a hybrid offspring [30].

### Fish skin as sandpaper

The Talmud noted that wooden utensils were smoothed with the skin of a “tunny fish” (Chullin 25a). This statement, in conjunction with the Mishna in Kelim (16:1) which mentioned “rubbing with fish skin” as the usual method of finishing wooden utensils, are probably the first documented sources for the use of fish skin as sandpaper. Whereas the Mishna in Kelim did not identify the species of fish, the Talmud in Chullin identified the fish as “tunny,” a breed of smaller tuna (“little tunny;” *Euthynnus alletteratus*) found in the Mediterranean. Little tunny is a kosher fish with scales limited to along the lateral line and on the corselet, *i.e.*, a thick band of scales circling the body [31]. To be useful as sandpaper, the fish skin must be abrasive. From the description of the fish, it would appear that, in terms of abrasiveness, the skin of the little tunny was, at most, the equivalent of “fine” sandpaper.

In contrast, in terms of abrasiveness, the skin of shark would be the equivalent of “coarse” sandpaper. Documentation of shark skin for use as sandpaper can be traced to the British Empire in the mid 18th century, as it was used by cabinet makers to finish very fine work surfaces. Shark skin lacks kosher-type scales, but rather the skin is made of a matrix of tiny, hard, tooth-like structures, called dermal denticles or placoid scales. These structures are shaped like curved, grooved teeth and make the skin a very tough armor with a texture like abrasive “coarse” sandpaper [32].

## Leviathan

The third chapter of Chullin (67b) ends with a discussion of Leviathan, described as a kosher fish, with fins and scales. Rashi elucidated that Leviathan's fins shine brightly and illuminate the seabed beneath them. The point to be discussed is how Leviathan's fins illuminate the ocean floor.

Sunlight penetrates the oceans to a depth of about 656 feet, termed the photic zone; photosynthetic algae and phytoplankton dwell in this region. Only a small amount of sunlight penetrates further, with the region from 656 to 3,280 feet termed the dysphotic or twilight zone. In this later zone, the amount of light is insufficient for photosynthesis. Below 3,280 feet is the aphotic or midnight zone and this region of ocean is bathed in darkness [33]. As sailors and commercial fishing boats have never sighted Leviathan, it must be assumed that Leviathan dwells in the deepest most portion of the ocean, in regions that are void of light. If so, Leviathan's fins cannot reflect existing light; there must be another mechanism whereby Leviathan's fins illuminate the ocean floor of the aphotic zone. Bioluminescence may be the solution to the question.

Bioluminescent chemical reactions are processes in which chemical energy is changed to light energy (*i.e.*, essentially, it is the opposite of photosynthesis, in which light energy is changed to chemical energy). The glow of fireflies on a dark night is a bioluminescent reaction. Most deep-sea animals produce some bioluminescent light; either the animals take in bioluminescent bacteria to gain the ability to light up or the necessary chemicals for bioluminescence are inherent within the animal itself [34]. A good example of an aquatic bioluminescent creature is the lanternfish (*Symbiolophorus branadi*), a deepwater fish that gets its name from the ability to produce light. With over 200 different species, lanternfish are thought to be the most common deep-sea fish, growing to a length of six inches and comprising as much as 65% of the deep-sea biomass [35]. Apparently, Leviathan is a bioluminescent deep-sea fish, with the areas of luminescent concentrating in the fins. However, it is not known whether the bioluminescent mechanism is due to photophores, tiny light organs connected to Leviathan's nervous system, or to bioluminescent bacteria colonizing the fins.

## School days

In a debate over a certain *halachic* principle, R. Yochanan criticized Reish Lakish by saying to him,

“even school children know the answer” (Chullin 81b). Perhaps, this is the most powerful statement in Talmud Chullin, as it indicated that Jews had a school system. Rabbi K. Spero, an instructor at Aish HaTorah, compared the Jewish concept of education and literacy to that of the non-Jewish populations. “Throughout history, the powers-that-be realized that it is far easier to control an illiterate population than a literate one. Knowledge empowers the individual, and an empowered individual is a potential revolutionary.” The leaders purposefully kept the masses illiterate. This was the prevailing attitude of ancient Greece and Rome, with only 5% of the general population able to read and write. The schools were reserved for the children of the ruling minority, who owned land. In the Catholic Church of medieval Europe, the only literate people were monks and upper level clergy and all major libraries were in monasteries. The societal caste system in India and the feudal societies in China and Japan fostered illiteracy among the populace (36).

Education was of top priority to the Jews. During the reign of King Chizkiah, education was at its peak. As noted in Talmud Sanhedrin (94a), if one searched from Gevas to Anipras one would not find a boy or a girl, man or woman, who was not conversant with even the complex laws of *tumah* and *taharah*. In Bava Basra (21a) note was made that R' Yehoshua ben Gamala, a *kohen gadol*, ruled that teachers of young children should be appointed in each district and each town and that children should enter school at the age of six or seven. The unusual high literacy among Jews was recognized by the Arabs, who referred to Jews and “the people of the book” (36).

## Concluding statement

The thoughts presented herein were intended to elucidate some scientific topics in Talmud Chullin, not to replace the learning of the Talmud itself. Some ideas may be 100% accurate to explain the true meaning of the Talmudic text and other ideas, however, may be considered only educated guesses.

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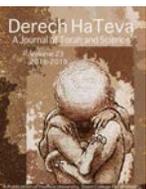
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# A Historical Overview of Derech HaTeva Publications

The scope of Derech HaTeva, with 24 volumes of incredibly original articles, cannot be fully realized until you start delving into their content. Once you do read an article, you inevitably read the next, and so forth. And then you wonder what you may have missed in past issues. If that's the case, please discover all previous and future publications online, at YAIR (Yeshiva Academic Institutional Repository), [repository.yu.edu/handle/20.500.12202/3956/browse?type=dateissued](http://repository.yu.edu/handle/20.500.12202/3956/browse?type=dateissued)

Below are some highlights:

<p><b>Volume 1, Spring 1997</b></p>  <ul style="list-style-type: none"> <li>• Yeast and the <i>Yeizer Hara</i>: The Biology Beneath the Symbolism (P. 15)</li> </ul>	<p><b>Volume 4, 1999-2000</b></p>  <ul style="list-style-type: none"> <li>• Was Moshe Left-Handed? (P. 14)</li> </ul>	<p><b>Volume 5, 2000-2001</b></p>  <ul style="list-style-type: none"> <li>• Chicken Soup: Jewish Penicillin? (P. 21)</li> </ul>
<p><b>Volume 6, 2001-2002</b></p>  <ul style="list-style-type: none"> <li>• Be Fruitful and Multiply: Infertility in Tanach (P. 38)</li> </ul>	<p><b>Volume 7, 2002-2003</b></p>  <ul style="list-style-type: none"> <li>• The Time of Death: A Torah Perspective (P. 23)</li> </ul>	<p><b>Volume 8, 2003-2004</b></p>  <ul style="list-style-type: none"> <li>• The Vaccination Tightrope (P. 55)</li> </ul>
<p><b>Volume 9, 2004-2005</b></p>  <ul style="list-style-type: none"> <li>• Jewish Genes: References to Genetics in the Torah (P. 35)</li> </ul>	<p><b>Volume 10, 2005-2006</b></p>  <ul style="list-style-type: none"> <li>• An Orthopedic Analysis of Jacob's Injury (P. 41)</li> </ul>	<p><b>Volume 11, 2006-2007</b></p>  <ul style="list-style-type: none"> <li>• Siamese Twins: Together Forever? (P. 54)</li> </ul>

<p><b>Volume 12, 2007-2008</b></p>  <ul style="list-style-type: none"> <li>• Stem Cell Research: A Torah Perspective (P. 40)</li> </ul>	<p><b>Volume 13, 2008-2009</b></p>  <ul style="list-style-type: none"> <li>• Vaccinations: An Exploration of their History, Development and <i>Halachic</i> Ramifications (P. 57)</li> </ul>	<p><b>Volume 14, 2009-2010</b></p>  <ul style="list-style-type: none"> <li>• Pomegranates: A Holy and Wholesome Fruit (P. 20)</li> </ul>
<p><b>Volume 15, 2010-2011</b></p>  <ul style="list-style-type: none"> <li>• Aging and Longevity in Science and <i>Tanach</i> (P. 14)</li> </ul>	<p><b>Volume 16, 2011-2012</b></p>  <ul style="list-style-type: none"> <li>• Taharat Hamishpacha: Its Potential Impact on Fertility (P. 30)</li> </ul>	<p><b>Volume 17, 2012-2013</b></p>  <ul style="list-style-type: none"> <li>• Hemophilia: The First Recorded Genetic Disorder (P. 37)</li> </ul>
<p><b>Volume 18, 2013-2014</b></p>  <ul style="list-style-type: none"> <li>• Does Following the Torah Make Us Happy? (P. 11)</li> </ul>	<p><b>Volume 19, 2014-2015</b></p>  <ul style="list-style-type: none"> <li>• Mitochondrial Replacement Therapy and Jewish Law (P. 20)</li> </ul>	<p><b>Volume 20, 2015-2016</b></p>  <ul style="list-style-type: none"> <li>• A Tooth for a Tooth: Not So Easy for Cohanim (P. 49)</li> </ul>
<p><b>Volume 21, 2016-2017</b></p>  <ul style="list-style-type: none"> <li>• Worth their Weight in Gold: Prosthodontics in the Talmud (P. 18)</li> </ul>	<p><b>Volume 22, 2017-2018</b></p>  <ul style="list-style-type: none"> <li>• Dinosaurs and Woolly Mammoths—is there a Torah Viewpoint? (P. 67)</li> </ul>	<p><b>Volume 23, 2018-2019</b></p>  <ul style="list-style-type: none"> <li>• A Halachic Perspective on Dental Implants (P. 47)</li> </ul>

