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"What is the path [to attain]
love and fear of Him?
When a person contemplates His wondrous
and great deeds and creations,
and appreciates His infinite wisdom
that surpasses all comparison..."

~ RAMBAM'S MISHNEH TORAH
HILCHOT YESODEI HATORAH 2:2

The Yom Kippur Effect

PNINA BIRMAN

Year after year many pregnant women are faced with the dilemma of whether to fast on *Yom Kippur*; however, women are included in the negative precept to fast on Yom Kippur: "The tenth of this seventh month shall be the Day of Atonement for you. It is a sacred holiday when you must fast and bring a fire offering to G-d. If anyone does not fast on this day he shall be cut off [spiritually] from his people..." (*Leviticus* 23:27, 28).[1] Specific leniencies are allowed for pregnant women. In the *Mishna* (*Yoma* 8:5) it states: "If a pregnant woman is fasting and smells and craves food, she is fed until she recovers." Rashi explains that if she does not eat, she and her fetus are in danger. In *Gemara Sukkah* (28b) it states that a pregnant woman who fell ill and may miscarry is given nourishment immediately because both her life and that of the fetus are in danger. The restrictions of *Yom Kippur* and *Shabbat* are set aside to save a Jewish life, even one not yet born. In the *Shulchan Aruch* (*Orach Chaim* 617:2) it is noted that if a pregnant woman smelled food and craved it, we whisper in her ear that it is *Yom Kippur*. If she is pacified by the mention of *Yom Kippur*, then well, and if not we feed her until she recovers. The Tzitz Eliezer adds that even if the mother is in no apparent danger, but the fetus is, we still feed the mother.[2-4] The view of these classical sources is reflected by R' Yisroel Fisher, a member of the *Beit Din* of the *Edah-HaHaredit*, who stated that in our generation, humans have become weaker and far more women miscarry. Therefore, it is recommended that pregnant women not in the ninth month should eat, but less than the amount for which punishment is incurred on *Yom Kippur*.[5] The question that arises is, are all of these measures necessary? What are the medical dangers to pregnant women who fast on *Yom Kippur*?

The medical literature contains some interesting and relevant studies on this topic. Research on the weekly cycles of births noted that the number of births was significantly lower on Sundays and holidays. This was attributed to the lesser number of induced births initiated on these "non-work" days. Ayala Cohen extended this study to Israel and reviewed birth records of selected Israeli communities from the mid- to late- 1970's. She noted that the lowest number of births occurred on

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Shabbat and on Jewish holidays. On Sunday, the beginning of the Israeli workweek, the number of births was increased. Interestingly, Cohen also noted that the number of births was unusually high on *Yom Kippur* and the day after the fast. This pattern was not evident for other Jewish holidays. Cohen, a statistician, did not venture to hypothesize a reason for this "Yom Kippur Effect", but instead chose to present the information and leave the reasoning to the medical doctors. [6]

A later study, done in Israel as well, was even more revealing. The goal was to examine the "Yom Kippur Effect", but in this study the days were divided according to Jewish tradition – from sunset to sunset. The researchers found that the increase in the number of births was significantly higher in the 24-hour period following the *Yom Kippur* fast. As a further control the births considered were only spontaneous births. In addition, despite the general increase in spontaneous births, there was no increase in pre-term births. They concluded that the 25-hour fast had its greatest effect on women who were at or near term. This was consistent with the finding that the number of births during the week after *Yom Kippur* was lower than during the week before *Yom Kippur*.[7]

In yet a third study on the "Yom Kippur Effect", the researchers were even more detailed in the experimental design. They compared a Jewish population, most of which presumably fasted on *Yom Kippur*, with a Bedouin population, which served as the control. In addition, they divided *Yom Kippur* and the day after it into 6-hour sections. Furthermore, as an additional control, they examined the effects of another Jewish holiday, *Sukkot*, on the number of births. The researchers found that as the *Yom Kippur* fast progressed, the number of spontaneous births increased, peaking during the 6-hour period immediately following the end of the fast. No similar increase was noted in the Bedouin women during these days. There was also no increase in the number of births on *Sukkot* or the day after it.[8]

So what is it about fasting that induces pregnant women in the final days of gestation to commence labor? Many hypotheses exist. First, let us examine the normal events that precipitate labor. The hormone progesterone normally inhibits uterine contractions. As the time for labor approaches, presumably, progesterone levels diminish, initiating labor, according to animal models. Even though in humans the level of progesterone appears to decrease significantly only when labor is well under way, it is thought that there is an earlier inactivation of progesterone receptors. Another hormone, estrogen, is involved in the birthing process. During labor there is an increase in the level of estrogen, a hormone important in establishing gap junction proteins in uterine muscle, thereby enhancing uterine contractions. The increase in estrogen also aids in the production of oxytocin receptors and in the activation of prostaglandins. Prostaglandins function in labor as potent stimulators of uterine contractions by increasing the intracellular level of calcium ions in myometrial cells. These cells respond to oxytocin, another hormone secreted by the pituitary gland. Towards the end of gestation, the number of uterine oxytocin receptors increases and this may aid in the induction of labor by combining the binding of oxytocin with other events. Perhaps, the fetus may signal that it is completely developed by secreting adrenocorticotropic hormone (ACTH) and cortisol. Cervical stretch, resulting from the positioning of the fetus, also triggers uterine contractions. There is an observed increase in the maternal plasma level of corticotropin releasing hormone (CRH), which peaks during labor. CRH potentiates the uterine contractile response to prostaglandins and oxytocin and stimulates additional prostaglandin production by the amnion. At the same time, maternal levels of CRH binding proteins decrease rapidly towards the end of gestation. This results in an increased level of free circulating CRH, which apparently binds to receptors in the uterine muscle. Thus, CRH is another determinant of the onset of labor. All of the above factors appear just before and/or at the beginning of labor, but it is not clear which one factor sets off the cascade of events that leads into the birthing process.[8-10]

Theories linking fasting and the induction of labor rely on these hormonal changes that occur just prior to or at the beginning of labor. One theory postulates that fasting brings about reduced blood glucose levels and an increase in the concentration of prostaglandins, which then initiates uterine contractions. In laboratory animals, it has been shown that infusing glucose reduces prostaglandin concentration and consequently, uterine contractions decrease. A second theory postulates that hypoglycemia leads to a transformation of fatty acids to arachidonic acid, the precursor for prostaglandins. The connection between prostaglandin production and the induction of labor is well established. In fact, administration of prostaglandin production inhibitors, such as indomethacin and aspirin, are used to delay a premature birth. A third theory for the connection between fasting on *Yom Kippur* and the induction of labor is based on the fact that hypoglycemia in the mother causes hypoglycemia in the fetus. The fetus then releases CRH from its hypothalamus, ACTH from its pituitary gland, and

THE RESEARCHERS FOUND THAT AS THE *YOM KIPPUR* FAST PROGRESSED, THE NUMBER OF SPONTANEOUS BIRTHS INCREASED, PEAKING DURING THE 6-HOUR PERIOD IMMEDIATELY FOLLOWING THE END OF THE FAST.

precursors for the production of estrogen from its kidneys, thus initiating labor. Yet another theory is that fasting causes a change in the viscosity of the maternal blood. An increase in blood viscosity and an increased hematocrit have been observed after a 24-hour fast. As a result of increased blood viscosity there may be diminished blood flow to the uterus, which may in turn lead to uterine contractions and labor. Lastly, dehydration from fasting results in a release of antidiuretic hormone (ADH), a hormone similar to oxytocin in structure and released from neighboring areas in the hypothalamus. This may lead to an increase in the release of oxytocin as well.[8]

So with all the above medical proof for the "Yom Kippur Effect" what is a pregnant, near term woman to do? Firstly, it is understood that a pregnant woman should consult with her physician and her rabbi. The view of labor and birth in Jewish law has traditionally been that these events are dangerous and thus there are allowances to prevent an early delivery. By the same token, pregnant women, even those near term, have been fasting for centuries and it is regarded as natural and normal. The principle of 'G-d preserves the simple' apparently comes into play. Nevertheless, certain high-risk people must take precautions. The researchers[7] who evaluated the "Yom Kippur Effect" suggested that it would be wise for women in the late stages of gestation to refrain from fasting, especially if they have a tendency towards early delivery. It is well established that women who have previously given birth pre-term have a tendency to do so again. A woman would do well to try and prevent hypovolemia – decreased blood volume – by drinking within the allowable limits when she feels the symptoms of dehydration, to keep her plasma volume from decreasing. In essence, there is no physical need for consumption of solid foods. Dehydration is very dangerous to the mother especially towards the end of gestation. Giving birth while dehydrated also raises the risk of the mother going into hypovolemic shock and there may be changes in fetal heart tones, maternal exhaustion and ineffective pushing by the mother.[5] However, the Torah authorities have recognized a psychological component. Foods should only be given to a pregnant woman who has a psychological need to eat, to the point that her facial expression indicates that she truly needs to eat.[11] Some other precautions which a pregnant woman should take are reduced exertion and avoidance of heat. In so doing she will be able to fast on Yom Kippur and have an easy birth the following day. DH

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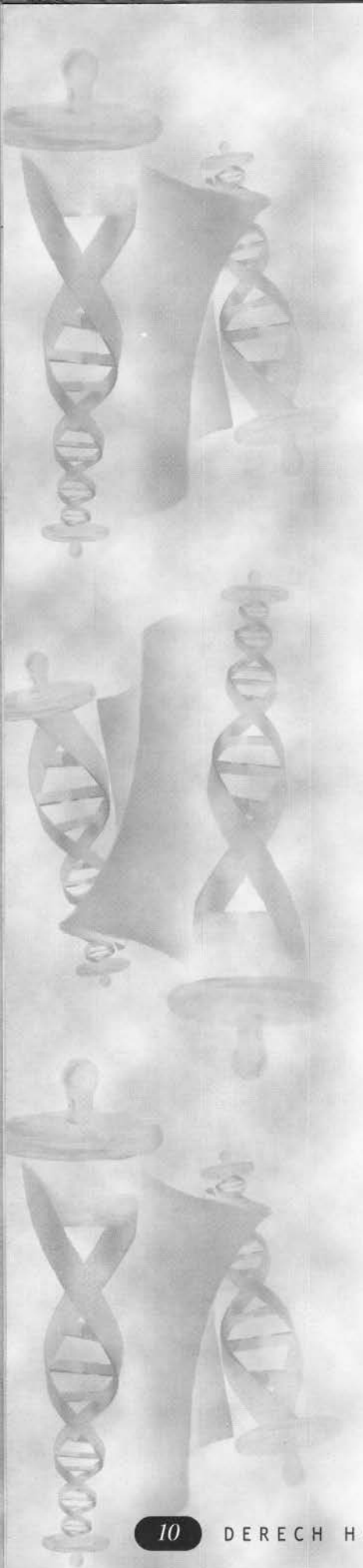

Longevity in the Bible and Modern Science

OLGA DYNINA

The beginning chapters of Genesis speak of people who lived for more than 900 years. Adam lived for 930 years,[1] Seth for 912,[2] Enosh for 905[3] and Noah for 950.[4] However, as early as Genesis 6:3 we learn of G-d's dissatisfaction with the corrupt behavior of people at the time of Noah and of His plan to decrease human lifespan. G-d declared: "...man's days shall be one hundred and twenty years." Ibn Ezra, one of the major Torah commentators, explained this verse to mean that human lifespan gradually decreased until it reached a maximum of 120 years. Peleg, who lived five generations after Noah, lived 239[5] years, whereas Abraham, who lived ten generations after Noah, lived for 175 years.[6] Moses, however, lived only 120 years.[7] Moreover, Abraham was the first individual mentioned in the Torah who aged. In Genesis 20:2 the Torah informed us that "Sarah conceived and bore a son unto Abraham in his old age, at the appointed time which G-d has spoken." By the time of the Exodus from Egypt, extreme longevity disappeared. Thereafter, the ages of the people in the subsequent generations were decreased to modern standards.

What caused such a tremendous decline of human lifespan and the appearance of signs of aging in Abraham and subsequent generations? To uncover possible answers to these intriguing questions reference is made to some modern scientific literature, which during the last two decades of the 20th century made a tremendous leap in our understanding of human aging. According to recent scientific data, mammalian cells have evolved an intricate set of checks and balances against uncontrolled cell proliferation. One check, termed programmed cell death, or apoptosis, is triggered by mutation of the p53 gene. Furthermore, the rate of DNA mutation correlates with the cells' lifespan. A mouse strain prone to accelerating aging was found to have an "...increased rate of somatic mutations accumulation compared with a corresponding strain that was resistant to accelerated senescence."[8] Another check appears to be

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the progressive shortening of the ends of chromosomes, termed telomeres, which are involved in normal cell division and may play a part in cellular aging.[9] Kim and Piatyszek showed a correlation between uncontrolled proliferation of cancer cells and the expression of telomerase, an enzyme capable of preventing the shortening of the telomere.[10] Their findings suggested that virtually all cancerous cells have activated telomerases to overcome the cellular biological clock. Furthermore, cancer cells are not the only cells for which immortality is dependent on telomerases. The extended life of normal cells is dependent on the activity of these telomerases. In fact, according to an editorial article in Nature Genetics "...normal mitotic cells are 'mortal' in culture and 'senesce' after a finite number of cell divisions. Telomere shortening has proved to be a potent molecular trigger of cellular senescence."[11] By artificially introducing telomerase into several different cell types, researchers were able to stop the aging of the cells and extend their lifespan.[12] Additionally, telomerase is critical for progression of stem cells to programmed adult cells. Indeed, mice deficient in telomerase had a diminished capacity to produce new blood and sperm cells.[11] Moreover, others reported that undifferentiated embryonic stem cells lacking telomerase are unable to proliferate.[10]

Another possible mechanism to account for cell aging and mortality is accumulated genetic damage in mitochondrial DNA. All aerobic cells require molecular oxygen to survive; they use this oxygen in oxidative metabolism to produce ATP in mitochondria. Without the energy provided by mitochondria, multicellular life would not be possible. Unfortunately, in the process of creating cellular energy, mitochondria produce free radicals. Mammalian cells have elaborate mechanisms to avoid free radical accumulation. However, if mammals produce more free radicals than they can control, DNA damage may result. This genetic damage accumulates over time and is passed by mitosis to the next generation of cells. Such accumulation of genetic damage caused by free radicals has been implicated as a potentially major factor contributing to the aging process.[13] Genes encoding for proteins that protect the cell from oxidative stress – such as superoxidase dismutases (SOD) and catalase – may therefore promote longevity. For instance, researchers found that the overexpression of SOD in the motor neurons of Drosophila extends its lifespan by 40%, as compared with wild-type controls.[8]

Another indication of the involvement of mitochondrial DNA in aging can be seen from epidemiological evidence presented by Sir-Masashi Tanaka and colleagues in support of the view that the maternal influence on longevity is greater than the paternal.[14] Indeed, mitochondrial DNA is characterized by maternal inheretance.[15] Finnish and Swedish genealogies also showed strong evidence that maternal mitochondria are at least partially responsible for longevity of cells.[16]

BY ARTIFICIALLY INTRODUCING TELOMERASE INTO SEVERAL DIFFERENT CELL TYPES, RESEARCHERS WERE ABLE TO STOP THE AGING OF THE CELLS AND EXTEND THEIR LIFESPAN.

What is responsible for the accumulations of free radicals in the mitochondria that perhaps were absent at the time of Adam? Could it be that a change in the diet of Noah played a crucial role in creating inheritable DNA damage? We find in Genesis 8:3 that G-d gave permission to Noah to eat meat. Before the Great Flood all humans were herbivorous, eating seeds, fruits and green vegetation. Meat is a high calorie food containing saturated fatty acids. High fat consumption is implicated in many human maladies such as high blood pressure, heart disease, and cancer. Animal (saturated) fat in general and red meat in particular are associated with several types of cancers and are strongly linked to malignancies of the colon and rectum. Saturated fats have been implicated in prostate cancer as well. What is missing in meat but is present in fruits and vegetables are antioxidants that neutralize free radicals. Other chemicals present in vegetarian foods may block the cellular signals of steroids, such as estrogen, that induce cell proliferation, especially proliferation of breast tissue.[17]

Moreover, diet can exert its effects not only through the type of calories consumed but also through their quantity. Rabbi Pinchas of Koretz once said: "Eating in moderation tends to lengthen life. We find among animals and reptiles that those who eat the least live the longest."[18] Researchers now believe that taking in more caloric energy than is expended can be harmful to health. Sixty years ago, scientists at Cornell University discovered that placing rats on a very low calorie diet prolonged their lives. The lifespan of these rats was increased by 33%, from three to four years. These researchers also found that rats on a low-calorie diet stayed younger longer and suffered from fewer chronic diseases, which were associated with old age. Many years later, similar experiments were performed on primates. Primates that were maintained on a calorie-restricted diet and supplied all important nutrients for animal survival had lower blood pressure, higher sensitivity to glucose, and showed fewer signs of aging.[19] Furthermore, recent research indicated that calorie restriction can be useful even if it is not started until middle age. The calorie restriction initiated in mice at early middle age extended their maximum life span by 10 to 20 percent and prevented the development of cancer. Perhaps high calorie consumption accelerates free

radical production by mitochondria, thereby accelerating the destruction of cellular components and decreasing ATP production. A low calorie diet, on the other hand, slowed aging by decreasing the amount of free radicals that enter the electron transport chain.[19]

Some scientists think that, in addition to consumption of a low calorie diet, human beings need to postpone their reproductive age in order to live longer. These researchers view senescence as a by-product of a pattern of natural selection. It affects all vertebrates that reproduce sexually. Asexual plants and animals, on the other hand, do not show signs of aging because their offspring, which are genetically identical to their parents, need to be young in order to survive in a highly competitive world. For example, "...asexual sea anemones kept for decades in aquariums do not show failing health."[20] On the other hand, sexually reproducing species age because natural selection declines after the start of adulthood. We can illustrate this point by looking into the prevalence of two diseases, progeria and Huntington. Progeria is very rare. This disease is caused by a chance mutation in one copy of a gene in an embryo, resulting in rapid aging in childhood. Individuals suffering from progeria are not likely to reproduce and thus do not pass their deleterious progeria genes to the next generation. Although Huntington disease is also caused by a mutation, symptoms of this disease do not appear until midlife, where the afflicted individuals may have already produced offspring. As a result, Huntington disease is more prevalent than progeria. Hamilton found, based on mathematical reasoning, that "...for organisms that do not reproduce by splitting in two, the force of natural selection on survival falls with adult age and then disappears entirely later in life." This prediction has been shown to be true in fruit flies, which after 10 generations of delayed mating, lived two to three times longer than control fruit flies that mated at their usual age.[20]

It is curious to note that following the Great Flood, people produced their offspring at an earlier age compared to their counterparts who lived before the deluge. From Genesis 9:28 we see that Noah was able to have children when he was 500 years old. A son of Noah, Shem, also had his children at one hundred years old. However, Shem's subsequent children and grandchildren gave birth much younger. Arpachshad, for instance, "...lived thirty-five years when he begot Shelah."[21] Shelah "...lived thirty years when he begot Eber."[22] Isaac Abarbanel, one of the major Torah commentators, noted that "...the same difference in the biological clock that resulted in extreme longevity may also have delayed adolescence until the sixth decade or later" in the people who lived before the deluge.[23]

PRIMATES THAT WERE MAINTAINED ON A CALORIE-RESTRICTED DIET AND SUPPLIED ALL IMPORTANT NUTRIENTS FOR ANIMAL SURVIVAL HAD LOWER BLOOD PRESSURE, HIGHER SENSITIVITY TO GLUCOSE, AND SHOWED FEWER SIGNS OF AGING.

Nahmanides, however, was of the opinion that Adam's early descendants lived extraordinary long lives primarily because of their biological perfection. According to his opinion, the reduction of the human lifespan was a result of the climatic change that was associated with the flood in the generation of Noah.[23]

Furthermore, according to many classical Jewish sources, Adam was not the first human being to be created. The Talmud speaks of 974 generations of humanoid creatures that existed before Adam. These human-like species may have possessed physical and mental capacities similar to those modern men. The main difference between these human-like creatures and Adam was that Adam was created without a set biological clock. It was only after Adam ate from the Tree of Knowledge that the biological clock was set to terminate his life; however, he still lived extremely long compared to the humans of today. According to Rabbi Aryeh Kaplan "...viewing the longevity mentioned in the Torah as a hereditary trait confined to Adam's descendants also explains how it was gradually reduced." Genesis 6:2 states "... the sons of god saw that the daughters of man were good and they took themselves wives from whomever they chose." According to the *Midrash*, "sons of god" were children of Adam who possessed the hereditary trait of longevity, and "daughters of man" were primitive humanoid creatures. Interbreeding between these groups resulted in an overall reduction of the lifespan in the descendants of Adam. G-d was not pleased with this interbreeding and with this decline of ethical standards of Adam's descendants, and He therefore declared in Genesis 6:3, "...My spirit shall not contend evermore concerning Man since he is but flesh; his days shall be a hundred and twenty years."[23] In fact, modern scientific literature accounts for the existence of human-like species that "...have been joined by anatomically modern Homo sapiens" and their extinction only a few thousand years ago.[24]

As we already have seen, the ability to bear offspring until the end of life is the quality of those animals and plants that have unusually long lives. These animals and plants appear to have delayed biological clocks. Moreover, their longevity is associated with a lack of signs of aging. Indeed, Noah was assigned a task of building an ark when he was 480 years old and finished at 600 years of age. Apparently, Noah's strength at 480 years was equivalent to that of a 30-40 year old modern man. Although we do not have, in the year 2000, all of the necessary technology to allow us to extend human life to its maximum potential, we should not despair. We have a prophecy found in

the Book of Isaiah that indicates that the extension of human longevity is indeed a possibility. Isaiah stated: "From then on, there will no more be one tender in years or aged... for as adolescent one shall die at a hundred years old."[25] According to many Jewish sources, the Messianic Age will not be a time of miracles; rather, it will be an age in which laws of nature will run their course. We may then assume, as stated in the teachings of Maimonides, that extension of human life could be possible solely by technological advances.[23] Hence, do not be discouraged... the 20th century brought us many rapid technological advances, and perhaps if we wait a little longer, we might find immortality.... DH

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Shades of "Jewish Green"

BRACHA ETENGOFF

Abuse and depletion of natural resources is a major issue at the top of the modern environmentalist agenda. "...Oil spills damage the beaches and kill fish and birds; building a dam may destroy entire species of animals; holes in the ozone layer allow dangerous levels of radiation; smog caused by car exhausts already pollutes and endangers many cities around the world; poisonous gases leak from chemical plants and harm thousands, not to speak of the dangers from nuclear reactors."[1] As Orthodox Jews, we must ask ourselves: Should these concerns hold a place on our agenda as well?

A resounding "Yes!" seems to be the answer, according to classic Biblical and Talmudic sources, as well as the writings of today's rabbinical leaders. In the words of R' Jonathan Sacks, Chief Rabbi of England, "No Jew should be indifferent to the destruction of rainforests".[2] Let us begin to explore the backdrop of Jewish sources against which R' Sacks makes this claim.

In the first chapter of Genesis, Adam is commanded to "fill the earth and subdue it", and to "rule" over the animal kingdom.[3] Those who spuriously claim that G-d gave man *carte blanche* to use and abuse the earth however he sees fit have often quoted this passage in isolation. Recently, radical environmentalists have pointed to this passage as "proof" that religion and the Bible are to blame for the philosophy of waste and destruction of the environment, which has engendered our modern ecological crises.[4] However, both groups have ignored the verse that follows only a chapter later to counterbalance the theme of domination of nature: "And G-d took Adam and placed him in the Garden of Eden to serve it and guard it."[5] Thus, "man is not only the *master* but also the *guardian* of nature."[2]

According to R' Twerski, the actual sin of the forbidden fruit of the Tree of Knowledge in the Garden of Eden was "anti-environmental"! "The knowledge which Adam and Eve were denied was that which would enable them to elicit the enormous forces inherent within the newly created world and subject them to their bidding, knowledge which we might equate with scientific discoveries and developments." R' Twerski goes on to explain that G-d would have permitted them this knowledge later, when they were mature enough to apply it responsibly. Today, the decision of whether to repeat or to correct their sin lies in our hands, and if we indeed choose to "place greater emphasis on science than on ethics, on technology than on morals, our sin is far greater."[6]

The Biblical injunction of *lo tashchit*,[7] which prohibits destruction of fruit trees, emphasizes this "guardian"

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aspect. The Talmud vastly extends the scope of this injunction: "Whoever breaks vessels or tears garments, or destroys a building, or clogs up a fountain, or destroys food, violates the prohibition of *bal tashchit*."[8] Thus, there is no concept of absolute ownership in Jewish law.[2] The Talmud also includes using fuel wastefully in this prohibition,[9] and the *Sifrei* includes water source interference.[10] Rabbi Hirsch even extends *bal tashchit* to include conspicuous consumption: "trying to attain a certain aim by making use of more things and more valuable things when fewer and less valuable ones would suffice; or if this aim is not really worth the means expended for its attainment."[11]

Thus, it seems that Helfand[12] has the requisite traditional precedents for his suggestion that the *halachot* of *bal tashchit* should be applied to numerous modern problems concerning the destruction of natural resources: "For example, it seems most likely that the pollution of waters by the use of detergents, especially those containing phosphates which upset the ecological balance and kill fish, is in violation of bal tashhit. The same statement can be made about all activities that produce or cause harmful pollution, e.g. the use of leaded gasoline, the operation of inefficient incinerators, the dumping of factory and other waste, and the like." And according to R' Turkel, the proactive as well as the prohibitive are included in *bal taschit*: "Conservation of energy is certainly included... Therefore, every person is commanded to do whatever he can to reduce waste of resources. This includes not using electricity unnecessarily, not wasting fuels of any kind, recycling materials, etc."[1]

IN THE WORDS OF R' JONATHAN SACKS, CHIEF RABBI OF ENGLAND, "NO JEW SHOULD BE INDIFFERENT TO THE DESTRUCTION OF RAINFORESTS."

From all of the above, it is clear that the Torah views humanity as guardians, as well as masters, of nature, and places limits on our use of natural resources. Many Jewish environmentalists believe that this charge is most powerfully stated in the following *midrash*, "G-d said to Adam: See My works, see how pleasant and good they are. Everything I have created, I have created for you. Be careful not to spoil and destroy My world. If you do so no one will repair it."[13]

Lest the reader feel that he/she cannot make a difference in humanity's overall treatment of our natural resources, I would like to conclude with an idea of Gotfryd's. He quotes the famous Maimonidean injunction to regard oneself "as equally balanced between merit and guilt", and to thereby feel that any act can tip this balance. He applies this to environmental concerns as follows: "In a global village, every single act can affect the world's ecological state. The bottom line in both natural sciences *and* Torah life is that in all human deeds, speech, even thought, one is free to choose among alternative paths leading to personal failure and ecological disaster (G-d forbid) on one hand, or personal success and global well-being on the other."[14] DH

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Was Moshe Left-handed?

THE CASE OF THE SINISTER MINISTER

REBECCA FELDMAN

Various *midrashim*[1] relay an anecdote regarding Moshe's youth, wherein a jealous Pharaoh wanted to ensure that it was not Moshe's intention to usurp his vast empire. A simple test was devised involving two bowls placed in front of Moshe: on his left was one brimming with gleaming gold, and on his right side was one containing scorching hot coals. If Moshe were to reach for the gold, it would "verify" that he was indeed after Pharaoh's power and he would then be summarily executed. If he reached for the coals, however, Pharaoh could rest assured knowing that his empire was secure. Young Moshe, taken in by the glitz before him, naturally reached for the gold-laden bowl at his left. His guardian angel Gavriel pushed Moshe's hand into the bowl of coals, swiftly, rescuing him from mortal danger. Burned by the coals, Moshe's hand flew to his mouth to be soothed by his cool lips, an action that caused his mouth and lips to be burned in the process. It was this sequnece of events that causded Moshe's speech impediment.[2] From this *midrash*, a theory[3] is gleaned that which presumes there is more to this story than one initially thinks. The theory ventures that this powerful event in Moshe's life was quite traumatic for the child. He was undoubtedly summoned before an overwhelmingly imposing crowd. Such an event could have severely impacted the toddler's mental development, specifically resulting in trauma to the brain.

The theory, put forth by Dr. Henry Garfinkel, noting both the high correlation between handedness and mental mechanism as well as the association between brain trauma and speech disorders, concludes that Moshe must have been left-handed. For it is known[4] that the angel Gavriel occupies supervision over the left side of one's body, and it is most usual for one to extend one's dominant hand when reaching for objects. Therefore, had Moshe extended his right hand, it would not have been Gavriel who intervened.

Given the staggering number of variables that the theory presupposes in order to be accurate, it will probably

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never be proven that Moshe was left-handed. Indeed, it is not the objective of this paper to argue the logical points of the theory. Nevertheless, let us investigate the significance of left-handedness in *Tanach* and *Halachah*. One famous instance in *Shoftim* (3:15) recounts the mighty Ehud, who found the use of his left hand to be most advantageous for he was able to conceal his weapon close to his right thigh and successfully foil the wicked Eglon and his bodyguards. Later in the book of *Shoftim* (20:17), a large group of those with dominant left hands were called to battle, presumably on account of the military benefit of such facility.

Dr. Julius Preuss[5] quotes a discourse in Talmud *Bechorot* 45b between Rav Yehudah HaNasi and the Sages regarding the disqualification of a left-handed *kohen* for priestly service. If he can use both hands equally well, nevertheless Rav Yehudah HaNasi considers him unfit; however, the Sages regard him to be fit. The crux of the Talmud's argument is as follows: Rav Yehudah HaNasi believes that equal strength in hands must signal some form of deficiency in the right hand. The Sages maintain that this is simply an instance where the left hand is especially strong. *Rambam*[6] sides with the Sages, ruling that only a *kohen* who is solely left-handed is considered inadequate, and is therefore excluded from priestly service.

Interestingly, however, the Talmud in *Shabbat* 103a mentions that the laws regarding writing on *Shabbat* involve strictly normative styles of writing. However, teaches the Talmud, one should not think that a left-handed person is excluded from this prohibition just because left-handedness is not normative, because his writing with his left hand is the same as a right-handed person utilizing his right hand. A possible inference from this is that left-handedness was seen as an alternative proclivity, and not some form of defect. Therefore, it could simply be that a *kohen* must conform to a level akin to perfection, and any aberration from the majority of the population is deemed deficient on a heightened scale of priestly worthiness.

Seen rarely in *Tanach*, and quite possibly considered a defect in *halachic* literature, let us turn to scientific research to illuminate the rather opaque nature of left-handedness. Bearing in mind the prohibition of left-handed priests, and remembering that Moshe's brother Aharon was the first High Priest of the Temple, one wonders if it can be genetically possible for two brothers to differ in orientation of handedness. One need not look further than one's own family to discover that handedness is not necessarily governed by genetics. Dr. Marian Annett[7] proves the lack of complete governance by genetics from other species that select their dominant hand. Additionally, Dr. Jerre Levy[8] suggests that the increase in "lefties" after the 1930's reflects a cultural relaxation of imposing right-handedness, rather than a shift in heredity.

THE THEORY, NOTING BOTH THE HIGH CORRELATION BETWEEN HANDEDNESS AND MENTAL MECHANISM AS WELL AS THE ASSOCIATION BETWEEN BRAIN TRAUMA AND SPEECH DISORDERS, CONCLUDES THAT MOSHE MUST HAVE BEEN LEFT-HANDED.

However, it is also unlikely that handedness is purely accidental, for the question remains why there would be such an overwhelming favor towards right-handedness. Approximately 90% of the population consider themselves as right-handed. Configurations on the arches of fingers differ dramatically between those who are right- and left-handed, enforcing the notion that handedness is determined somewhat prenatally. Nevertheless, Dr. Annett's findings do lead to the conclusion that random circumstances surrounding the early stages of development significantly influence one's variability in preference. In fact, there is a remarkably higher presence of genetic material from the mother than from the father, quite possibly due to the constant exposure to the mother at extremely early and vital stages of the child's development. A theory known as the Salk hypothesis claims that such a marked difference is because 80% of mothers hold their babies on their left side, placing the baby's right hand closer to the mother's heart. It is therefore possible that Moshe's mother had to conceal him on her right side, not unlike the way Ehud stealthily masked his weapon of assassination.

Dr. Garfinkel's theory also referred to the association between Moshe's postulated brain trauma and his possible sinistrality (left-handedness). Research has shown a significant correlation between mental development and handedness. Already at birth the hemispheres of the brain are differentiated in function; the right side is generally stronger in apprehending spatial skills and general structures, and the left side's strength lies mainly in language and speech comprehension. Humans tend towards the dextral bias because of a blend of cultural factors as well as the stimulus from a single gene that induces a "right shift". This single gene directs the development of speech in the left hemisphere of the brain, thereby increasing strength in the right side of the body. Handedness and hemispheric dominance correspond contralaterally, and therefore dominance in the right hemisphere signals dominance in the left hand. This theory does explain dextral predominance, but surely does not determine an overall bias against left-handedness.

Drs. Geschwind and Behan[9] discovered a greater chance of developing immune diseases amongst sinistrals, for the immune system forms in the central core of the brain during gestation before then migrating to the rest of the body. In fact, there is a probability that

left-handedness may actually result from some disorder in the left hemisphere, effecting a shift of dominance to the right side of the brain. There is also a much higher frequency of learning disabilities and dyslexia in those who are left-handed; this is due to a high level of testosterone that affects neuronal development. This fact also explains the significantly larger number of learning disabilities in males than in females. Dr. Annett, however, maintains that there is simply a more prevalent bias towards dextrality among women.

Although the scientific research does provide us with a modest background for Dr. Garfinkel's theory, we are no closer to proving its accuracy. It therefore remains quite inconclusive, albeit feasible within the rubric of the scientific evidence, to deduce that Moshe Rabbeinu's speech impediment truly stemmed from being left-handed. DH

ACKNOWLEDGEMENTS:

I would like to thank Dr. H. Babich for inspiring and encouraging this work and for generously nurturing my interest in biology. I would also like to thank Rabbi E. Kanarfogel for discussing aspects of this paper so eruditely with me.

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Kesser Shain Tov

MICHAL GOLD

Dentistry has slowly evolved from an ancient craft into a modern science. Biblical and Talmudic literature is replete with references to teeth, providing insights into the way dentistry was once practiced. Interestingly, many of the methods for the practice of dentistry in the ancient world, as described in the Talmud, are similar to modern day dental treatments. In addition, dentistry for cosmetic treatment may be traced back to ancient times when gold crowns were a sign of wealth and beauty. The treatment of teeth is not a new phenomenon; rather, it is deeply rooted in our past.

The concept of nutrition promoting oral health is already mentioned in *Beraishit* (49:12), where it notes "teeth white from milk." Furthermore, in *Mishlei* (25:19) the importance of teeth to health and well-being is stated, "like a bad tooth and an unsteady foot, is confidence in a faithless man." Shlomo HaMelech describes his wife as having "teeth like a flock of ewes from washing, having twins, and not one is lost" (*Shir HaShirim* 4:2).[1] The great emphasis placed on beautiful teeth is noted in *Ketubot* (11b), which states that a person who whitens his neighbor's teeth is better than one who gives him milk to drink.[2] Oral hygiene through cleaning between the teeth with a toothpick is mentioned in the *Yerushalmi Dmai* (3,5) in an episode in which Rabbi Shimon ben Cahana and Rabbi Elazar were passing a vineyard. One said to the other, "bring me a twig from the hedge for picking my teeth"; the other immediately drew back remarking that if all passerbys did so, the whole hedge would disappear.[3] In *Pesachim* (113a) the seriousness of a tooth extraction was stressed by Rav who told his son to avoid such dental operations. A Talmudic commentator explains that extraction of a molar tooth may adversely affect eyesight. Rabbi Yehuda HaNasi was relieved from a severe toothache by Elijah The Prophet, who touched his tooth (*Yerushalmi Ketubot* 12:35).

Teeth also play an important and specific role in the Jewish legal sphere. The phrase "an eye for an eye and a tooth for a tooth" (*Bamidbar* 21:24; *Vayikra* 24:20; *Devarim* 19:21) is a famous dictum in the Torah. This phrase is not taken literally in Jewish law, as it refers to the financial compensation to which the injured person is entitled. The importance of teeth is further emphasized in the laws concerning the owning of slaves. If a master knocks out the tooth of a slave, the slave is then freed (*Bamidbar* 21:27).[1]

The structure, function, and physiology of teeth are noted in the *Tanach* and Talmud. *Yirmiyahu* (31:30) describes the "man who eats sour grapes, his teeth are set on edge." The

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use of teeth for eating is addressed in *Michah* (3:5), "when they have something to bite with their teeth." This is likewise seen in *Bamidbar* (11:33) "while the meat was still between their teeth, before it was chewed, the anger of *Hashem* was kindled." The lack of food is symbolized by the cleanliness of teeth, as in *Amos* (4:6), "I gave you cleanness of teeth in all your cities and lack of bread in all your places."[1] *Chazal* were evidently aware of the differences in the morphology of groups of teeth, as well as in their functions. The incisors were simply called "teeth". Referring to the passage "keep *Kachai* and teeth" (*Chulin* 59a), the *Tosfot* explain, "*Kachai* are the back teeth that grind the food, whereas 'teeth' mean the front teeth," which are involved in cutting and slicing. Since a distinction is made here between anterior teeth and posterior *Kachai*, it is obvious that the "teeth" are incisors. Regarding the molars, it is written (*Yoel* 1:6): "Its teeth are lion's teeth and it has the fangs of a lioness." Here, *Rashi* explains fangs as "the rough teeth with which the lion chews." Thus, already in ancient times, there were clear distinction, morphological and functional, drawn between the various groups of teeth.[3]

Teeth are used to exemplify strength, power, and the ability to conquer. In *Devarim* (32:24) a discussion of destruction is referred to as "teeth of beasts." King David described his enemies as "men whose teeth are spears and arrows" (*Tehillim* 57:4). The *Navi Yirmiyahu* (*Eichah* 3:16) laments that *Hashem* broke his teeth with gravel stones. A broken tooth is said to be "like confidence in an unfaithful man in time of trouble" (*Mishlei* 25:19). Aisav wept at his encounter with Yaakov because his teeth were loose and painful (*Beraishit Rabbah* 78:9).[4] In addition, the value that Judaism places on teeth may be seen from the fact that a toothless *Kohen* was disqualified from serving in the *Beit Hamikdash* (*Berachot* 44a).[5] This prohibition attests to the great weight accorded to aesthetics and position of power, which has played an important role in society from very early times.

In antiquity, tooth replacement seems to have been used only for cosmetic purposes, and therefore Talmudic discussions usually mention it concerning women. In *Nedarim* (66b) it is stated that Rabbi Yishmael beautified the daughters of Israel: "Rabbi Yishmael made a tooth in the same place as the false one to make them more beautiful." Apparently, he replaced their false, ugly *totevet* teeth with beautiful gold ones. With her beauty blemish removed, the woman was able to marry.[6] The Talmud distinguishes between different types of tooth replacements. In the *Talmud Yerushalmi*, the issue of a woman with a false tooth is addressed: "she is still ashamed to say to the *nagra* (carpenter), 'I have lost my tooth, it has fallen out, please make me another one.'" It is thus understood that a carpenter, rather than a dentist, was the one who fashioned false teeth from wood. *Rashi* comments on this passage that the tooth was a *nochria* (false) one made out of wood.[7] A golden tooth, on the other hand, was expensive and hence accessible only to the well-to-do woman (*Shabbat* 65a), whereas even people of middle income could afford a *totevet* tooth (*Yerushalmi Shabbat* 11c). The word *totevet*, translated "artificial," may have been derived from the root word meaning "foreign," suggesting, for example, wood or ivory. Or, it may come from the root word meaning "cover," indicating a crown. Whether it was ivory, wood or gold, usage of dental materials in Talmudic times closely resembled practices today.[8]

INTERESTINGLY, MANY OF THE METHODS FOR THE PRACTICE OF DENTISTRY IN THE ANCIENT WORLD, AS DESCRIBED IN THE TALMUD, ARE SIMILAR TO MODERN DAY DENTAL TREATMENTS.

The Talmud does not offer information on the methods and procedures for making restorations, which, if they improved the masticatory function, must have been sophisticated. However, there are references in the Talmud indicating that drills were used to penetrate the tooth. In *Bamidbar* (21:27) it states: "And if he causes his manservant's tooth or his maidservant's tooth to fall out, he shall let him go free for his tooth's sake." The *Gemara* comments on this verse: "while cleansing (*lachtor*), the tooth falls out." *Rashi* explains that the word "*lachtor*" to mean to clean the base of the tooth, which may refer to a scaling procedure that apparently was an acceptable technique in *Rashi*'s time. However, the Hebrew translation of the word *lachtor* means "to drill." This confirms that craftsmen used drills in antiquity to treat teeth, perhaps much like the drills used by dentists today.

An interesting *halachic* issue discussed in the Talmud concerns carrying a false tooth on *Shabbat*. The controversy revolves around the question of whether a false tooth is considered a sign of wealth and beauty or whether it signifies a medical treatment. "A woman may go out with anything that is placed in her mouth, providing that she does not put it in her mouth in the first place on the *Shabbat*. If it falls out, she may not put it back. As for an artificial tooth or a gold tooth, Rabbi permits it, but the sages forbid it" (*Shabbat* 64 a, b). A lengthy *halachic* discussion ensues from this *Mishna* statement. Rabbi Zerra said that this refers only to a gold tooth, but that all would agree that a silver tooth is permitted to be worn on *Shabbat*. Abaye said, in the name of Rabbi Eliezer and Rabbi Shimon ben Elazar, that whatever detracts from a person's appearance, one will not come to display it. There is

evidently an implication here of the difference between an artificial gold tooth and an artificial silver tooth. There are two sides to the question of the gold tooth and its permissibility. One holds that gold is more valuable than silver. Therefore, those who forbid it feel that the woman might be tempted to remove the gold tooth and show it to her friends in a haughty manner. She may then inadvertently carry it in her hand into the street and violate the injunction against carrying on *Shabbat*. Others say that a gold tooth, with its great value notwithstanding, is permissible since the woman will not remove it nor flaunt it before her friends for it is an embarrassment for her to do this and therefore a specific prohibition against this is not needed. The discussion continues with a silver tooth that does not entail the same considerations, as it is not viewed as valuable as a gold tooth and the concern for possible *Shabbat* violation does not apply.[6]

Not content with this, the *Gemara* (*Shabbat* 65a) itself offers another reason for the prohibition. The *Gemara* states that a woman who goes out into the courtyard may fear that her friends will laugh at her false tooth and shame her. She may then remove the tooth and place it in her pocket, perhaps forgetting about it, and subsequently proceed into the street and transgress the violation. Throughout this discussion, it is clear that the sages of the Talmud were not only well versed in legal aspects of *halacha*, but were also very perceptive of human psychology.[6] Today, artificial teeth are fashioned to resemble the color of the other teeth and gold is rarely used. Thus, this issue may not be binding today since most would agree that a false tooth is for medical purposes and is not viewed solely as a fashion statement.

From this extensive examination of teeth in the Torah and Talmud, it is clear that Judaism is cognizant of the important role of teeth. The Talmud discusses several aspects of teeth in reference to halachic, legal, physiological, symbolic and practical matters. One last point which is interesting to note is that *Shain*, the Hebrew word for tooth, is the root of the word "*veshinantam*," meaning "teach" as in the context of the *pasuk*, "teach these words thoroughly to your children" (*Devarim* 6:7). *Rashi* comments on this phrase that the wisdom of Torah should be "sharp upon one's tongue," meaning that one should be fluent in its teachings just as a tooth is sharp. When Torah is transmitted, it is done so with the strength of the teeth so that it remains deeply rooted. DH

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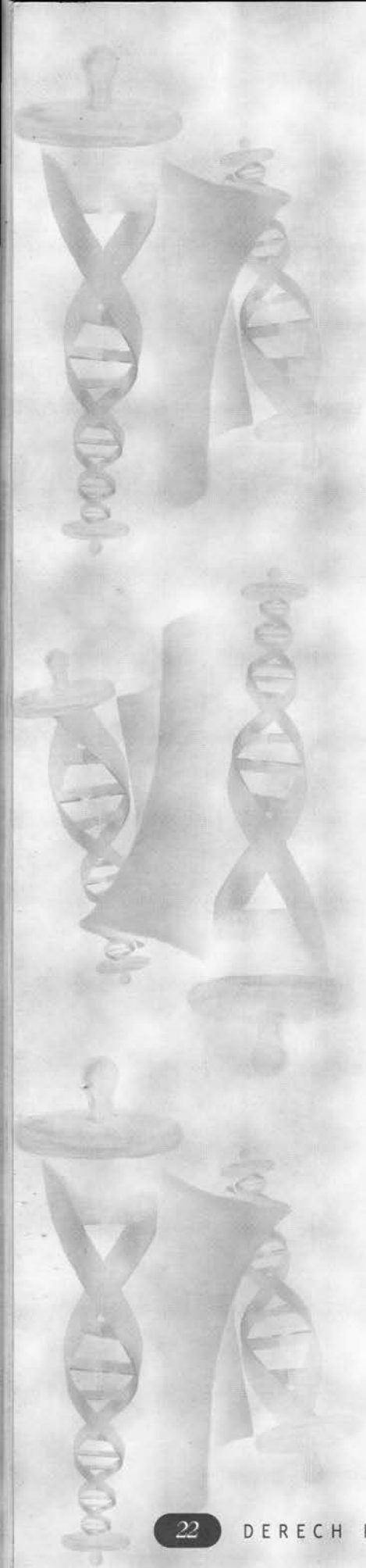

Were Our Predecessors Lepers?

NECHAMA HOCHBAUM

Many teachers in Jewish schools instruct their students that the modern day counterpart to Biblical *tzaraat* is leprosy. I remember learning in kindergarten that Miriam suffered from leprosy, a disease which turned her skin snowy white. However, after a detailed analysis of leprosy, also known as Hansen's Disease, one can definitely conclude that biblical *tzaraat* is not the ailment that we now refer to as leprosy. This has been confirmed by *Chazal*, modern rabbinical authorities, and gentile biblical scholars. The two diseases have different symptoms, physiological mechanisms, and effects on their victims. *Chazal* have taught (*Arachin* 16a and various *midrashim*) that *tzaraat* was a punishment for the sins of bloodshed, false oaths, sexual immorality, pride, robbery, and selfishness. They emphasized that *tzaraat* was not a typical bodily disease, but rather a physical manifestation of a spiritual malaise. It was a spiritual affliction with a physical component that was designed to prompt the sinner to mend his ways. Even those who define *tzaraat* as a physical disease still do not equate it with leprosy. *Sforno*, a renowned biblical commentator and doctor, remarked that there were major differences between the symptoms of *tzaraat* and those of leprosy. Samson Rafael Hirsch, in his commentary on *Tazria* wrote, "the symptoms described in our chapter (referring to *tzaraat*) have nothing at all in common with the diseases which are described in books of medical science on skin diseases under the heading of 'Lepra', leprosy."[1] Why do most translations, both Jewish and non-Jewish, equate *tzaraat* with leprosy? This erroneous translation of *tzaraat* dates back to the Greeks, apparently because of a misinterpretation of language. When the Hebrew Torah was translated into the Greek Septuagint, the word '*tzaraat*' was translated as 'lepra'. The Greek text was later translated into Latin, and finally into English. The word 'lepra' was eventually translated into 'leprosy'.[2]

In addition to much rabbinical and scholarly evidence, there is a profundity of medical literature proving that biblical *tzaraat* is not leprosy. The medical and biological proofs differentiating the two diseases are tangible and convincing. The causative agent of leprosy is the bacterium, *Mycobacterium leprae*, an obligate parasite found only in tissues of humans and other warm-blooded animals. Although most known for producing lesions on the skin, leprosy also causes lesions in the peripheral nerves, eyes, nose, larynx, mouth, organs of the reticuloendothelial system, and internal organs,

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such as the testes, adrenal glands, and kidneys. Of all its targets, leprosy primarily afflicts peripheral nerves. Bacteria accumulate in the nerve bundle causing inflammation and infiltration of phagocytes. The nerve swells and enlarges, resulting in damage to the neurons. This damage may cause loss of sensory and motor function, paralysis, and anesthesia of all affected areas.[3]

M. leprae has a low degree of virulence, a long generation time, and grows at low optimum temperatures. Due to its low optimum temperature, leprosy tends to affect the cooler regions of the body, including the skin, face, hands, and feet. Leprosy cannot grow on inanimate objects. It is not highly contagious and does not easily invade tissues or secrete any serious toxins. Transmission of the disease requires prolonged and intimate contact. Once leprosy afflicts individuals, it causes a slowly progressive chronic infection, with adverse health changes seen over a period of years.

The thirteenth chapter of Leviticus opens with a general announcement of cutaneous signs that would require inspection by the high priest. A person afflicted with *tzaraat* must report to the high priest. Many believe that *tzaraat* was a biblical disease which presented itself in four different ways: lesions on previously normal glabrous skin; lesions on previously abnormal skin; lesions in areas of diffuse alopecia; and localized alopecia, or baldness.

Lesions on previously normal glabrous skin included the primary lesions, *baheret* and *se'et*. *Baheret* was a depigmented patch and *se'et* was a hypopigmented patch. Both grew on skin which previously was normal. At minimum, the hypopigmented patch was the color of a hen's eggshell. The patch may have been slightly erythmatous, and to be considered *tzaraat* it had to be at least the size of a lentil bean. Secondary changes to these lesions included the presence of at least two white hairs growing in the lesion, erosion situated within the lesion, and an increased lesion size.

Lesions on previously abnormal skin included *shechin* and *michvah*. Normal skin that experienced any inflammatory process involving erythema, vesicle formation, crusting, weeping or erosions was classified as abnormal skin. Burns, traumatic injuries, or eczematous dermatitis of any etiology caused abnormal skin. *Shechin* was a hypopigmented patch on such skin. *Michvah* was a hypopigmented patch on the site of a healing burn. The secondary changes of these lesions included the existence of white hairs or an increase in lesion size.

IN ADDITION TO MUCH RABBINICAL AND SCHOLARLY EVIDENCE, THERE IS A PROFUNDITY OF MEDICAL LITERATURE PROVING THAT BIBLICAL *TZARAAT* IS NOT LEPROSY.

Lesions in the areas of diffuse alopecia occurred on the scalp. *Baheret* was a condition describing alopecia of the entire posterior half of the scalp. *Gabachat* described alopecia of the entire anterior half. The lesions had to exist within either of the bald areas. Secondary changes to these hypopigmented or depigmented patches in the bald areas included erosions and enlargements of the lesions.

Localized alopecia lesions were the only kind of *tzaraat* that did not involve a color change of the skin. The primary lesion was a localized patch of alopecia which occurred on the scalp or beard area. Secondary changes included enlargements of the lesion or the presence of two new golden hairs in the lesion.[4]

During its various stages of disease progression, symptoms of modern day leprosy can include hypopigmented lesions, atrophy, inflammatory changes, ulcerations, and alopecia. At first glance, these are similar to the signs noted in biblical *tzaraat*. However, it is highly unlikely that all the necessary signs of *tzaraat* would exist together in any form of leprosy. Not only do the physical signs of leprosy and *tzaraat* differ, but so does the progression of the two diseases. Examination of the patient by the priest was carried out every seven days. *Tzaraat* progressed from primary lesions to secondary forms in a short period of time. However, leprosy is slowly progressive with changes seen over a period of years, not weeks. The extent of dermatopathology would not have changed from one priestly examination to the next. Thus, the leprosy of today is obviously not the biblical *tzaraat*. The biblical description of *tzaraat* did not include any reference to the severe mutilation that leprosy often causes. The strongest proof is the fastidiousness of *M. leprae*. This bacterium has never been cultured with any artificial microbiological medium or with any living cell culture system. Yet, the Torah describes houses and clothing afflicted with *tzaraat*. Since leprosy cannot affect inanimate objects, it cannot be *tzaraat*.

It seems strange that *tzaraat* is not a modern-day disease. Apparently, as a spiritual affliction it only affected individuals on an already high spiritual level. It is quite possible that in today's exiled generation, people are "unworthy" of this spiritual affliction. DH

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Polydactyly in the Torah and Talmud

LEA ROSENFELD

Polydactyly is a fairly rare genetic abnormality involving the inheritance of supernumerary digits on the hand or foot. The extra digit (exceeding the normal count) is usually smaller than the other digits, may be extremely rudimentary, and is typically attached by a small stalk. Although it remains a rare occurrence, this condition is the most common hand anomaly. Polydactyly often occurs simultaneous to other genetic syndromes, such as the chromosomal aberration trisomy 13, Ellis-Vancrevald syndrome, or other genetic disorders such as gigantism and dwarfism.[1] The P gene is a dominant gene that controls the extra digit expression in humans with incomplete penetrance. Since the P allele exhibits variable expressivity, the supernumerary digit can be absent, observed as a stub, or a full size digit.[2]

Polydactyly is presumably linked with autosomal dominant transmission, controlled by the P gene. It therefore comes as no surprise that this condition can be traced back thousands of years to both the Torah and the Talmud.

The first recorded case of a polydactyl was noted with a Philistine from the time of King David. This was a time of war between the Philistines and the Jewish people, and the Torah gives full descriptions of the large and fearsome Philistine warriors. The Bible reads: "There was a man of huge dimensions whose fingers and toes were six each, twenty-four in number; he, too, was born to the giant."[3] This individual appears to bear the genetic disorder gigantism, a common occurrence for a polydactyl.

Cases of polydactyly can be found in the Talmud as well. There is one discussion regarding the premature freeing of a Canaanite slave from the Jewish master. Upon a master's imposed removal of an irreplaceable body part of the slave, such as an eye, tooth, or polydactylous finger, the Canaanite slave must be set free.[4]

There is yet another mention of polydactyly in the Talmud in a discussion between two Rabbis who met an individual with twenty-four digits. Our

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Rabbis debated whether or not it is advantageous to be a polydactyl. Rabbi Tarfon's impression is that the abnormality is a valuable asset, whereas Rabbi Jose thinks it to be a dreadful occurrence.[5] The commentator, Rashi, goes on to say that Rabbi Jose hopes that such people will diminish among Israel and suggests that all bastards should be labeled with this genetic abnormality in order to identify them as such and prevent any Israelite from marrying them. It is not clear why Rabbi Tarfon stands in defense of this man, while Rabbi Jose vehemently opposes him, but recent studies have shown a possible advantage to such an anomaly. The 1800's revealed an episode of a young boy who possessed supernatural mathematical and computational abilities. This "human calculator" was ordinary in all ways aside from his inheritance of twenty four digits. Just like his brother, father and great grandmother, this boy was polydactylous. It is possible that his P gene had a pleotropic effect and may have been linked with his exceptional skills.[6]

THE AGELESS TORAH IS UNIQUE IN THAT ITS LASTING MESSAGE SPEAKS ETERNALLY, AND CAN BE RELATED TO ALL MEMBERS OF SOCIETY.

It is important to take note of the everlasting relevance that the Torah presents for its readers. From the ordinary to the extraordinary, all possible scenarios are delineated in the Torah. The rare genetic disorders that may be otherwise overlooked, become parts of key discussions. And while numerous genetic disorders and abnormalities are found throughout the Torah, only those malformations that exist today are discussed.[6] If one were to discover identifying qualities of an abnormality that is unfamiliar to modern day society, it is likely that the reader is simply unaware of the current paradigm for those things described in the often obscure and difficult Biblical and Talmudic terminology. The ageless Torah is unique in that its lasting message speaks eternally, and can be related to all members of society. DH

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Biblical Bones

MELISSA SCHENKER

Two hundred forty-eight is a number we hear a lot about in Judaism. The human body has 248 limbs, corresponding to the number of days in the lunar year (*Makkos* 23b). The *gematriah* of Avram is 243. Upon the addition of *hey* to his name, he became Avraham, now totaling 248 in *gematriah* and implying that Avraham had dominance over his 248 limbs (*Nedarim* 32b). Another Talmudic reference to 248 is *Moed Kattan* 17a, in which the *Amoraim* argue over how long the status of *cherem* remains in the body. Shmuel is of the opinion that *cherem* remains in a person forever, like pig fat, which remains in an oven for eternity. Conversely, according to Raish Lakish, when someone is forgiven the status of *cherem* leaves that person; just like a person enters the world with 248 limbs, he must leave with 248 limbs. Lastly, it is well known that the number of negative *mitzvot* corresponds to the 248 limbs in our body.

Besides being the topic of discourse in many of our *seforim*, the number 248 also has *halachic* ramifications. Based on Numbers 19:4, the *halacha* is derived that anything found in a room with a dead corpse is considered *tameh*. The *halacha* is elaborated further in a *mishneh* in *Ohalot* 1:8, which enumerates the 248 limbs of a human being and then states that a dead corpse can cause impurity to anyone who touches, carries, or is in the same room with it. There exists an exception. If the corpse is not complete and does not have enough limbs, then it does cause impurity to anything or anyone that touches or carries it, but does *not* cause impurity to someone who is in the same room with it. However, if it has enough limbs, then the normal *halacha* applies. How do we know if a corpse has enough limbs? The *mishneh* in *Ohalot* 2:1 answers this question. An incomplete corpse containing more than half of its limbs has the same *halachic* status as an entire corpse, whereas an incomplete corpse with less than half of its limbs does not render impure something or someone in the same room. Therefore, if we assume that human beings have 248 limbs, then a corpse with 124 limbs or less would not transmit impurity to anyone in the same room, while a corpse with 125 limbs or more would have the same *halachic* status as an entire corpse. Anatomy textbooks state that at birth the human skeleton contains approximately 270 bones. However, by the time a human being reaches adulthood, the skeleton is reduced to 206 bones.[1] According to this number, a corpse with 104 or more limbs would render someone ritually impure.

Many studies have attempted to explain the discrepancy in the number of limbs according to the Talmud and science. The focus in this article, however, is directed to the number of vertebrae in the spine. The *mishneh* in *Ohalot* 1:8 states that the human body consists of 18 vertebrae. Reference to 18 vertebrae is also

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made in *Berachot* 28b, where the *Amoraim* discuss the 18 *berachot* in the *shmoneh esrai*. Rabbi Tanhum said in the name of Rabbi Yehoshua ben Levi that the 18 *berachot* correspond to the 18 vertebrae in the spinal column. The correlation is that the 18 blessings in the *shemonah esrai* are the spiritual spinal column of a Jew's religious life.[2] However, medical textbooks enumerate 33, not 18, vertebrae.[3] Again, this discrepancy has *halachic* ramifications. In a *mishneh* in *Ohalot* 2:3 it states that according to *Beit Hillel*, if one of the vertebrae is missing from the backbone of a corpse, it does not transmit impurity to those in the same room. According to *Beit Shamai*, however, if two of the vertebrae are missing, then the corpse does not transmit impurity to those in the same room.

The 33 vertebrae of the human spine are distributed as follows: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 4 coccygeal vertebrae. The list of human limbs enumerated in *Ohalot* 1:8 can help us decipher how the number "18 vertebrae" was determined. The *mishneh* in *Ohalot* states that human beings have eight bones in their neck. This may refer to the hyoid bone and the seven cervical vertebrae. Possibly, the *Tanaim* included the seven cervical vertebrae as bones of the neck rather than of the vertebral column, thereby lowering the count of vertebrae to 26.[4]

Although a child has five sacral and four coccygeal vertebrae, by the time a person is 18 years old, the two lowest segments of each region begin to fuse. This fusion process extends upwards until all the segments of each region become united, usually by 25 to 30 years of age.[5] When the *mishneh* listed the number of limbs in the human body, most likely it was discussing an adult with one fused sacral and one fused coccygeal vertebra. This, in conjunction with the enumeration of the cervical vertebrae as part of the neck, further lowers the number of vertebrae to 19.

The *mishneh* in *Ohalot* 1:8 mentions a part of the body called *kotlith*, which consists of 3 bones. This term occurs only once in the Talmud and that is in the above-cited *mishneh*. Dictionaries note that *kotlith* is derived from the Greek term *kotyle*, which refers to the head of the femur. Maimonides translates *kotlith* into the Arabic, *al-kitnah*, and Moslem physicians, such as Freytag, always use the word *katan* to refer to the region of the loins or the sacrum. Apparently, the sacrum can be included as one of the bones of the *kotlith* and thus is not enumerated as a vertebra, thereby lowering the count to 18 vertebrae.[4]

Vayikra Rabbah 18:1 identifies the bone *luz*, as a vertebra at the end of the spinal column that resembles an almond. Presumably, this bone could be the coccyx. It is obvious from this *midrash* that *Chazal* did not consider the coccyx to be part of the spinal column, but rather to be a distinct entity. Thus, our count is now 17 vertebrae, consisting of five lumbar and twelve thoracic vertebrae. However, many exceptionally tall adults have six lumbar vertebrae. So, the final count by *Chazal* of 18 spinal bones apparently refers to the six lumbar and twelve thoracic vertebrae.

Our spine is an extremely important component in the prayer process, especially for praying *Shmoneh Esrai* correctly. In *Berachot* 28b, Rabbi Tanhum stated in the name of Rabbi Yehoshua ben Levi that one who says this *t'fillah* must bow until the vertebrae in the spinal column are loosened. Furthermore, it states in *Bava Kamma* 16a that if a person does not bow when reciting the *Modim* prayer in the *Shemoneh Esrai*, his spine will turn into a snake at the end of seven years. According to Rav Avrohom Yaakov Finkel, this statement is an allegory and should not be taken literally. The underlying idea is that *Modim* is the part of *Shemoneh Esrai* in which we thank *HaShem* for all the good things He does for us. When we stand straight, it demonstrates our pride and independence. By bowing, we demonstrate that we surrender to *HaShem*'s will and recognize that He is the source of everything in our lives. The snake symbolizes the arrogance and evil that made Adam disobey *HaShem* in the Garden of Eden. A person who does not bow to *HaShem* appears haughty and arrogant, and receives the fitting punishment that at the end of seven years his spinal column turns into a snake.[5] May all of us always use our spinal columns and the rest of our bodies to fulfill the will of *HaShem*. DH

ANATOMY TEXTBOOKS STATE THAT AT BIRTH THE HUMAN SKELETON CONTAINS APPROXIMATELY 270 BONES. HOWEVER, BY THE TIME A HUMAN BEING REACHES ADULTHOOD, THE SKELETON IS REDUCED TO 206 BONES.

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The Truth Within

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Are today's "*Cohanim*", Jewish priests, any more likely to be direct descendants of Aharon, the first *Cohen*, than other Jews? Are Ethiopian Jews truly descendants of King Solomon or the tribe of Dan? Is the Lemba oral tradition, which recounts the African tribe's relationship to the Jews, credible? The answers to these tantalizing questions have remained stubbornly out of our reach...until now. The answers, in fact, lay within us the entire time. Or rather, within our DNA.

Each male receives one half of his DNA from his father and the other half from his mother. There are two differences between the contribution of the sperm and the egg. The sperm does not provide the zygote with mitochondria, which have their own set of DNA. Mitochondrial DNA, therefore, is passed directly down through the generations from mother to child. The sperm, however, is the only contributor of the Y chromosome, most of which is non-psuedoautosomal. This means that it does not share complementary regions with the X chromosome, and therefore, does not undergo recombination, the exchange of information with homologous chromosomes.[1] Changes in either of these sets of DNA, from one generation to the next, are due solely to mutations.

Mitochondrial DNA and the Y chromosome give us a historical record of sorts, telling us which populations are most closely related. Mutations within genes can cause problems and are often selected against, preventing them from being passed down through the generations. However, mutations that occur in the non-coding areas of DNA are not necessarily harmful, and usually are passed from one generation to the next.[2] The more closely connected two populations are, the more similar their frequencies of certain gene types are.[1]

"And they shall have the priesthood as a statute forever, and you shall consecrate Aharon and his sons."[3] Only Aharon and his descendants were anointed as the *Cohanim*, priests, of the Jewish people. Therefore, according to Jewish tradition, all present day *Cohanim* are direct descendants of Aharon. Thus, we would expect that the Y chromosomes of men claiming to be *Cohanim* would have common haplotypes, which are combinations of mutations found in the non-coding genes. These markers would represent the unique characteristics of Aharon's Y chromosome that were passed down intact, from father to son, or rather *Cohen* to *Cohen*, throughout the generations.

Scientists first studied the frequency of a particular *Alu* element on the Y chromosomes of men in the general Jewish population and in the *Cohen*

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population. *Alu* elements are short chromosomal segments able to copy and insert themselves into new locations in the human genome. Scientists chose to research the frequency of the *Alu* segment known as YAP, since it arrived in its present spot on the Y chromosome relatively recently in human history. As only some segments of the population have this *Alu* element, it can be used as a marker. Researchers found that 18.4% of the general Jewish population were YAP-positive, compared with 1.5% of the *Cohanim*. Scientists later identified a total of six haplotypes whose frequencies distinguish the *Cohanim* from the rest of the Jewish population. In addition, these percentages were consistent within the *Ashkenazi* and *Sephardi* communities. This makes sense, since this split within the Jewish community occurred several hundred years after the *Cohen* lineage was established. These results indicated that the oral tradition passed from father to son, regarding *Cohen* status, has remained intact.[4,5]

In contrast, studies done using mitochondrial DNA did not support the legend that Ethiopian Jews are the descendants of King Solomon or the tribe of Dan. Mitochondrial DNA in particular was studied since it is passed directly from mother to child, and it is the mother who determines Jewish status. Scientists compared the frequency of certain restriction sites on mitochondrial DNA of Ethiopian Jews to the frequency of these sites among the world-wide Jewish population and general African population. Restriction sites are sequences of DNA that are recognized by restriction endonucleases, the enzymes that cleave DNA. Restriction sites are specific to restriction endonucleases, meaning that when DNA is exposed to a certain restriction enzyme, it will only be cut if it has the sites that this specific enzyme recognizes. The resulting fragment patterns can be used to determine the relationship between various populations. Populations that are more closely related will have more restriction sites in common, and therefore more similar banding patterns. While *Ashkenazi* and *Sephardi* communities showed very similar frequencies to one another, the Ethiopian Jews showed a frequency closer to that of East Africans. These results, along with other data, indicate that the Ethiopian's maternal ancestors were very likely Mediterranean and African.[6]

The results of this study were consistent with similar research done on Falasha Jews, which focused on the Y chromosome. Falashas are Ethiopian Jews who recently moved to Israel. They also claim to be descendants of King Solomon and speak Amharic, a Semitic language. Using a Y-chromosome-specific DNA probe, scientists compared the frequency of sixteen haplotypes among Falashas, non-Jewish Ethiopians, *Ashkenazi* Jews, and *Sephardi* Jews. Haplotypes VII and VIII were the most common among *Ashkenazi* and *Sephardi* populations, representing over 50% of their total number of haplotypes. While these haplotypes were found in lower numbers among Ethiopians, they were missing entirely from the Falashas' Y chromosome. Furthermore, haplotypes V (most commonly found among Arabs) and XI (most commonly found among Orientals) were the dominant haplotypes among Ethiopians and Falashas, representing around 70% of their total number of haplotypes. These results support the theory that Falashas are descendants of Ethiopians who converted to Judaism.[7]

SCIENTISTS LATER IDENTIFIED A TOTAL OF SIX HAPLOTYPES WHOSE FREQUENCIES DISTINGUISH THE *COHANIM* FROM THE REST OF THE JEWISH POPULATION.

Another group whose Jewish ancestry is in question is the Lemba. This southern African population is distinct from its Negroid neighbors in many ways and professes to have Jewish ancestry. Although they speak Bantu like their Negroid neighbors, they also speak a different language among themselves, which is not understood by outsiders. They circumcise males, follow strict dietary laws, and rarely accept non-Lemba men into their community. Historically, they were known to be skilled metal workers and potters, and the men wore long cotton garments called a *khanzu*. This mode of dress is common along the east coast of Africa, not in the northern areas of South Africa where the Lemba live. According to the Lemba's oral tradition, their ancestors were Jewish craftsmen from a large city overseas who established trading posts along the eastern coast of Africa, around the seventh century BCE. When these men received news that their home town had been destroyed, they took local women for wives. Members of the group later migrated southward and westward.

Scientists who compared Lemba Y chromosome haplotype frequencies to other populations' deduced that they had received significant gene flow from Semitic males, and to a lesser extent, from Negroid males. Tests of the Lemba's mitochondrial DNA also indicated Negroid ancestry. These results are consistent with the Lemba tradition, which claims that Jewish men married African women, and rarely permits intermarriage with non-Lemba men. Based on this data, it cannot be determined whether Arabic or Jewish male ancestors were the origin of the Lemba's Semitic haplotypes. However, several of their customs seem to be distinctly Jewish, as opposed to Moslem: their separation of milk and meat, their use of liquor, and their method of circumcision.[8]

These are but a few of the many applications of DNA analysis. Scientists are using genetics to gain understanding

in many areas, such as evolution,[1] migration patterns of ancient populations, and the extent of contact between various ancient cultures.[9] As our knowledge of the human genome increases, so will our insight into the past. DH

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The Jewish People Under The Microscope

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As Orthodox Jewish communities grow in size and numbers, medical and health care professionals have become increasingly aware of the special requirements for this unique population. Appropriate articles in medical journals accompany this awareness. Several of the earlier articles in the medical literature made note of Jewish dietary laws.[1-4] In the more recent medical literature the concern broadened to include the special needs of Orthodox Jewish patients in the emergency department,[5] in hospice care,[6] in reproductive issues, such as infertility, assisted reproduction, multifetal pregnancy reduction, and genetic screening,[7-11] in pregnancy, childbirth, and breast feeding,[12-14] and in psychotherapy.[15] An extremely "warm" article (co-authored, in part, by graduates of SCW), explaining to health care professionals the lifestyle of Orthodox Jewish couples, was published in a journal devoted to occupational therapy.[16]

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As research scientists and physicians became more familiar with Orthodox Jewish populations, clinical case histories and scientific research studies were cited in the medical and scientific medical literature. A series of articles has identified the lifestyle of the Orthodox Jew as healthier, both physically[17-21] and mentally,[22] to that of the secular Jew. This topic was reviewed, in part, in a prior issue of *Derech HaTeva*.[23]

The most common scientific and medical studies are of Jewish genetic diseases. The phrase "Jewish genetic diseases" is found in the medical literature and numerous diseases have been identified in the *Ashkenazi* and *Sephardic* communities. Some of the better known *Ashkenazi* Jewish genetic diseases include Tay Sachs disease, Gaucher disease, Canavan disease, Niemann-Pick disease, mucolipidosis IV, Bloom syndrome, idiopathic torsion dystonia, familial dysautonomia, PTA (factor XI deficiency), pentosuria, and cystic fibrosis.[24, 25] The genes for breast cancer, which may be at an elevated incidence among Jewish women of *Ashkenazi* descent,[26, 27] and the gene for inherited deafness in *Ashkenazi* Jews[28]

recently have been identified. A higher incidence of specific genetic diseases has been noted in *Sephardic* subpopulations. For example, of the following neurologic genetic diseases, cerebrotendinous xanthomatosis was identified in Moroccan Jews, Creutzfeldt Jakob disease in Libyan Jews, corticosterone methyloxydase deficiency type II in Iranian Jews, and oculopharyngeal muscle dystrophy in Bukhara Jews.[29, 30]

The identification of Jewish genetic diseases is a two-edged sword. On one hand there is the obvious practical importance of recognizing a genetic basis for any disease. Dor Yeshorim sponsors a program to promote genetic screening of young people considering marriage. Potential couples are tested and subsequently informed whether their match is compatible (i.e., they are not at risk of having children with the genetic disease in question) or are alerted that they each carry a recessive gene that could result in a child with one of the inherited diseases. Those latter couples are then invited to come in for genetic counseling.[31] On the other hand, the focus on Jewish genetic diseases makes it appear that the Jews are defective as a people. Also noted by Korczyn,[29] "the scientific study of these [genetic] diseases has been hampered for many years by the fear – among Jewish scholars – of contributing to prevailing prejudice, and among non-Jews by fear of being suspected of anti-Semitic motives." Grady,[28] in an article in the New York Times, noted: "... some Jewish people fear that genetic studies involving Jews will stigmatize them by creating the false impression that they are more prone than others to hereditary diseases." In that article, Rabbi M.D. Tendler was cited as explaining that although he considered genetic testing for individuals to be acceptable, the screening of populations to find the incidence of a gene was amoral and potentially a source of employment and insurance discrimination against Jews.

Interest in the Jewish people as the subject of clinical/medical research is easily demonstrable. Through the site, http://www.ncbi.nlm.nih.gov/PubMed/, the National Library of Medicine was searched for relevant articles published in the biomedical literature. Using the key word, "Jews," a search conducted on January 2, 2000, for articles within the prior year (1/199 – 12/31/99) revealed 170 publications, primarily in the discipline of genetic diseases. This literature search did not include articles submitted to psychology/psychiatry or sociology journals and did not include literature on medical ethics. The key word "Jewish" was not utilized in the search, as that key word also provides articles in which the term "Jewish" appears to identify the researchers' affiliation (e.g., Long Island Jewish Hospital) and most of those citations are not concerned with Jewish issues. Using the key word "Protestants" 186 references were retrieved, but mostly were not "hard science" publications; e.g., articles, such as "Aging, religious doubt, and psychological well-being" or "Celebrating sixty years. Faithful to a mission," were common. For some other religious groups, the number of "hits" was: 33, Christians; 7, Catholics; 5, Hindus; 3, Moslem; and 2, Buddhists.

A SERIES OF ARTICLES HAS IDENTIFIED THE LIFESTYLE OF THE ORTHODOX JEW AS HEALTHIER, BOTH PHYSICALLY AND MENTALLY, TO THAT OF THE SECULAR JEW.

The type of articles published in the scientific literature also demonstrates interest in the Jewish population. Below is a summary of the more unusual articles that have appeared in the medical literature. Whereas some of these articles are intellectually and scientifically interesting, the clinical significance of others is dubious and, most probably, simply represents an over-interest in Jewish topics. For example, consider the following articles on the various Jewish holidays.

Rosh HaShannah: Emphysema – a lung disorder – is usually associated with chronic exposure to cigarette smoke or other noxious chemical irritants. However, a case history is described of a 17-year old boy who apparently over-exerted himself during his shofar blowing on *Rosh HaShannah*. The youth, admitted to a hospital with pain in the midline of his neck and with difficulty in swallowing, was diagnosed with interstitial emphysema in the lungs and the soft-tissue layers of the neck. He fully recovered within 24 to 36 hours.[32]

Yom Kippur: The Day of Atonement was the subject of three diverse clinical studies. (a) Mosek and Korczyn[33] observed that chronic headache suffers were much more likely to develop headaches during the Fast than those without such history of headaches (66% versus 29%, respectively). This headache, termed the "Yom Kippur headache," is characterized as nonthrobbing, mild to moderate in intensity, and bilateral and frontal in location. Caffeine and nicotine withdrawal did not influence headache development. (b) Three studies showed a correlation between the *Yom Kippur* Fast and inducement of labor. In the study at Shaare Zedek Medical Center in Jerusalem, a striking increase in the rate of spontaneous deliveries occurred for the 24-hour period after the termination of the Fast; this correlation has been termed the "Yom Kippur effect."[34-36] (c) Overindulging after the Fast lead to the following case study reported by Solomon.[37] Two hours following her meal after the *Yom Kippur* Fast, a woman experienced pain originating in the stomach area but then radiating to her back. The woman was rushed to the emergency room. Elevated levels of the enzymes amylase and lipase, needed for the digestion of

starch and fats, respectively, were detected in her blood. After being put on a clear liquid diet for 24 hours, then advanced to a low-fat diet, her back pains and elevated enzyme levels were corrected.

Chanukah: Apparently, "*Chanukah gelt*" (i.e., the chocolate coins encased in a foil wrapping) should have a "hazardous to health" warning label. During *Chanukah* a woman experienced pain upon swallowing. The pain increased with each day of the holiday until, eventually, she could barely swallow. X-ray analysis showed that a piece of *Chanukah gelt* was lodged in the mid-portion of her esophagus.[37]

Purim: The Fast of Esther, followed by drinking and dancing on *Purim*, were the bases for the case study, titled "*Purim* syncope," which describes the loss of consciousness experienced by a yeshiva high school student who over-celebrated on *Purim*. Apparently, his fainting on *Purim* resulted from a combination of stress factors: fasting on the day prior to *Purim*; commencing the *Purim* festivities by consuming three glasses of wine; and dancing with "his fellow Yeshiva friends."[38] Another interesting clinical case made note of an 8-year boy hospitalized with vomiting, abdominal pain, hallucinations, sweating, and pinpoint pupils. Such symptoms are indicative of opium intoxication. Prior to exhibiting these symptoms, the boy had eaten about two dozen freshly prepared poppy seed hamantashen. Whereas poppy seeds *per se* are opium-free, the vegetative coat, or capsule, that contains the seeds may contain opiates. It was postulated that the poppy seeds used in these hamantashen were contaminated with opium alkaloids, resulting in the apparent opium intoxication noted in the youth.[38]

Pesach: Can the will-to-live, a psychosomatic process, influence the time of death? The question of whether people can postpone their death until the arrival of an important event was investigated by Phillips and King.[39] The event selected was *Pesach*, which is a time of importance for Jews, as it functions both as a religious holiday and a time for family gatherings. This period of time earned no particular significance for the non-Jewish population, the control group in their study. The investigators studied the patterns of Jewish and non-Jewish death rates around the time of *Pesach*. In the week before *Pesach* there were fewer Jewish deaths than in any week in their 24-week study period. Conversely, in the week after *Pesach*, there were more Jewish deaths than in any other week in their study period. This pattern, termed the "Passover effect," was noted for the three leading cause-to-death categories, i.e., heart disease, cancer, and cerebrovascular disease. The non-Jewish death rate remained unchanged.

Other clinical studies with a Jewish orientation include the following:

Focusing on learning Torah: In the early 1980s Berson *et al.*[40] observed that myopia, or nearsightedness, was significantly higher among Orthodox Jewish school-aged males, as compared to background levels in the general population. As only males were studied, a familial factor could not be excluded, i.e., perhaps a higher incidence of myopia also occurred in females attending Orthodox Jewish schools. Zylbermann *et al.*[41] continued this study and evaluated male and female students, both Orthodox and secular, among the Jewish population of Jerusalem. The prevalence of myopia was 31.7% in females attending secular schools, 36.2% in females attending Orthodox schools, 27.4% in males attending secular schools, and 81.3% in males attending Orthodox schools. Except for the Orthodox Jewish males, the data for the other groups were consistent with background levels in other populations. The researchers concluded that the higher incidence and prevalence of myopia in the Orthodox Jewish male students was due to their heavy accommodative eye use, attributable to their particular study habits. The study habits of the Orthodox Jewish males were characterized by: (a) sustained near vision, (b) frequent changes in accommodation due to the swaying habit during study – the rocking back and forth of the upper torso apparently is an aid to concentration, (c) use of texts characterized by different sized prints side-by-side, and (d) the need for accurate accommodation when reading tiny print – the letters in the commentaries, that accompany the main text, may be as small as 1 mm in height.

THE RESEARCHERS CONCLUDED THAT THE HIGHER INCIDENCE AND PREVALENCE OF MYOPIA IN THE ORTHODOX JEWISH MALE STUDENTS WAS DUE TO THEIR HEAVY ACCOMMODATIVE EYE USE, ATTRIBUTABLE TO THEIR PARTICULAR STUDY HABITS.

Occupational hazards of a scribe: An interesting incident of occupational toxicology was described for a 70-year old scribe in Israel. This elderly gentleman was admitted to a hospital subsequent to a grand mal seizure followed by confusion. Elevated levels of lead were detected in his blood. Apparently, the scribe, who used a home-made lead-containing ink for writing on the parchments, was accustomed to licking his ink-loaded feather quill frequently during work. Lead, a potent neurotoxin, was identified as the causative agent.[42]

Skin cancer and tz'ni'uth: In recent years there has been a great increase in the number of persons with skin cancer, which has been linked to exposure to the ultraviolet radiation in sunlight. There are various types of skin cancer; the form termed malignant melanoma arises when dermal melanocytes (i.e., pigment-containing cells) become cancerous. Light-skin individuals who burn easily seem to be especially at risk for this type of cancer. Within the city of Jerusalem the incidence of malignant

melanoma for European/American born males in the Orthodox Jewish neighborhoods was significantly lower than in the rest of the city; for females the degree of significance was borderline. A similar pattern was evident upon comparison of the populations in the Orthodox Jewish city of B'nei Brak to its neighbor city, Givatayim. The investigators attributed the lower incidence of malignant melanoma to the protective role of the orthodox traditional clothing. "Orthodox males wear heavy, dark clothing all the year round, grow full-length beards and cover their heads with a wide-brimmed hat. Females wear long-sleeved dresses, thick stockings, and – following early marriage – a head covering. Both males and females are less frequently exposed to sunbathing during adolescence, and definitely afterwards."[43]

Pork parasite in Orthodox Jewish community: In the early 1990s four Orthodox Jews from the New York City area were diagnosed with neurocysticercosis. This disease is characterized by seizures, brain lesions, hydrocephalus, and various other neurologic disorders. Neurocysticercosis is an infection of the central nervous system by the larval form of the pork tapeworm, *Taenia solium*, and is acquired by ingesting taenia eggs shed in the feces of a human carrier of tapeworms. A spectrum of investigators, including those from the Centers for Disease Control and Prevention in Atlanta, GA., were mobilized to identify the source of the pork-derived parasite. The investigators surmised that disease transmission was linked to the tapeworm-infected immigrant housekeepers employed in these Orthodox Jewish households. The housekeepers were from Latin American countries where *T. solium* was endemic.[44, 45]

Allergic to tefillin: Hypersensitivity, an exaggerated immune response resulting in tissue damage, is manifested in the second or subsequent contact with an antigen (termed, the allergen). Allergic contact dermatitis, a type IV hypersensitivity, is caused by haptens, or small molecules which are not antigens themselves, but can become antigenic if they bind to a larger carrier molecule, such as a protein. In allergic contact dermatitis the hapten combines with skin proteins to form the allergen that elicits the immune allergic response on the skin. Common haptens include metals and jewelry. Two case reports in the scientific literature describe allergic contact dermatitis to *tefillin*. The case report of an Israeli Orthodox Jewish male read as follows. "Examination revealed erythematous, crusted, and oozing linear lesions that began on his left arm and extended in a continuous clockwise spiral fashion down his left forearm, onto the wrist, and onto his middle and fourth fingers. Similar eczematous lesions were present on the nape of the neck and feet."[46] The other case report involved an American Orthodox Jew with severe dermatitis on his left arm, spreading to the right arm, hips, and legs.[47] The metallic anion, chromate, used in the leather tanning process, was identified as the causative agent (i.e., the hapten) responsible for inducing the dermatitis.

Can't fool mother nature: Anaphylaxis is a type of allergic reaction. Scientifically, it is a type I hypersensitive reaction, resulting from the interaction of allergens with IgE antibodies on the surface of mast cells and basophils, causing them to produce mediators of anaphylaxis (histamine, leukotrienes, kinins, and prostaglandins) that bring about increased permeability of blood vessels, increased smooth muscle contraction, and increased mucus production. As a result, a person may experience inflammatory responses, difficulty in breathing through the constricted bronchial tubes of the lungs, and a runny nose from excess mucus secretion. Anaphylactic reactions that are systemic, affecting several parts or the entire body, can be life-threatening.[48] Individuals that are allergic to milk products often rely on kosher labeling to select dairy-free foods. Gern *et al.*[49] noted six patients allergic to milk proteins who experienced adverse allergic reactions after eating frozen desserts labeled "nondairy" or "pareve." Jones *et al.*[50] cited the case of a 2-year old milk-allergic boy who experienced anaphylaxis, which included spasms of the bronchi, after ingestion of "pareve"-labeled raspberry sorbet. Trace amounts of milk proteins were detected in the "pareve" sorbet. In both studies, trace amounts of milk proteins were, most probably, incorporated into the frozen desserts, as equipment used to package ice cream was subsequently used to package the sorbet.

The above-cited case histories and/or clinical research studies should not be construed as the more common type of study on Jewish populations. These studies, which were reported in the peer-reviewed medical journals, however, do underline the interest in Jewish rites, customs, and holiday as related to medical concerns. At times, however, it seems that the Jewish people are overly analyzed, i.e., viewed under a microscope. DH

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ADDITIONAL NOTES (not incorporated into the manuscript)

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